

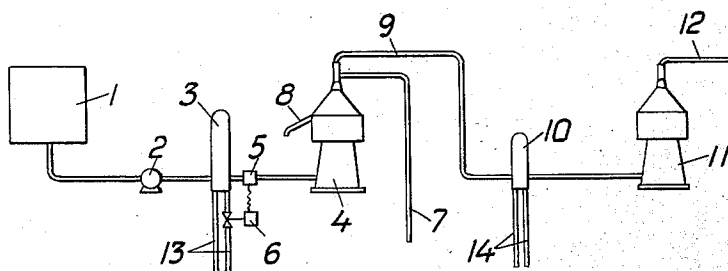
Jan. 30, 1951

H. O. LINDGREN

2,539,915

METHOD OF PURIFYING HEAVY BOILER OIL

Filed Dec. 2, 1948



*Inventor*

*Hans Olof Lindgren*

*By Davis, Nixie & Faithfull*  
*Attorneys*

## UNITED STATES PATENT OFFICE

2,539,915

METHOD OF PURIFYING HEAVY  
BOILER OIL

Hans Olof Lindgren, Smedslatten, Sweden, as-  
signor to Aktiebolaget Separator, Stockholm,  
Sweden, a corporation of Sweden

Application December 2, 1948, Serial No. 63,187  
In Sweden December 9, 1947

3 Claims. (Cl. 252—346)

1

This invention relates to a process for purifying heavy boiler or bunker oil containing water and solid impurities and intended for fuelling internal combustion engines, especially Diesel engines.

Heavy fuel oil, so-called boiler or bunker oil, is commonly used also as fuel for Diesel engines, because this type of oil offers considerable economical advantages as compared with Diesel oil, owing to its lower price. The heavier boiler oils at least, being only so-called topped crude oils and not distillates, contain some very fine wearing solids, such as sand, crystals or many metal salts, oxides, etc., which as a rule are not found in the Diesel oil. When such oils are to be used for fuelling Diesel engines, they must therefore be subjected to very careful and effective purification, because otherwise the wear of the injection nozzles, the piston rings and the cylinder liners would be excessive and entail repair costs which may equal or even exceed the reduction of the fuel costs. The object of purifying the oil is to remove water and solid impurities therefrom as efficiently as possible, and the operation is preferably effected in centrifugal separators having a high purifying ability. In order to reduce the viscosity of the heavy boiler oil and thereby facilitate the centrifugal separation, the oil should be heated to the highest permissible temperature which should, however, always be so high that any existing emulsion of oil and water is broken. It is important that the heating be carried out in the correct manner. If too low a temperature is used, the emulsion is not broken to a sufficient degree and if the temperature is raised too much or the heating is carried out too slowly, there is a risk that quick-burning asphaltic materials contained in the oil are polymerized and precipitated and that certain impurities combustible only with difficulty are transferred into non-separable form by re-dissolving. This type of fuel also contains some easily volatile fractions which should also be prevented from volatilizing.

The present invention has for its primary object the provision of an improved process for purifying heavy boiler oil containing water and solid impurities, whereby the inconveniences referred to above are avoided.

According to the invention, the heavy boiler oil is subjected to emulsion-breaking heating and subsequent centrifugal separation. However, the emulsion-breaking heating and the separation are effected so rapidly that any appreciable precipitation of quick-burning asphalt substances is prevented. It has been found that the quicker the

2

heating and the separation are carried out, the greater is the likelihood that the quality-improving asphalt substances will be retained in the oil. It is important that the heating be effected without access of the air, that is, while excluding atmospheric air from the oil. The heating should be continued until a temperature of 80–95° C. is reached, the most suitable temperature varying somewhat according to the kind and nature of the impurities. As previously mentioned, it is important that the highest permissible temperature is not exceeded, as otherwise the non-desirable free asphalt substances would become dissolved in the oil and could not therefore be removed in the separation. The same also applies to the period of time during which the oil is kept at the highest temperature. As a rule, the oil during the heating and the separation should not be kept at the highest temperature for a longer period than about ten minutes. The simplest manner to effect the heating and subsequent cooling is by using a heat exchanger of the so-called plate apparatus type, in which the desired temperature can easily be maintained with the aid of a thermostatic regulating device and more considerable variations can be avoided. The separation should be conducted in such a manner that the easily volatile fractions are prevented from escaping, and to this end the separation may be effected either in so-called hermetic centrifugal separators or in a closed centrifugal system. In the latter case, communications are preferably provided between the various outlets or between each outlet and the receiving vessel of the separator, or both, so that a pressure equalization takes place in the various vessels and pipes at the same time as a given saturated quantity of air circulates in the system.

