Patented Feb. 17, 1931 1,793,014

UNITED STATES PATENT OFFICE

RICHARD LEE RODGERS, OF CHICAGO, ILLINOIS

FUEL AND METHOD OF MAKING SAME

No Drawing. Application filed April 27, 1928. Serial No. 273,430.

My invention relates to an improved artificial fuel having for its base the more or less solid carbon residue of petroleum distillation or cracking, said carbon residue being referred to merely as petroleum carbon, of which residue the annual United States production is understood to approximate 1,500,000 tons, is increasing and a large part of which, probably one-half, consists of smalls or fines.

As is known, the carbon residue of such distillation or cracking is a substance of unusual purity, ranging in different cases as low as one-tenth of one per cent of non-combustible matter and probably averaging in all cases less than one per cent of such matter, yet, aside from a limited demand therefor, the smalls or fines of such residue (and, as well, much of the massive production of it from petroleum cracking stills as hereinafter explained) is not salable at prices and convenience satisfactory to the producer. Actual, established, satisfactory demand for much carbon residue is proven inadequate by the large accumulations of it to be found about numerous petroleum refineries and the considerable volume, amounting to as much as sixteen per cent of the petroleum cracked at some refineries, entails to producers not only substantial direct losses but, as well, substantial indirect losses and inconvenience from the necessity and expense of storage in space preferably in different cases utilized for other purposes.

By reason of the different distillation and cracking systems at present in vogue, the problem of petroleum operators with respect to carbon residue is variable. Prior to the present extensive practice of cracking petroleum or fractions thereof, carbon residue appears to have been a product only of stills wherein complete or so-called dry petroleum distillation was performed and which method of distillation continues largely to be practiced. In other words, carbon residue was the product only of distillation carried to utmost practical limits with the result of a more or less dry carbon residue. The carbon residue of such complete or so-called dry distillation, in so far as not consisting of smalls or fines, further in so far as put on the market in firm, dry, lumpy condition, commands a fairly ready sale at prices generally approaching, sometimes equalling but not often exceeding those obtained for highest priced domestic coal. But the infirm, oily or smalls or fines portion of such more or less dry carbon residue, or of any carbon residue, constitutes an impossible problem of general, if any, marketing at such prices.

Growth of the present practice of cracking petroleum or fractions thereof, which continues, has led to a large, increasing and accumulating production of unsalable or unsold carbon residue from cracking stills of both massive and smalls or fines character.

Carbon residue from cracking stills is customarily oily and unclean, is at times malodorous, and smoke and soot may result from combustion of it. Despite its excess of thermal value over any known solid fuel of general usage, the aforesaid characteristics of carbon residue from cracking stills render it quite objectionable to many domestic consumers whose needs the massive portion thereof might otherwise satisfactorily serve.

The carbon residue produced by one well known and widely used cracking process, in addition to being objectionable to domestic consumers in the massive form as aforesaid, is characterized by friability and a pronounced tendency to slack in time from massive form to smalls or fines.

By most favorable practical methods of removal from stills the carbon residue produced by the aforesaid well known and widely used cracking process yields a half or more of its whole as smalls or fines. Some operators of this particular cracking process, to reduce the length of removal period and thus save expense and stoppage of profitable oil throughput greater than to be offset by possible gain from sale of massive carbon residue known to be objectionable as aforesaid, effect such removal by boring out of the still the carbon residue contained therein and with the result of largely or fully reducing the whole of such contained carbon residue to smalls or fines salable, if at all, mainly for

industrial use at approximately the low prices obtaining for coal screenings.

All of these objections, deficiencies and losses are profitably eliminated by my process of which the following is a description:

In carrying out my invention I take the aforesaid carbon residue and reduce it by any suitable means, such as crushing or pulverizing, to a required or desired degree of fineness, such degree depending on the character of said carbon residue and the petroleum carbon yielding material employed therewith. The operable range of fineness I find a wide one, but for practical purposes a fineness of from approximately 10 to 50 mesh, and finer, may be used.

I thoroughly mix with the aforesaid carbon residue reduced to fineness, by any suitable means, an amount of petroleum carbon yielding material, hereinafter often referred to merely as carbon yielding material, that will render satisfactorily solid, dry and coherent the batch so created, by heating said batch to a carbonizing temperature in any suitable carbonizing retort, oven, chamber or equivalent apparatus, hereinafter referred to generally as a retort, and so causing said carbon yielding material in said batch contained to yield and exercise its carbonizable content as a carbonized, homogeneous binder of said batch.

For such carbon yielding material I use any suitable crude petroleum, or derivative thereof, or preferably the naturally liquid or liquefiable residuum from off petroleum cracking stills, the latter being usually an indirect derivative from the base of a fraction of crude petroleum rather than directly from such crude and having been found by me of great serviceability (and of usual availability at any petroleum refinery) among petroleum products for the carrying out of my process and, as well, of secondary, nominal or no market value, one or more of such carbon yielding materials being usually available at any petroleum refinery.

It will be understood that the petroleum derivatives or residuum which I use as my binder, are natural derivatives or residuum of a petroleum cracking or distillation operation, which chemically are substantially neutral or non-acid, either on account of the neutral character of the original crude petroleum or because of its neutralization during the cracking or distillation process, made necessary by impurities in the original crude pertoleum. Such natural petroleum derivatives or residuum are, therefore, to be distinguished from products of subsequent refining operations, as for instance may be obtained from the refining of lighter distillates and lubricating oils which are often treated with sulphuric acid, with precipitation of an acid sludge, commonly called acid tar. I do not regard such sludge as a petroleum derivative or residuum, and do not employ it in my process and materials.

