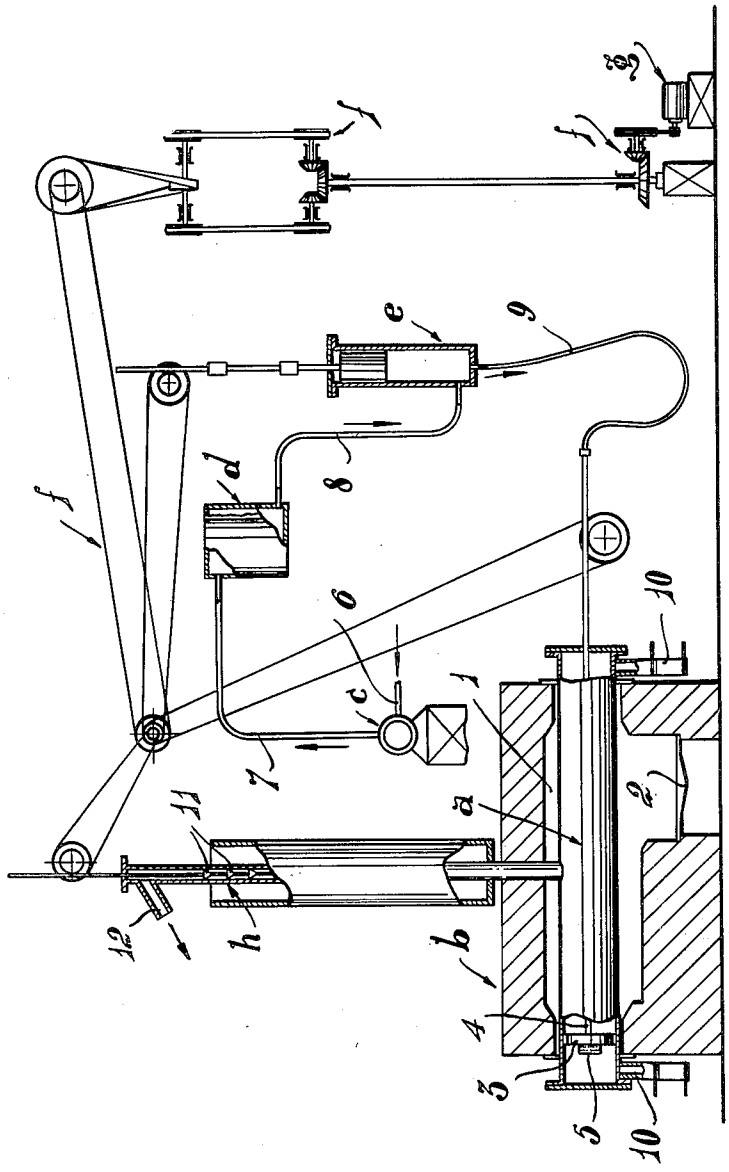
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METHOD OF AND APPARATUS FOR THE THERMOLYTIC DECOMPOSITION OF HEAVY LIQUID HYDROCARBONS

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METHOD OF AND APPARATUS FOR THE THERMOLYTIC DECOMPOSITION OF HEAVY LIQUID HYDROCARBONS

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1

The present invention refers to a process for obtaining at low cost a series of valuable products, especially carburetants for internal combustion engines.

The process according to the present invention is based on the use of a starting material which, even though known per se, has never been employed heretofore as a source for obtaining carburetants, fuels for general use, solvents and generally a series of highly desirable products.

In fact, the carbonization of wood which is carried out in practically all countries of the world in order to obtain charcoal is effected under such operating conditions that all those products which are not charcoal such as the substances given off in the form of gases, are waste, and nothing is done in order to prevent them from freely escaping into the atmosphere. Among the products thus lost, there is vegetable tar which comprises within its heterogeneous composition, light, medium and heavy oils.

As the result of a series of experiments, it has now been discovered that it is possible to obtain by a highly economical process, a series of very valuable products if the aforementioned tar is subjected to molecular disintegration preferably in one single step. The invention therefore essentially resides in the aforementioned feature and is distinguished from prior art by the fact that it consists in obtaining the products referred to by means of one single operation from one single starting material. This means to say that instead of obtaining complex products from a mixture of a number of components separately and independently produced, they are obtained directly.

The process provides considerable advantages since it does away with the system of fractional or individual production of the various components, which system is unavoidably expensive. The invention renders possible the production, on a commercial scale and at considerably reduced cost, of products such as carburetants and solvents which as is well known, are highly desirable products.

More particularly, it may be said that the process according to the instant invention consists in obtaining a mixture of aliphatic and aromatic hydrocarbons by means of molecular disintegration in one single step, from vegetable tars.

It will be appreciated that within the essential aspect of the invention which has just been explained, the process may be carried out in a great number of ways which will be evident to those familiar with the art.

