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(54) Process for the treatment and the recovery of crudes

(57) A process for the treatment of fillers and/or crudes with high content of water, salts and sediments, such as slop-oil and the like, consisting in heating slop-oil at temperatures not above 100°C and in centrifugating the so heated slop-oil, obtaining a purified slop-oil to be directly submitted to distillation, of a sludge and a phase constituted by water, which aqueous phase may be submitted in its turn to centrifugation on prior heating at temperatures not above 100°C, to recover possible oil residues before being disposed of.

Said centrifugations are preferably realized with vertical axis centrifuges.

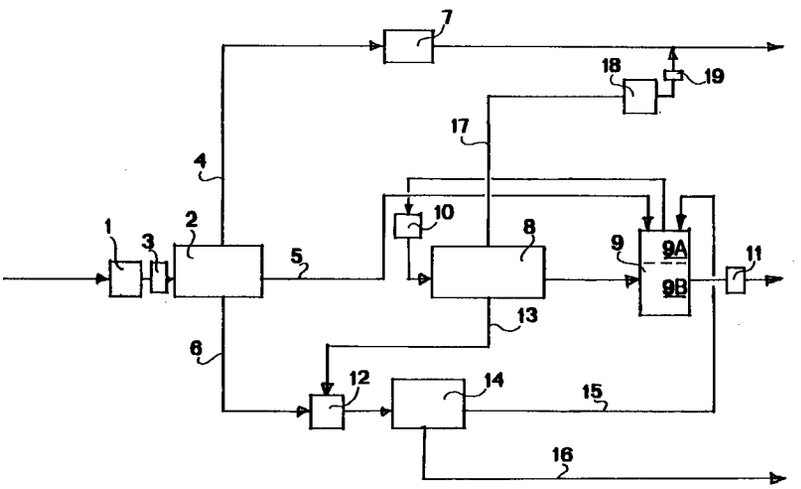

fig.1

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Description

This invention relates to a continuous and automatic process for the treatment and the recovery of fillers and/or crudes having a high content of water, salts and sediments such as for instance slop-oil, with low energy consumption.

This invention relates also to an apparatus for the realization of said process.

The fillers commonly referred to as "slop-oil" are usually characterized by high contents of water (up to 50% by volume) and salts and sediments (1-5% by weight on the average) and low contents of gasolines and light fractions (3-5% by volume on the average).

Slop-oils, given the high percent of water they contain, cannot be sent directly in charge to the atmospheric distillation plant, unless on prior dehydration of the same and separation of at least the greatest part of salts and sediments.

The methodologies adopted at present in the refineries to reduce the contents of water contained in slop-oils (at least up to 0.5% by volume) are substantially the following ones:

- The water contained in slop-oils is separated by evaporation through a mild heating of the filler (oven outlet temperature about 140°C), to obtain the separation of water from filler through evaporation. Such conditioning treatment of slop-oils involves however too high a fuel consumption for ovens, high maintenance costs of the apparatuses and, due to the presence of salts and sediments, a reduction in the effectiveness of heat exchange of the plant and a worsening in quality of products. Besides, some salts may crystallize causing the formation of acids which corrode the apparatuses.
- Suitable de-emulsifiers are added to the filler stored in the tank, so as to obtain the separation of water directly during the storing. However, such treatment involves long times of permanence of the filler in the tank, high costs of the chemicals utilized, and due to the layering which creates in the tank, the formation of a strong emulsifying layer which can be broken only by thermodynamic methods.
- Before being conveyed to the distillation plant, slop-oil is caused to pass through a desalter. The filler is pre-heated at a given temperature and water is added. Sometimes, to easier the breaking of the emulsion, also a de-emulsifying agent is added, which is intimately mixed to the filler together with the process water. Once the mix has entered the desalter, it is submitted to a strong electrostatic field, which causes the water drops present to aggregate and precipitate on the bottom of the vessel.

In this case, besides the consumption of chemicals and electric energy necessary for the process, a rather poor working of the desalter is observed, which needs beeing regulated continuously; this is due to the desalter being effective only if it works with a filler whose characteristic parameters remain constant in the long run, which does not happen with slop-oil also because of the layering which creates in the storing tank.

