

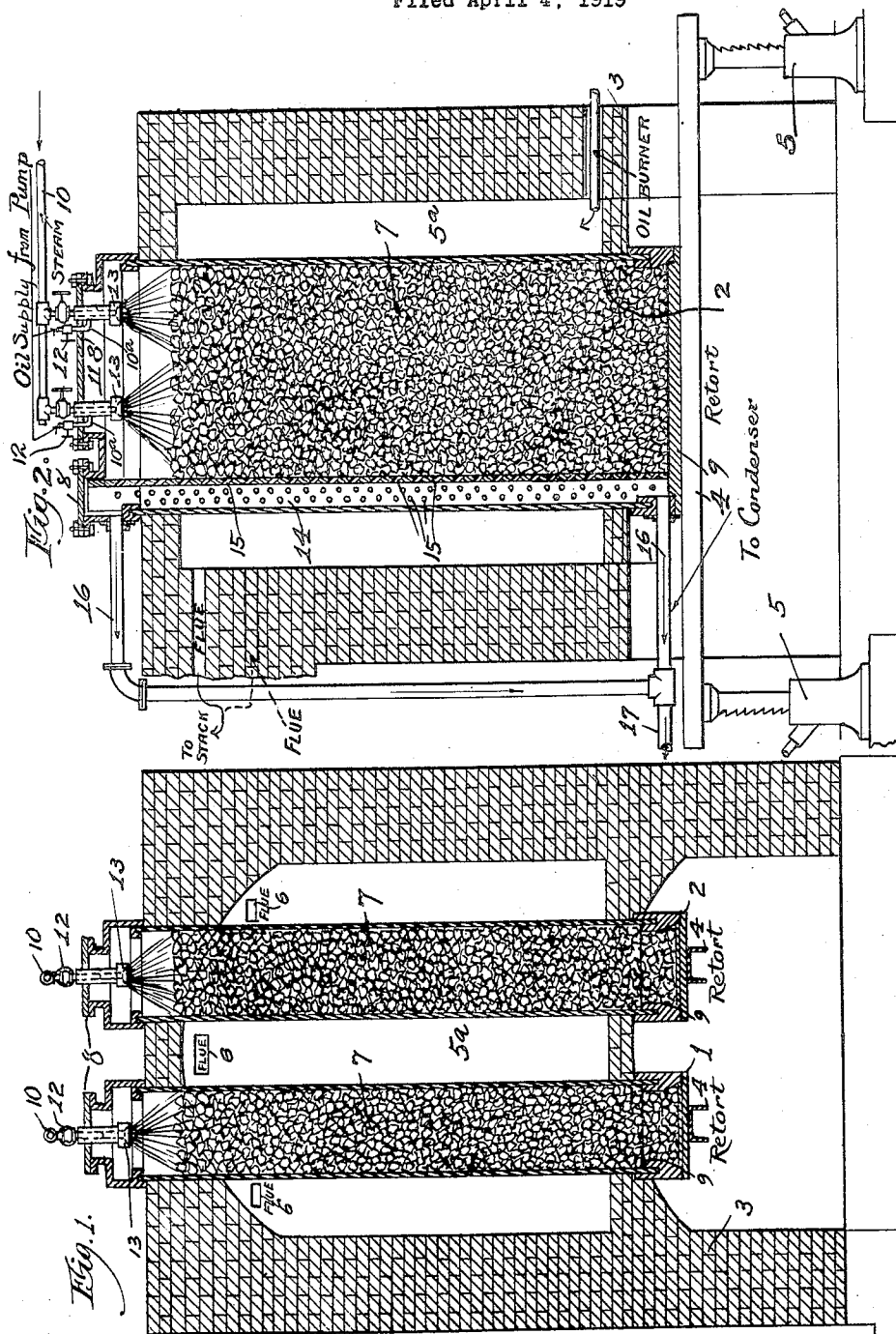
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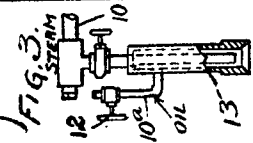
H. H. CULMER

PROCESS OF TREATING HYDROCARBON OILS

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Witness,
[Signature]



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UNITED STATES PATENT OFFICE.

