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PROCESS OF MANUFACTURING PETROLEUM-LIKE OIL BY DRY DISTILLATION OF A CARBONACEOUS MATERIAL
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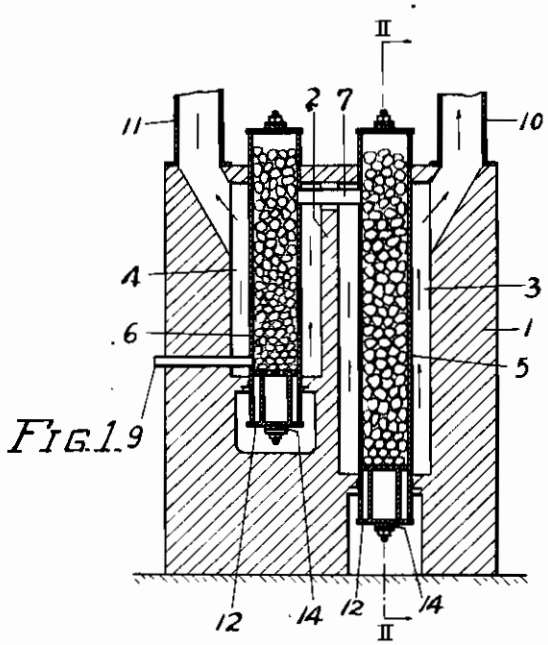


FIG. 1.

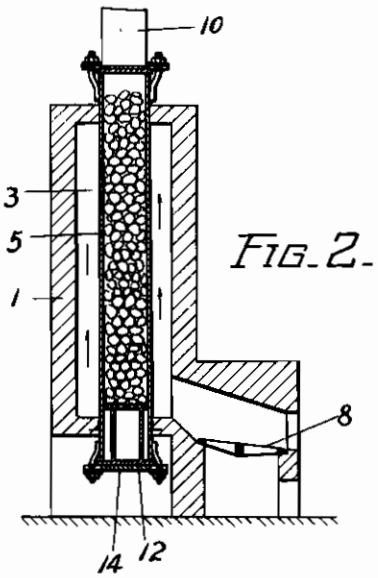


FIG. 2.

FIG. 3.

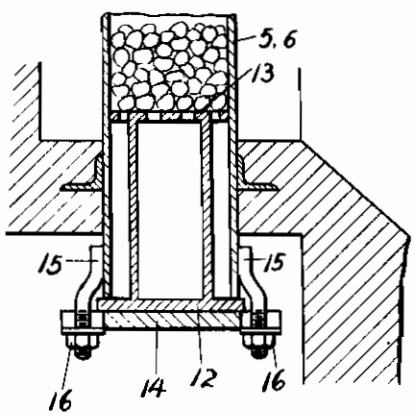
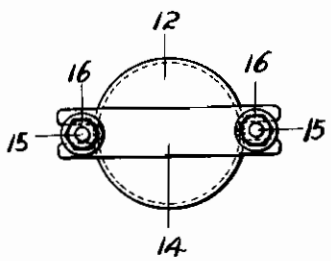


FIG. 4.



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ALIEN PROPERTY CUSTODIAN

PROCESS OF MANUFACTURING PETROLEUM-LIKE OIL BY DRY DISTILLATION OF A CARBONACEOUS MATERIAL

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This invention relates to a process of manufacturing petroleum-like oil by dry distillation of a carbonaceous material and consists in producing gas containing oil vapours by dry distillation of coal, brown coal, pitch, oil shale, timber or the like; passing the gas directly and without condensation through a separate reaction chamber stuffed with a catalyst comprising an adsorptive colloidal substance such as active charcoal, acidic clay, Florida earth, Fuller's earth, Kieselguhr and the like, which is preferably formed into granular or other suitable shape and kept at a temperature of 350° to 800° C., whereby converting the oil vapours contained in said gas into a vapour of stable petroleum-like oil; and then collecting same in liquid by cooling after taken out of the reaction chamber. The invention has for its object to readily produce petroleum-like oil, and especially rich in volatile oils, from coal, brown coal, oil shale, timber and the like, in an extremely simple manner with good yield.