An object of this invention is to provide a process for the treatment of slop-oils, such as to allow to separate in practice by one only operation all the water and the most part of salts and sediments of the oily fraction, obtaining an oily fraction which can be fed directly without further treatments to the atmospheric distillation plant.

Another object of this invention is to provide a process for the treatment of slop-oils such as to allow to separate water even when the latter is present in very great amounts, up to 50%, substantially without any marked increase in costs compared to smaller amounts. Still another object of this invention is to provide a continuous and fully automatic process for the treatment of slop-oils utilizing also discontinuous working apparatuses and allowing to obtain an aqueous phase already substantially separated from the sediment containing phase.

These and still other objects and related advantages which will be made clear by the following description are achieved by a process for the treatment of crudes with high contents of water, salts and sediments, such as slop-oil and the like, which process, according to this invention, comprises the following stages:

- heating of the crude or the slop-oil at a temperature not above 100°C;
- centrifugation of the so heated crude, obtaining a first fraction constituted by purified crude suitable to be directly submitted to distillation, of a second fraction constituted by water and a third fraction constituted by sludges.

In fact, it has been observed that said purified crude has normally a water content of less than 0.5% by volume and a sediment content of less than 50% by weight relatively to the sediment content in the crude fed, so that, as said, it can be submitted to distillation directly in the topping plant, without drawbacks and with very high yields.

Always according to this invention, said second fraction constituted by water is submitted to a purification process comprising the following stages:

- heating at a temperature not above 100°C, and possible addition of de-emulsifiers of a known type;
- concentration by centrifugation, obtaining a fraction of purified oil suitable to be directly submitted to distillation and a fraction constituted by purified water suitable to be treated according to disposal processes of a kwown type, on prior possible cooling and possible gravity separation by decantation or the like of the oil droplets still present as such.

In fact, it has been observed that said purified water coming out from said concentration by centrifugation has

an oil content below 500 ppm and a sediment content below 3% by volume.

The third fraction coming out from said crude centrifugation stage, constituted by sludges, has normally an oil content below 20% and a water content below 50%. Advantageously, according to the process subject matter of this invention, crudes, slop-oils and the like are treated that have the following characteristics:

Specific weight	0.85 - 1.0 kg/l at 15°C
Water content	0 - 50% by volume
Viscosity	5 to 60 cst at 50°C
Sediments	0 - 5% by weight

Said centrifugation stages, in particular the centrifugation stage of the crude and the concentration by centrifugation of the water to be purified are preferably realized by means of vertical axis centrifuges. Further characteristics and advantages of this invention shall appear more clearly from the following description, made with reference to the practical embodiment and the drawing given by way of mere non limitative example of the invention, wherein Fig. 1 shows in form of a block diagram the example of process realized according to this invention.

EXAMPLE

Fig. 1 shows an embodiment of the process constituted by a unit which can treat a stream of 32 m^3/h of slop-oil.

The slop-oil coming from the tank yard enters storage 1 (25 m^3), whose level is automatically kept constantly at about 50%, is conveyed through two centrifugal pumps to a battery 2 constituted by four centrifuges (separators), on prior heating of the product through a battery of plate-type exchangers 3, two of which exchange heat with the anhydrous product coming out of the centrifuge, and the other two exchange heat with a 2 bar saturated steam.

The inlet temperature of slop-oil (T_{max}=100°C) is suitably regulated and kept constant through a system of regulation of the steam flow to the exchangers, while the control of the stream of slop-oil (about 8 m^3/h per separator) takes place through a regulation system located on the feed line of each machine.

From the three outlets of each so fed centrifuge, one has:

- a first fraction 4 constituted by purified slop-oil
- a second fraction 5 constituted by water
- a third fraction 6 constituted by slurries.