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PROCESS OF TREATING HYDROCARBON OILS.

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To all whom it may concern:

Be it known that I, HARRY H. CULMER, a citizen of the United States, residing in the city of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Processes of Treating Hydrocarbon Oils, of which the following is a specification.

This invention relates to improvements in process of treating hydrocarbon oils and refers more particularly to the treatment of heavy or viscous petroleum oils, whereby such oils are thinned or reduced in gravity, and materially increased in value. As is well known in the petroleum industry considerable difficulty is experienced in the transportation of heavy crude petroleum oils such as those from the California petroleum fields, through pipe lines. This results from the fact that these oils are so viscous and sluggish that they do not flow through the pipe lines at ordinary temperature, and have to be frequently heated and the pipe line provided with numerous pumping stations in order to force the oil through the line. The present invention lessens the viscosity of the oil and reduces it to such a thin fluid or liquid condition that the oil will readily pass through the pipe lines at all ordinary temperature. At the same time, the process converts certain of the heavy into lighter hydrocarbons, thus increasing the yield of the lighter and more valuable distillates of the oil. The invention is also adapted to thinning the heavy fuel oils, for example, for the use of same on war ships, and the like, or for use in industrial plants. The process also frees the oil from water content whether the water is merely mixed with the oil or in an emulsified condition.

By my process I destroy the colloidal solution of hydrocarbons in the oil and as before stated, render them into a thin or limpid liquid. The increase of light oily contents in the oil of course renders the oil more valuable from a refining standpoint. It is also to be noted that after this oil has been treated by my process it retains its thin fluid condition even at relatively low temperatures.

Fig. 1 is a side elevation of the apparatus.

Fig. 2 is a front elevation of the same.

Fig. 3 is a detail of the nozzle arrangement for spraying the oil onto the coke.

Referring in detail to the drawings, the closed retorts 1 and 2 are mounted in the fur-

nace 3 by means of suitable I-beams 4 which are supported therein by jacks 5. Any number of these retorts may be mounted in the furnace according to the size of the heating space and the volume of oil to be treated. The heating space 5^a is maintained at a high temperature by any means such as gas burners or the like. The heating gases after passing through the furnace are directed to a stack (not shown) through the flues 6. The retorts are filled with coke 7 which is ground to the desired size and loaded into the retorts through their removable tops 8 or removable bottom plates 9. The heavy viscous oil after being heated to a temperature at which it will flow freely is introduced through the pipes 10^a into the top of the retorts. The inlet pipes 10^a are controlled by valves 12 and are connected to the spray nozzles 13 which distribute the oil over the top of the coke. A steam pipe 10 injects steam through the center of the nozzle spraying the oil upon the coke. The coke is maintained at a high temperature and as the oil is sprayed thereon the lighter fractions are released from the oil and rise into the duct 14 through a series of small perforations which are inclined upwardly. These lighter fractions after collecting in the duct are directed through the connecting pipes 16 to the pipe 17 through which they are piped to a condenser (not shown).

The heavy residual material which is left in the retort fills the voids between the small lumps of coke and is cleaned at intervals when the voids in the retorts become completely filled. It is understood that the oil supply pipe and the connecting line to the condensers are lagged to prevent loss of heat through radiation.