2

The molecular disintegration or breaking up of the vegetable tar may be brought about by any known method such as pyrogenation, hydrogenation or cracking. Satisfactory results have been obtained by effecting the pyrogenation or heat treatment under specific working conditions in order to bring about successive chemical shocks upon the heavy molecules of the tar which tend to dissociate within the range of convenient distillation temperatures until the almost complete transformation thereof into lighter molecules is obtained, and this is achieved by systematical rectification at the very moment of pyrogenation. An equipment permitting the desired results to be obtained has been illustrated by way of example in the accompanying drawings in which the several parts of the equipment have been represented somewhat schematically.

The present invention is directed to a method of molecularly disintegrating or cracking heavy tar or heavy hydrocarbon comprising spraying a film of the heavy tar or hydrocarbon against a surface heated to a cracking temperature, retaining the tar on the heated surface while it is being cracked, progressively moving the locus of spray to continuously spray new increments of tar onto successive surface areas heated to the disintegrating or cracking temperature of the hydrocarbon being treated, removing from said heated surface solid residues produced during cracking, and recovering the disintegrated or cracked fractions which are mainly composed of hydrocarbons of the benzene series, such as benzene, toluene, xylene, cumene, retene, and the like. In the preferred form of the invention, the heated surface is a cracking tube.

From an apparatus standpoint, the invention broadly comprises an apparatus for cracking a hydrocarbon entity comprising the combination of a cracking surface adapted to be heated to the cracking temperature, means for progressively moving a spray head along said cracking surface, means for removing from the latter the decomposition residue produced during cracking of the hydrocarbon including tar, and means for recovering the disintegrated or cracked fractions. In the preferred form of the invention, the spray head reciprocates along said cracking surface and during its reciprocation emits successive increments of a hydrocarbon spray against successive areas of the cracking surface. The cracking surface is preferably in the form of a cracking tube. In one form of the invention the spray head is secured to a piston, said piston during its reciprocatory movement removing from the interior

wall of the cracking surface decomposition residue produced during the cracking of a heavy hydrocarbon.

In the drawings equal or corresponding parts have been designated by the same numerals or characters.

Referring to the drawing, it will be seen that *a* is a metal cylinder of relatively small diameter as compared with its length, mounted in heat exchange relationship with a hearth **1** of a furnace *b* provided with a grill **2** for solid fuel. Within the cylinder *a* there is arranged a piston **3** mounted on a piston-rod **4** which is longitudinally reciprocated by suitable means (not shown). The working face of the piston, which is of simple effect, is provided with an atomizing head **5** adapted to inject into the cylinder a finely subdivided spray of liquid tar fed through the bore of hollow piston-rod **4**. Piston-rod **4** is fed from an auxiliary equipment comprising a pump *c* connected to the tar reservoir (not shown) through a pipe **6**. Through another pipe **7** the tar is led into an intermediate reservoir *d* which in turn communicates through pipe **8** with the piston pump device *e*, this latter being provided for the purpose of feeding the liquid through flexible hose **9** into the bore of rod **4**. All the movements which must take place in order to operate the movable parts of the equipment are effected by means of a transmission system *f* driven by engine *g*.

It will be noticed that cylinder *a* is provided with two sumps **10** into which the carbon residues entrained by piston **3** are discharged. Associated with cylinder *a* is arranged a rectifying column *h* through which the gases forthcoming from the disintegration of the tar within the cylinder are passed. The rectifying column is provided with a number of rectifying plates **11** and an upper outlet **12** for discharging the partially rectified gases.

In accordance with the foregoing, the tar from the auxiliary pumping equipment enters cylinder *a* and is projected in the form of a fine spray against the inner walls of said cylinder which are heated to approximately 500° C., by furnace *b*. When the tar particles strike against the thus heated inner walls of cylinder *a*, the molecules are cracked or broken up because of the lower stability of the heavier molecules. The light fractions, which are those desired to be obtained, then enter the rectifying column *h* and are finally led towards storage tanks or any other suitable storage means. Those molecules which have not been modified within cylinder *a* may be recycled thereto for further treatment.

The light fractions are mainly composed of hydrocarbons of the benzene series such as benzene, toluene, xylene, cumene, retene, crysene and saturated acyclic fatty hydrocarbons. In experimental tests it has been possible to obtain, by means of the equipment described, up to 28% of aromatic and aliphatic hydrocarbons having boiling points comprised between 70° C and 200° C., said percentage being based on the amount of tar treated. The compositions obtained from the process according to the invention may show some variations in their chemical structure according to the wood from which the tar treated has been produced, and according to the particular operating conditions of a given treatment, etc. In view of the variety of factors which influence the chemical composition of the distillate obtained, it will be evident that the characteristic properties of the liquids obtained will vary accordingly, in the same way for instance as oils obtained from different crudes will vary according to the crudes. In connection with the present invention these differences do not adversely affect the suitability of the final products for the practical purposes already mentioned.

