

June 29, 1926.

1,590,841

J. R. McCONNELL

PROCESS OF TREATING HYDROCARBONS

Filed July 27, 1925

Fig. 1.

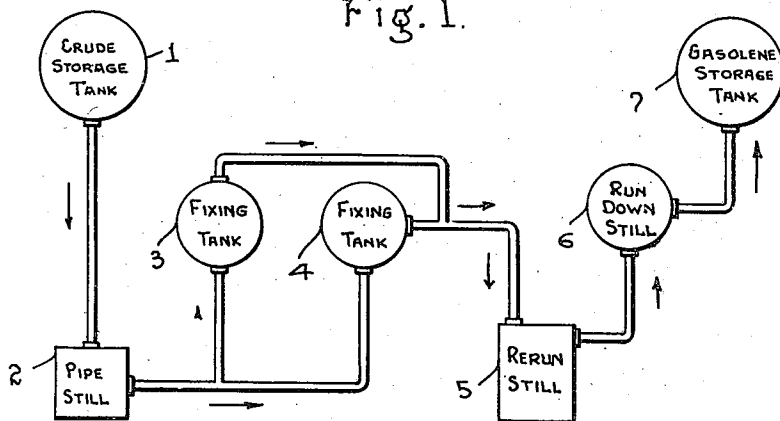


Fig. 4.

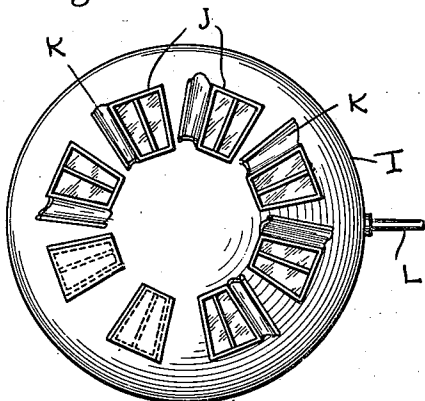


Fig. 2.

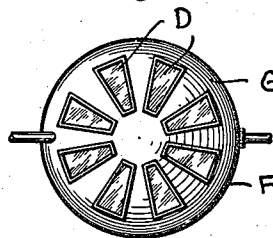


Fig. 5.

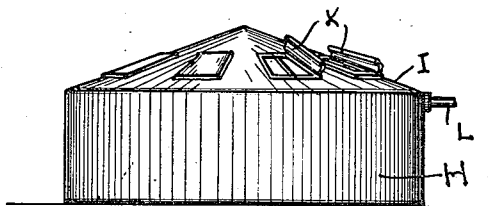
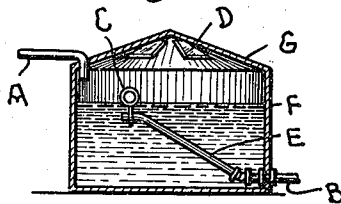


Fig. 3.



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Patented June 29, 1926.

1,590,841

UNITED STATES PATENT OFFICE.

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PROCESS OF TREATING HYDROCARBONS.

Application filed July 27, 1925. Serial No. 46,487.

My invention relates to the treatment of light hydrocarbons preferably distillate hydrocarbons to obtain a gasoline which is substantially free from color or what is known as a clear product of a 25 plus color by Saybolt chromometer. This process is known as the fixation process for refining gasoline. This application is a continuation in part of Ser. No. 735,650, filed Sept. 3, 1924.

Gasoline refined from crude oils such as Santa Fe Springs, Huntington Beach or Signal Hill, if carried to a finished product by straight distillation without clay or acid treatment, has the peculiar property, when exposed to daylight, of taking on a discoloration which may be pink, yellow or light chocolate, and the reaction is more rapid when sunlight is directed upon the liquid; for instance, when the untreated gasoline from these crudes is placed in the so-called visible pump. This discoloration is found objectionable by the trade, which demands a clear, colorless product.

The present methods of treating gasoline with characteristics mentioned in the second paragraph to obtain a colorless product, is to agitate with sulphuric acid of 66 Bé. and finish by washing with water and alkaline solution. In some cases a clay (refiner's clay or fuller's earth) is used in conjunction with the above treatment. Another method is to treat with refiner's clay direct, without the use of acid. However, in the latter case, where acid is omitted, the color of the gasoline has often been found unstable. These processes have no bearing on what is described below as the fixation process, but are merely mentioned so as to clearly differentiate between the old processes and the new.

The acid and clay treatments mentioned above entail considerable extra handling, extra apparatus and a loss in the volume of gasoline, and, in addition, often when redistillation does not follow the acid treatment a portion of the acid remains in the gasoline, soluble as sulphonic acid, which has an injurious effect on the motor. The acid also removes from the gasoline a portion of the aromatic hydrocarbons, which are valuable products in the gasoline, due to their faculty of eliminating to a certain extent, detonation in the motor. It is known that gasoline (of the characteristics mentioned in the second paragraph) treated with

clay alone has turned a decided pink on exposure to light.