The separation may be effected in one or more stages, and preferably in two stages, the separation of the second stage taking place at a somewhat lower temperature than the separation of the first stage. After the first stage separation, the oil should be chilled or allowed to cool off so that its temperature decreases about 5 to 10° C., whereby slow-burning asphalt substances dissolved in the oil are precipitated. They are then removed in the second stage separation, and on being separated they entrain the very finely comminuted solid matters left in the oil after the first stage separation.

In the accompanying drawing, the single illustration is a schematic view of one form of a plant for purifying heavy boiler oil according to the invention. From a tank 1 the heavy boiler oil

is pumped by a pump 2 to a heating zone or heater 3 (preferably a plate apparatus) in which the oil is quickly heated to the required temperature, for example 80-95° C., before it is subjected to centrifugal separation, preferably in two stages. The first stage separation is carried out in a centrifugal separator 4 of the hermetic or closed type, whereby the oil is prevented from coming into contact with atmospheric air. The separator 4 is one which effects a three-way separation and discharges the three components separately from the centrifugal bowl, such separators of the hermetic or closed type being well known. In the pipe extending from the heater 3 to the separator 4 a thermostatic regulating device 5, 6 of conventional construction is interposed. The thermostat 5 controls the valve actuator 6 to increase or decrease the rate at which the heating medium is supplied to the heat exchange zone 3, so as to counteract any substantial change in the temperature of the heated oil passing to separator 4.

From the separator 4 three components are discharged, namely, water, sludge, and separated boiler oil. The water is discharged through a pipe 7, the sludge through an outlet 8, and the oil through a pipe 9. The separated oil is fed through pipe 9 to a cooler 10 which, like the heater 3, is preferably a plate apparatus and in which the oil, prior to being fed to the second stage separator 11, is cooled 5 to 10° C. The separator 11, which is a centrifugal purifier, may also be of the air-tight type, although this is not necessary. The purified oil is discharged from the machine through an outlet 12. In this separator only small amounts of sludge are separated, which are retained in the sludge space of the centrifugal bowl until the separation is completed. As the oil is almost completely liberated from water in the first separating stage, no appreciable amounts of water are separated in the second stage. The heating and the cooling mediums are fed to the apparatus 3 and 10, respectively, through pipes 13 and 14.

In the new process, the rapidity of the emulsion-breaking heat treatment and the close control of the temperature prevent the slow-burning asphaltic substances, or those which are combustible only with difficulty, from dissolving in the oil, but allow the lighter and quick-burning asphaltic substances to remain dissolved in the oil.

Before the latter substances can precipitate or coagulate noticeably, the heated oil is quickly centrifuged so that the quick-burning asphaltic substances pass out with the oil in which they are dissolved, rather than with the precipitated slow-burning asphaltic substances or with water. The subsequent limited cooling of the oil will precipitate or re-precipitate remaining slow-burning asphaltic substances in the oil, and these impurities will thus act in the second-stage separation to entrain other solid comminuted impurities not affected by the first stage separation.

I claim:

1. In the purification of heavy boiler oil containing water and solid impurities and intended as fuel for combustion engines, especially Diesel engines, by subjecting the oil to emulsion-breaking heating and subsequent separation of oil from water and solid impurities, the improvement which comprises flowing a stream of the oil through a heating zone and there heating it rapidly to an emulsion-breaking temperature of about 80-95° C., and centrifuging the heated oil before there is any noticeable precipitation of quick-burning asphaltic substances in the oil, the time during which the oil is maintained at the highest temperature in the heating and separating steps being no greater than ten minutes.

2. The improvement according to claim 1, in which the heating is effected while excluding atmospheric air from the oil.

3. The improvement according to claim 1, comprising also the steps of cooling the centrifugally separated oil to reduce its temperature by about 5 to 10° C., and subjecting the cooled oil to a centrifugal purification treatment.

HANS OLOF LINDGREN.

#### REFERENCES CITED

The following references are of record in the file of this patent:

#### UNITED STATES PATENTS

| Number    | Name      | Date          |
|-----------|-----------|---------------|
| 1,299,590 | McKibben  | Apr. 8, 1919  |
| 1,474,629 | Hall      | Nov. 20, 1923 |
| 1,699,379 | Sperry    | Jan. 15, 1929 |
| 2,365,256 | Edwarsson | Dec. 19, 1944 |