It is well known that tar can be obtained by the way of dry distillation of coal or brown coal and the like. For instance, from coal or brown coal about 5% to 20% of tar may be obtained. Generally such tar contains about 40% to 50% of pitch and about 10% of gasoline, although the proportions more or less varies as the kind of the coals used. Moreover, said tar also contains other substances such as acidic oils, basic oils and paraffine, so that the tar can not be used as substitute of petroleum. In view of this, it is usually subjected to distillation or other treatment to separate it into paraffine, acidic oils, volatile oils, heavy oils and pitch, etc., or it is converted into gasoline by a destructive hydrogenation process under high pressure.

Although the chemical reaction which takes place when tar is produced by the so-called low temperature distillation of the above-mentioned raw materials is unknown, it may be chemically assumed that the hydrocarbons once vaporized from said raw material are condensed and converted into those of higher molecules when they are cooled, since such hydrocarbons contain those of unsaturated higher molecules and higher phenols, and by merely heating said products they are not readily vaporized, but undertake quite different decomposition to produce pitch, so that they do not return to the original vapour phase of hydrocarbons.

According to this invention, when the permanent gas containing oil vapours produced by dry distillation, that is, thermal decomposition of coal, brown coal, pitch, oil shale, timber or the like is introduced directly into a separate reaction chamber without condensation, and passed through a catalyst stuffed therein and comprising an adsorptive colloidal substance, such as active charcoal, acidic clay, Florida earth, Fuller's earth, Kieselguhr, and the like preferably formed into granular, cord-like or other suitable shape to pass the gas therethrough, and kept at a temperature of 350° to 800° C., it has been found that the majority of vapours of paraffine, acidic oils and basic oils in tar are decomposed into vapour of a petroleum-like oil of lower molecules, which is stable and contains gasoline and other volatile matters in remarkably increased content. This petroleum-like oil has a specific gravity lower than oils obtainable by the known low temperature distillation process; has least viscosity, contains from about 30% to 40% of gasoline, about 30% to 40% of light oils, about 20% to 40% of heavy oils, and substantially no pitch. It can be easily fractionated by mere distillation. It is found that the yield of this petroleum-like oil may decrease about 10% to 20% of oils yield obtainable by the known low temperature distillation process of the same raw material. It is deemed that this decrease in the yield may due mainly to gaseous conversion and water formation of a part of the oil vapours contained in the gas.

In the accompanying drawings:

Figure 1 is a vertical section through an apparatus suitable for carrying out the process of this invention;

Figure 2 is a section taken along line II—II of Figure 1;

Figure 3 shows in an enlarged scale a detail of a closing means used on the lower end of the distillation tower or of the gasolinating tower; and

Figure 4 is an end view of Figure 3.

Referring to the drawings, a retort 1 is divided by a partition wall 2 into two compartments 3 and 4. In the compartment 3, there is provided a distillating tower or column 5 which is charged with coal, brown coal, pitch, oil shale, timber or the like. In the compartment 4, there is provided a tower 6 which is filled with a catalyst, that is, a gasolinizing agent, such as active carbon, acidic clay, Florida earth, Fuller's earth, Japanese loam, Kieselguhr or the like, which is adapted for gasolinizing the vapour produced by dry distillation, that is, thermal decomposition of said raw material. The towers 5 and 6 are connected at their upper portions by a pipe 7. Each of said towers 5 and 6 is provided with an

independent fire grate, the fire grate 8 being adopted for the tower 5, and another similar fire grate (not shown) being provided for the tower 6. 10 and 11 are chimneys.

The gas containing oil vapours produced by dry distillation of the raw material in the tower 5 is introduced into the tower 6 through the pipe 7 and, while descending through the tower 6, it is chemically reacted by the catalyst acting as gasolinizing agent in said tower, and thus the oil vapours are gasolinated. It is discharged through a discharge pipe 9 provided in the lower part of the tower 6, and is collected after condensation. The lower end of each of the towers 5 and 6 is closed by means of a closure 12 having a bottom 13. Said closure 12 is clamped by means of a bar 14 held in place by bolts 15 welded to the lower part of the tower and nuts 16 screwed thereto. Similar closing means is provided at the top of each of the towers. Each tower is provided with a hopper at the top, and at the lower end it is provided with a discharge port for the purpose of replacement of the charge.