The purified slop-oil 4, already conform to specification as concerns water content, is conveyed to storage 7 (15 m^3), and from here, through a centrifugal pump, having exchanged heat with the slop-oil which feeds the machines, is conveyed to the storing tank and then to the topping plant. Such stream of slop-oil is continuously modulated so as to keep stable at 50% the level of storage 7.

The second fraction 5, constituted by the water coming from the four machines, is conveyed to a fifth centrifuge 8 (concentrator) as it might contain some percent points of hydrocarbons whose value depends on the consistency of the emulsifying phase present. Such stream, before arriving at 8, enters the smallest part of tank 9 (16 m^3). The latter is in fact divided into two parts by a vertical partition (9A with a capacity of 4 m^3 and 9B with a capacity of 12 m^3); such parts are in communication with one another in the upper part.

The water to be purified, with a constant stream, is conveyed, through a centrifugal pump, to the concentrator, on prior heating with a steam plate-type exchanger 10 (temperature of the outgoing water nearing 100°C) and on line addition of a demulsifying agent.

The purified water coming out from centrifuge 8, reenters tank 9 and more precisely at 9B, so that the possible oil traces still present, floating on water, overflow at 9A.

The level of the latter is constantly kept at about 50% by a regulation system which modulates the stream of purified water taken from the bottom of 9B and which is conveyed, always through a centrifugal pump, to water treatment, on prior refrigeration with water in water plate-type exhanger 11.

Sludges 6 are instead collected, together with those 13 coming out from the concentrator 8, in tank 12 (5 m^3). From here, through a volumetric pump controlled by an on/off level located on 12 and whose capacity is regulated according to the consistency of sludges, the latter are conveyed to a decanter 14 which provides to separate the fluid phase 15 from the solid one 16.

A volumetric pump, controlled by a load cell system, provides to conveying the solid phase of sludges into suitable caissons for the disposal.

As concerns the purified slop-oil 17 coming out from the concentrator 8, it reaches tank 18 and is conveyed hencefrom by means of a volumetric pump, on prior refrigeration with water in a plate-type exchanger 19, to storing and then to topping.

Besides the advantage of feeding directly, with the addition of purified slop-oil, the atmospheric distillation plant, the process described is fully automatic, does not require the utilization of ovens, reduces markedly the consumption of possible de-emulsifiers necessary, obtains at the plant outlet three streams having the following characteristics:

PURIFIED SLOP-OIL

- water below 0.3% by volume
- sediments below 50% by weight compared to those contained in the slop-oil entering the plant.

PURIFIED WATER

- oil below 300 ppm
- sediments below 1% by volume, taking into account that the oil stream coming out from the concentrator is on the average below 3.5% of the feeding stream of slop-oil to the plant.

SLUDGES SOLID PHASE

- oil below 15%
- water below 40%

Besides, for the realization of the above described process for the treatment of slop-oils, discontinuously running machines are utilized (centrifuges) which, suitably located in the circuit together with prefixed capacities and suitable regulation systems, allow to carry out the transit and the treatment of slop-oils through such machines in a continuous and fully automatic way.

Claims

1. Process for the treatments of crudes having a high content of water, salts and sediments such as slop-oils and the like, characterized in that it comprises the following stages:

   - heating of crude or slop-oil at a temperature not exceeding 100°C;
   - centrifugation of the crude so heated, obtaining a first fraction constituted by purified crude suitable to be directly submitted to distillation, a second fraction constituted by water and a third fraction constituted by sludges.

2. Process according to claim 1, characterized in that said second fraction constituted by water is submitted to a purification process comprising the following stages:

   - heating at a temperature not exceeding 100°C and possible addition of de-emulsifyiers;
   - concentration by means of centrifugation, obtaining a fraction of purified oil suitable to be directly submitted to distillation and a fraction constituted by purified water suitable to be treated according to disposal processes of known type.

3. Process according to claim 1, characterized in that said centrifugation of crude and said concentration through centrifugation of water to be purified are carried out by utilizing vertical axis centrifuges.

4. Process according to claim 1, characterized in that discontinuously running machines are utilized, such as centrifuges, suitably located in the circuit together with fixed capacities and suitable regulation systems, so that the passing and treatment of slop-oils takes place in a continuous and fully automatic way.