The actual amount of carbon yielding material to be employed naturally depends somewhat on its character and the character and fineness of the carbon residue. In general, the preferred proportion of carbon yielding material may range from ten to twenty-five per cent by weight of the batch, but a residue of given fineness usually requires greater amounts of carbon yielding material of relatively low viscosity than is required with a carbon yielding material of higher viscosity, and a carbon residue of greater fineness usually requires more carbon yielding material of a given character and viscosity than a carbon residue of less fineness.

After creation of the batch as aforesaid, I place it in a suitable retort or retorts as aforesaid, and apply heat thereto. As a means of accomplishing greater solidity and coherence as hereinafter mentioned, I may, before or after placing said batch in said retort or retorts as aforesaid, compress said batch by suitable means. Said heat is applied and maintained at such temperature for such time as will create throughout said batch a temperature of the minimum degree evidenced by redness of color, whereupon and whereby the carbon yielding material in said batch yields and exercises its carbonizable content as a carbonized, homogeneous binder of said batch, and whereby said batch is converted to a state of coherence, dryness and solidity fully equal to the choicest natural yield of the distilling or cracking operation.

Now referring to the aforesaid amount of carbon yielding material that will render satisfactorily solid, dry and coherent the batch so created by causing said carbon yielding material in said batch contained to yield and exercise its carbonizable content as a carbonized, homogeneous binder of said batch, I find that in general, taking the mean of the serviceable minimum and maximum of said carbon yielding material, it is possible under favorable conditions to increase or decrease it by twenty per cent by weight and still produce a fuel of the solidity, dryness and coherence aforesaid. This latitude by further correct calculation, permits increase of such minimum if desired, to a maximum fifty per cent greater than such minimum and in other words, means that a maximum of carbon yielding material fifty per cent greater than the serviceable minimum thereof may be employed.

At different or all petroleum refineries is usually found a greater or less accumulation of more or less unsalable petroleum products in the range of which will likely be contained materials yielding the binder essential to my process. According to the degree such more or less unsalable products are

available and are suitable for my requirements, such products are obviously utilizable in my process within the minimum to maximum absorption limits thereof, in consequence of which the considerable spread or elasticity of such minimum and maximum limits are advantageously employed by any petroleum refiner operating my process according to his circumstances with respect to accumulation of unsalable products.

By reason of the heat employed in my process it operates, with respect to said carbon yielding material, as an incidental process of petroleum distillation. Inasmuch as a large portion of such carbon yielding material as I employ is recoverable as a condensate by means well known in the distilling art, it becomes apparent that I may perform in connection with the carbon yielding material in every batch carbonized, a substantial incidental distillation of said carbon yielding material, the distillate thereof being largely recoverable by the usual processes as a condensate of lighter and consequently more valuable and marketable character. As aforesaid, all carbon yielding material employed is caused to yield its carbonizable content as a carbonized binder of said batch, with the result that the condensate of such distillate is a refined substance.

I claim:

1. The process of producing an artificial fuel from the carbon residue of petroleum distillation or cracking which consists in reducing said residue to fineness, mixing said residue with a substantially neutral liquid petroleum derivative, and applying heat to the batch so formed at a carbonizing temperature to cause it to yield and exercise its carbonizable content as a carbonized, homogeneous binder of said batch into solid, coherent fuel.

2. The process of producing an artificial fuel from the carbon residue of petroleum distillation or cracking which consists in reducing said residue to fineness of ten to fifty mesh, mixing said residue with a substantially neutral liquid petroleum derivative, and applying heat to the batch so formed at a carbonizing temperature to yield and cause it to exercise its carbonizable content as a carbonized, homogeneous binder of said batch into solid, coherent fuel.

3. The process of producing an artificial fuel from the carbon residue of petroleum distillation or cracking which consists in reducing said residue to fineness, mixing said residue with a substantially neutral liquid petroleum derivative in amounts approximating from ten to twenty-five per cent by weight of the batch so formed, and applying heat to said batch at a carbonizing temperature to cause it to exercise its carbonizable content as a carbonized, homogeneous binder of said batch into solid, coherent fuel.

4. The process of preparing an artificial fuel from the carbon residue of petroleum distillation or cracking, which consists in reducing said residue to fineness, mixing at atmospheric temperature said residue with a substantially neutral petroleum derivative which is liquid at atmospheric temperature, and applying heat to the batch so formed at carbonizing temperature to cause it to yield and exercise its carbonizable content as a carbonized, homogeneous binder of said batch into solid, coherent fuel.

5. The process of producing an artificial fuel from the carbon residue of petroleum distillation or cracking, which consists in reducing said residue to fineness, mixing said residue with a natural, substantially neutral petroleum material, and applying heat to the batch so formed at a carbonizing temperature, to cause it to yield and exercise its carbonizable content as a carbonized, homogeneous binder of said batch into solid, coherent fuel.

6. The process of producing an artificial fuel from the carbon residue of petroleum distillation or cracking, which consists in reducing said residue to fineness of ten to fifty mesh, mixing said residue with a substantially neutral liquefiable petroleum derivative, and applying heat to the batch so formed at a carbonizing temperature to yield and cause it to exercise its carbonizable content as a carbonized, homogeneous binder of said batch into solid coherent fuel.

7. The process of producing an artificial fuel from the carbon residue of petroleum distillation or cracking, which consists in reducing said residue to fineness, mixing said residue with a substantially neutral liquefiable petroleum derivative in amounts approximating from ten to twenty-five percent by weight of the batch so formed, and applying heat to said batch at a carbonizing temperature to cause it to exercise its carbonizable content as a carbonized, homogeneous binder of said batch into solid coherent fuel.

Signed at Chicago, Ill., this 25th day of April, 1928.

RICHARD LEE RODGERS.