An example of a mode of carrying out this invention is as follows:

Employing the apparatus as described with reference to the accompanying drawings, the tower 5 is charged with, say, coal B as raw material, and the tower 6 is filled with Japanese acidic clay as catalyst which is preferably dried by heating at 200° C. Said coal B is first heated at 500° C., and the gas containing low temperature tar vapours produced thereby is directly passed through said catalyst layer which is heated at 500° C., and then it is condensed after taken out of the tower 6. By such process, a petroleum-like oil has been produced, which has light yellow colour and viscosity equal to that of petroleum, contains about 30% volatile oils, the yield thereof being about 13% of the raw material coal. On the contrary, when said vapour is cooled without being passed through the said catalyst layer, the low temperature tar thus produced is black oily substance which has no fluidity at normal temperature and is melt by heating, and the yield thereof is approximately 15%. Thus, it will be seen that according to this invention a petroleum-like oil can be most readily produced from coal B with a minor loss of about 10% relative to said low temperature tar.

The following table shows the results obtained by charging various sorts of raw materials in the tower 5; using active charcoal particles and other catalysts in the tower 6; effecting dry distillation of said raw materials in the tower 5 at temperature of from 500° to 600° C.; and passing the gas containing tar vapours thus produced through the catalyst layer in the tower 6 maintained at temperature of from 400° to 550° C.

Raw materials		A (North China)	B (Japan)	B (Japan)	C (Japan)	Coaltar pitch	Oil shale (Manchukuo)	Timber Jap. (pine)
Catalyst		Active charcoal.	Active charcoal.	Loam	Kieselguhr	Active charcoal.	Active charcoal.	Active charcoal.
Yield of oil relative to material coal		6.3%	13.0%	8.9%	14.0%	25.0%	5.0%	10.5%.
Yield of coke relative to material coal		84.0%	65.0%	65.0%	63.0%	40.5%		23.7%.
Constituents of oil (vol.%).	Volatile oil 0–220 c	32.1%	39.0%	60.0%	35.0%	38.0%	36.0%	41.0%.
	Light oil 220–300 c	38.5%	40.0%	37.0%	37.0%	44.0%	42.0%	39.0%.
	Heavy oil 300 c	29.4%	21.0%	Minimum	28.0%	18.0%	22.0%	20.0%.

The analytical results of the above raw materials are as follows:—

	Volatile matters	Fixed carbon	Ash	Water	Sulphur	Calories
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Kg. cal.*
A coal	13.0	81.0	4.0	2.0		7,500
B coal	42.8	36.2	13.4	5.6	2.5	6,500
C coal	45.2	35.8	11.2	5.8	2.0	6,600
Coaltar pitch	54.8	40.2	0.3	1.5	3.2	8,700
Oilshale (Manchukuo)	17.6	4.1	74.8	3.5	0.7	1,320
Timber (pine)	23.5	23.7	0.8	52.0		4,100

According to the process of this invention, the residue of dry distillation of the raw materials can be utilized as coke or low temperature coke, when the same are coal. Preferably the thickness of the catalyst layer applied may be varied according to the characteristics and activity of the catalyst used. The total amount of the permanent gas produced increases as increase of thickness of the catalyst layer and also as the rise of the temperature, resulting to decrease the oil yield however to increase the percentage of the volatile matters in the oil yield. Here, the increasing tendency of total contact of gasoline in the oil yield is shown as the temperature of the heated catalyst is elevated from 350° to 500° C. and then the decreasing tendency is shown from 500° to 800° C., the maximum being at 500° C. or about. When dry distillation of the raw material is effected by external heating, the produced gas may contain a moderate amount of ethane and higher gas, so that a part of the gas may be utilized as a raw gas for synthetically producing a polymer gasoline.

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