Describing now one example of carrying out my improved process—I may take heavy crude Mexican petroleum of say 12 Baumé gravity. This oil is so sluggish that it will not flow through a pipe line at ordinary temperature. This oil may first be charged into a tank equipped with a closed steam coil, then the oil is heated in this tank to 200° F. more or less, until it is sufficiently limpid to be readily forced through a pump. This hot viscous oil is then forced by a suitable pump through a regulating valve to a spray nozzle. From the spray nozzle the oil is sprayed into a suitable converter or retort. The oil may be either forced through the spray nozzle by itself or may be forced

through in conjunction with a jet of superheated steam. This convertor or retort may be of any desired shape or for example a vertical cylinder, externally heated and partially filled with red hot petroleum coke. The body of this coke in this convertor is preferably of a size that will pass a one inch ring and be retained by a half inch ring. The coke which will pass the one half inch ring is removed before the coke is charged into the retort. The object of this is to provide a bed of coke containing suitable voids. This retort may be either a cast iron retort or a silica refractory retort. This retort is provided with a vertically extending duct circumferentially perforated, the perforations are so arranged that they slant upwardly and inwardly so as to prevent their being clogged. The oil that enters the duct through the perforations in liquid condition, may be drawn off at the bottom and the vapors drawn off at the top or they may be drawn off through the same outlet. This duct is preferably perforated substantially throughout its entire length. The arrangement is such that the vapors and the oil will flow from the hottest to the coolest part of the retort toward the take off duct. As the oil enters the retort it flows into the voids of the coke and filters through the red hot bed of coke therein contained. This coke may act as a catalyst removing or destroying the viscous character of the oil and breaking up the heavy viscous hydrocarbons into those of lighter gravity or into hydrocarbons of a thinner character.

The temperature of the retort will vary to some extent with the character of the oil being treated and the extent to which it is desired to reduce the viscosity of the oil. I have found that in treating Mexican oils of the character above referred to, a temperature of 750° F. to 1300° F. will produce the desired result. If an excessive temperature is employed it will produce too large a quantity of fixed gases, and in such cases there will also be a tendency to produce an excessive amount of free carbon.

It seems that in spraying the oil into a red hot coke bed in combination with superheated steam, that the hydrogen of the steam is linked on to the hydrocarbons of the oil while the oxygen combines with the red hot coke or carbon and forms a carbon monoxide gas, suitable as fuel. For certain cases instead of using superheated steam it may be desirable to spray the oil into the retort with a jet of hydrogen gas. This will result in a more pronounced formation of lighter hydrocarbons as for

example, those of a gasoline character. The oils thus treated will of course to this extent be more valuable.

If the voids in the bed of coke for any reason, become choked up, the retort is cleaned, the coke run through a crusher again and screened to the desired size and then put back into the retort. The "fines" may be ground fine in a mill and sold as carbon black or sold for use as electric arc carbon. It is to be understood that in carrying out this invention it will in most cases be very desirable to avoid any destructive distillation of the oil to the extent of injuring it and rendering it unsuitable for either refining purposes or for use as fuel oil.

I claim as my invention:

1. A method of lowering the viscosity of hydrocarbon oil consisting in spraying the oil upon a bed of incandescent coke contained in closed externally heated retorts, maintaining the coke at temperatures regulated to prevent the formation of any substantial quantity of incondensable gases, withdrawing the treated oil and products of distillation from the coke body by passing it from the hotter to the cooler portions.

2. A process of lessening the viscosity of heavy viscous petroleum oil consisting in spraying the liquid oil in closed retorts externally heated containing a hot bed of petroleum coke, continuously removing the oil from the hottest portion of the retort to the coolest portion thereof, to prevent the destructive distillation of the oil, removing and collecting the treated oil and generated vapors and regulating the external heat supply to the retorts to maintain the desired conversion conditions.

3. A process of lessening the viscosity of heavy petroleum oil consisting in spraying the oil into closed externally heated retorts containing beds of incandescent petroleum coke, continuously percolating the liquid oil through the coke with steam and controlling the temperatures to prevent destructive distillation of the oil, and withdrawing the vapors and liquid from the hotter to the cooler portions of the retorts.

4. A method of lessening the viscosity of heavy hydrocarbons consisting in percolating the liquid oil through coke maintained and externally heated in an enclosed retort, withdrawing the oil from the hotter to the cooler portions of the retort, and during the reaction maintaining the oil and coke at temperatures to prevent the formation of any considerable quantity of fixed gases.

HARRY H. CULMER.