The compositions obtained show, among other desirable characteristics, the property of forming stable mixtures with normal grade ethyl alcohol (94/97° GL) and thus they are most suitable for use in carburetant mixtures in conjunction with ethyl alcohol, in internal combustion engines. The compositions obtained in accordance with the present invention may also be employed as fuels for other purposes, solvents for paints, varnishes, etc.

It will be understood that the process of the present invention may be varied or modified without departing from the essence of the invention which is defined in the annexed claims.

I claim:

1. In the method of cracking tar, the steps comprising spraying a film of tar against a surface heated to a cracking temperature, retaining the tar film on the heated surface, progressively moving the locus of spray to continuously spray new increments of tar on successive surface areas heated to the cracking temperature, progressively removing from said heated surface solid residues produced during cracking, and recovering the cracked vapors.

2. In the method of cracking tar, the steps comprising spraying a film of tar against the surface of a cracking tube heated to a cracking temperature, retaining the tar film on the heated surface of the tube, progressively moving the locus of spray to continuously spray new increments of tar on successive surface areas of the heated cracking tube, progressively removing from said tube solid residues produced during cracking, and recovering the cracked vapors.

3. In an apparatus for cracking tar, a horizontally disposed elongated cylinder, a furnace arranged in surrounding relation with respect to said cylinder, a piston of slightly less diameter than the diameter of said cylinder reciprocably arranged in said cylinder, an atomizing head arranged on the working face of the piston and adapted to inject into the cylinder a finely subdivided spray of fluid, a hollow horizonally disposed piston rod connected to said piston, a feeding assembly for supplying tar to said piston rod, a pair of vertically disposed spaced parallel sumps arranged at opposite ends of said cylinder for receiving carbon residue, a vertically disposed rectifying column arranged in communication with said cylinder and provided with a plurality of rectifying plates, and an outlet arranged on the upper end of said rectifying column for the egression therethrough of partially rectified gases.

4. In an apparatus for cracking a heavy hydrocarbon, the combination of a cracking surface adapted to be heated to a cracking temperature, means for reciprocating a spray head along said cracking surface while the spray head during one stroke of its travel emits successive increments of a hydrocarbon spray against successive surface areas of said cracking surface, means for removing from the latter during the return stroke of the spray head decomposition residue produced during the cracking of the heavy hydrocarbon, and means for recovering the cracked vapors.

5. In an apparatus for cracking a heavy hydro-

carbon, the combination of a substantially horizontal cracking tube, means for progressively moving a spray head in one direction along said cracking tube while the spray head emits a hydrocarbon spray against the cracking tube, means for removing from the latter during the movement of the spray head in an opposite direction the decomposition products produced during cracking of the hydrocarbon, and means for recovering the cracked vapors.

6. In an apparatus for cracking a heavy hydrocarbon, the combination of a substantially horizontal cracking tube, a piston reciprocating in said tube, a spray head secured to the piston for emitting a hydrocarbon spray against the interior wall of said tube, means for feeding a hydrocarbon to said spray head, said piston during its return stroke removing from the interior wall of the tube solid decomposition products produced during the cracking of the hydrocarbon, and means for recovering the cracked vapors.

7. In an apparatus for cracking a heavy hydrocarbon, the combination of a substantially horizontal cracking tube, a piston reciprocating in said tube, a spray head secured to the piston for emitting a hydrocarbon spray against the interior wall of said tube, a hollow piston rod operatively connected to said piston and said spray head for feeding hydrocarbon to said spray head, said piston during its return stroke removing from the interior wall of the tube the solid decomposition products produced during the cracking of the hydrocarbon, and means for recovering the cracked vapors.

8. In an apparatus for cracking a heavy hydrocarbon, the combination of a substantially horizontal cracking tube, a piston reciprocating in said tube, a spray head secured to the piston for emitting a hydrocarbon spray against the interior wall of said tube, means for feeding a hydrocarbon to said spray head, said piston during its return stroke removing from the interior wall of the tube solid decomposition products produced during the cracking of the hydrocarbon, means for recovering the cracked vapors, and spacedly disposed means operatively connected to said tube for receiving solid decomposition products removed by said piston from the interior wall of the tube.

9. In an apparatus for cracking a heavy hydrocarbon, the combination of a substantially horizontal cracking tube, a piston reciprocating in said tube, a spray head secured to the piston for emitting a hydrocarbon spray against the interior wall of said tube, means for feeding a hydrocarbon to said spray head, said piston during its return stroke removing from the interior wall of the tube solid decomposition products produced during the cracking of the hydrocarbon, means for recovering the cracked vapors, spacedly disposed means operatively connected to said tube for receiving solid decomposition products removed by said piston from the interior wall of the tube, and means for removing said decomposition products from the cracking tube on the piston reciprocating in said tube.

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