Broadly stated, my process comprises treating light hydrocarbons such as distillate hydrocarbons containing a compound sensitive to daylight to produce a product substantially free from color and not sensitive to daylight by exposing the distillate hydrocarbons, containing the sensitive compound, to daylight rays to fix the color or complete the color reaction to its maximum, and thereafter removing the discoloring compound preferably by distillation.

I have discovered that if a distillate hydrocarbon, for example, a hydrocarbon of low boiling point, from the crudes mentioned, has its discoloring compound completely fixed and is then redistilled, there is obtained a clear product which permanently remains in this condition and is a satisfactory commercial commodity. In other words, referring to the finished product, the gasoline will have a 25 plus color measured in terms of the Saybolt chromometer. The Saybolt chromometer method is set forth on page 31 of Technical Bulletin 323, U. S. Department of Interior and is entitled, "Specifications for petroleum products." Preferably, I fix the color of the distillate hydrocarbons in the naphtha distillate stage by exposure to daylight or sunlight rays, and the fixed sensitive portion, which is probably of an organic sulfur composition, becomes non-volatile and therefore remains in the residue on distillation. This, it is thought, accounts for the freedom from color in the finished gasoline on redistillation.

The subjecting of the distillate hydrocarbon to the action of daylight until complete color change has taken place, is what is referred to as complete fixation.

If the discoloring compound contained in the distillate hydrocarbon has not been entirely fixed, due to insufficient exposure to daylight, the resultant gasoline after distillation will be clear but will go off color when exposed to daylight to a degree proportional to the amount of discoloring compound which has not been fixed. This is what is referred to as partial fixation. In this case the gasoline is again subjected to daylight exposure, and if need be, redistilled to obtain a permanently colorless gasoline. Usually, after distillation of the partially fixed distillate hydrocarbon the resultant

gasoline becomes pink on exposure to daylight. If the pink is only of a faint hue it may be bleached to a very faint tinge of yellow, which in some cases may be allowed to remain in the marketable gasoline. However, no gasoline which has been partially fixed and then bleached, ever turns out as good in color as that which is completely fixed and then distilled. In case of partial fixation, a portion of the sensitive discoloring compound is still volatile and is carried over with the finished gasoline.

The naphtha distillate hydrocarbon from the crude, on exposure to light, which is at first water white, may change in color to green, pink, brown or chocolate, and finally to a yellow. The heavier the distillate the greater the discoloration, due to light action.

For a complete understanding of my process of treating hydrocarbons and the apparatus therefor, reference is made to the accompanying drawing, the figures of which are more or less diagrammatic, in which—

Fig. 1 shows the flow sheet of the product from the crude tank to the finished gasoline storage tank;

Fig. 2 is a plan view of the top or deck of the fixing tank;

Fig. 3 is a side elevation of the fixing tank;

Fig. 4 is a plan view of the storage tank; and

Fig. 5 is a side elevation of a storage tank, indicating how the windows are placed thereon and the means for covering the windows when it is desired to shut off the daylight.

The apparatus shown in Figures Nos. 2 and 3 comprises a 2000 barrel tank F, preferably 15 ft. high and thirty feet in diameter, and has inserted in the deck (G) windows (D) of prismatic glass. This glass is held in ordinary wooden frames bolted securely to the iron deck of the tank, so the tank at all times is practically air-tight. A secondary adjunct is a float (c) which raises a swing line (E) in the tank to a point about six inches below the liquid level. Hence, in drawing from the tank that liquid, nearest the surface, is always taken, and consequently that which has been subjected to the greatest light action. (B) is the discharge conduit and (A) is the inlet conduit.

The greater the number of windows in the tank deck (G), the greater will be the light-exposing surface and consequently the reaction inside of the tank will occur more quickly. I have found that when the light surface occupies approximately twenty per cent of the tank deck surface, satisfactory results are obtained.

On the decks of the fixing tanks are placed conventional sprinklers which are used in warm weather for keeping the tank cool and to overcome radiation caused by the reflectors. The storage tank (H) shown in figures

4 and 5 has on the deck I, a series of windows (J), each of which has attached thereto a flap (K) of the rubber sheeting or similar material. The flaps (K) may be thrown over the glass when it is desired to shut out the daylight rays. (L) is the inlet conduit and (P) is the outlet conduit.

Referring to Fig. 1, in carrying out the process the naphtha distillate coming from the crude stills 2, is run by gravity into either of the fixing tanks 3 or 4. When using a tank 3 or 4 of type (F) as shown in Figs. 2 and 3, the daylight rays are allowed to enter the fixing tank through the windows (D) of diffused glass on the deck (G). The naphtha distillate entering the tank is exposed to the action of the daylight rays and the exposure is continued for a period of from 15 to 30 daylight hours, or more if necessary. Two or more tanks capable of holding 2000 barrels may be used for this purpose, one of which fills up in 30 daylight hours. When one of the tanks, 3 or 4 is full, and the naphtha distillate has been entirely fixed in color, the distillate is pumped to the re-run stills 5 to be re-distilled to the proper end point, then into tank 6, at which point it is tested and if of proper test, is transferred to storage tank 7. If fixation has been completed in tanks 3 or 4, the gasoline obtained in tank 6 will be 25 plus in color and of a definite color stability.