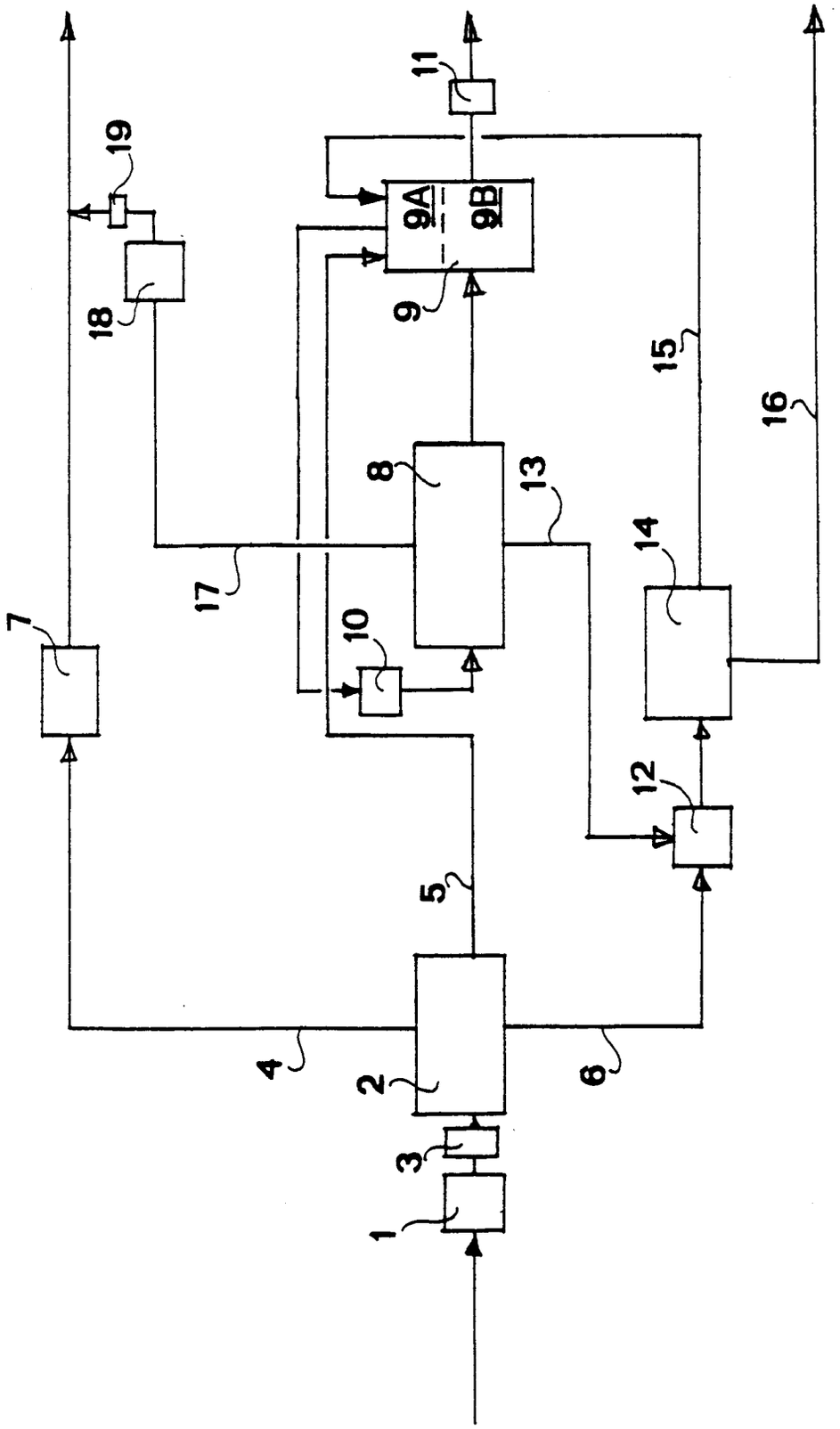

fig.1