The proper operation of the process depends primarily upon the construction of the fixing tanks (F), and the insurance of complete fixation of color before distillation to make the finished gasoline. The naphtha distillate may be either distilled from the conventional horizontal still, with or without towers, or the pipe still, and either continuously or in batches. After fixing the color, redistillation may take place in steam stills, horizontal combination or any other proper distilling device.

The term "naphtha distillate" as used above is, of course, to be given the customary meaning accorded it by those skilled in the art. The Bé. gravity and the boiling point may vary considerably. As an illustrative example the naphtha distillate may be obtained as follows, but it is obvious that I do not limit myself to a naphtha only obtained as outlined. As stated, the following is merely illustrative:

Naphtha distillate may be defined broadly, as that product representing the first cut from the crude oil, sometimes called "tops" and having a Bé. gravity 45 to 52, an initial B. P. of 120 degrees to 140 degrees F., and an E. P. of 400 to 550. To obtain this product the crude oil is heated to approximately 450 degrees F., and the naphtha distillate is thrown over as vapor and condensed. The temperature of the naphtha distillate in the fixing tank, of course, may vary.

With an average temperature of 65 degrees, satisfactory results have been obtained. When the naphtha first leaves the condenser from the crude stills, it is water-white in color, but after being in the fixing tanks a short time usually it turns green, and finally the green changes to light brownish yellow; at this point a sample may be taken and distilled in the laboratory to ascertain whether fixation has been completed. If completed, as shown by a finished gasoline of stable color when exposed to the sun for one-half hour, the naphtha distillate may be redistilled on the re-run stills, and produce a gasoline which will remain clear and bright of a 25 plus color, under ordinary exposure to daylight.

The color fixation may also be accomplished by use of an artificial light such as the ultra violet ray.

My process is also applicable to the treatment of cracked gasoline. In the cracking of fuel oil to produce motor fuel or gasoline, the first step is, usually, to produce "a pressure distillate." This pressure distillate contains the light fractions of gasoline which are obtained by subsequent distillation of the pressure distillate. The gasoline so obtained is very susceptible to the action of daylight, usually taking on a rich yellow or reddish-yellow color. In most cases, this color is eliminated by treatment with an acid such as sulfuric, or by treatment with fuller's earth. I find that by subjecting the raw gasoline produced by cracking to the prolonged action of daylight rays, a large percentage of the color becomes fixed. Upon subjecting this fixed cracked gasoline to a process of distillation, approximately 70% clear 25 plus color gasoline may be obtained as a distillate. The balance of the distillate will contain some color which can be removed either by acid or clay treatment.

The application of my fixing process to cracked gasoline, dispenses with the necessity of treating a large percentage of the cracked gasoline with either acid or clay.

Gasoline distilled from partially fixed naphtha distillate may be exposed to daylight rays through diffused glass and the color thereby completely fixed.

In the claims, the term, "light rays" is intended to cover daylight rays, ultra violet rays or rays of any character which will function to substantially completely fix the color of the sensitive discoloring compound present in the hydrocarbon treated.

This application is a continuation in part of McConnell application Ser. No. 735,650, filed Sept. 3, 1924.

I claim:—

1. The process of treating light hydrocar-

bons containing a sensitive discoloring compound to produce water-white light hydrocarbons substantially free from color and having a definite color stability, comprising exposing the light hydrocarbons for a period of time to the sole action of light rays to completely fix the color of the sensitive discoloring compound and thereafter distilling the so treated light hydrocarbons.

2. The process of treating light hydrocarbons containing a sensitive discoloring compound to produce a water-white gasoline substantially free from color and having a definite color stability, comprising exposing the light hydrocarbons for a period of time to the sole action of light rays functioning to completely fix the color of the sensitive discoloring compound and thereafter distilling gasoline from the so treated light hydrocarbons.

3. The process of treating light hydrocarbons containing a sensitive discoloring compound to produce a water-white gasoline substantially free from color and having a definite color stability, comprising exposing the light hydrocarbons for a period of time to the sole action of daylight rays to completely fix the color of the sensitive discoloring compound and thereafter distilling gasoline from the so treated light hydrocarbons.

4. The process of treating naphtha distillate containing a sensitive discoloring compound to produce a water-white gasoline substantially free from color and having a definite color stability, comprising exposing the naphtha distillate for a period of time to the sole action of light rays functioning to completely fix the color of the sensitive discoloring compound and thereafter distilling gasoline from the fixed naphtha distillate.

5. The process of treating naphtha distillate containing a sensitive discoloring compound to produce a water-white gasoline substantially free from color and having a definite color stability, comprising exposing the naphtha distillate to the sole action of daylight rays for a period of time to completely fix the color of the sensitive discoloring compound and then distilling gasoline from the fixed naphtha distillate.

6. The process of treating naphtha distillate to produce a stable 25 plus color comprising subjecting the naphtha distillate to the sole action of daylight rays to completely fix the sensitive discoloring compounds prior to distillation of said distillate and thereafter distilling water-white gasoline from the fixed naphtha distillate.

In testimony whereof he hereunto affixes his signature.

JOHN ROBERT McCONNELL.