

PATENT SPECIFICATION



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COMPLETE SPECIFICATION.

Improvements in the Manufacture of Liquid Fuel similar to Petrol.

I, EUGENE ALBERT PRUDHOMME, of No. 22, rue Georges Clemenceau, Antibes (Alpes-Maritimes), France, French citizen, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

The present invention relates to a process for the manufacture of liquid fuels having the general characteristics of petrols and benzols.

The improved process according to the invention consists in adding to water gas or Dowson gas issuing from a gas producer, gases rich in hydrocarbons particularly of the acetylene series and in passing the complex gas mixture thus obtained first over a hydrogenation catalyst, then over a dehydrogenation catalyst and finally over catalysts hereinafter described to effect polymerisation of the acetylene hydrocarbons.

The addition to the water gas or Dowson gas of these hydrocarbons has the effect of initiating and facilitating the catalytic operations, and of rendering uniform the transformation of the gas mixture into liquid fuel.

This addition of hydrocarbons can be obtained by treating in the gas producer solid fuels rich in volatile materials, particularly woody lignites. For this purpose, the action of gas producer is in the known manner so regulated that above the reducing zone a part of the solid fuel distils material rich in hydrogen, methane, benzene, etc. These liquid or gaseous products mix with the carbon monoxide and the hydrogen from the main reaction of the water gas ($C + H_2O = CO + H_2$) and in the catalyst tubes participate in reactions which considerably increase the final yield in liquid fuel of the process.

The invention includes also a modification of the above process which consists

in passing a current of hot gas, derived from the gasification of the solid fuels, through a heated mass of solid fuel, lignite for example, causing a low temperature distillation of such mass of solid fuel. The complex gas mixture thus obtained and containing a considerable proportion of hydrocarbons, in particular acetylene hydrocarbons, is then treated by the catalysts.

The invention also includes a process of purifying the above gas mixture, in which such gas mixture is passed over the purifying mixture, for example that of Laming, i.e. over a mixture of lime and protoxide of iron, rendered porous by the addition of sawdust, this Laming's or similar mixture being heated to a temperature sufficient to prevent the condensation of the heavy hydrocarbons.

The invention also includes other characteristics hereinafter described and their various combinations.

A method of practically carrying out the whole of the operations enabling the manufacture in conformity with the invention of liquid fuel is described below, by way of example, with the assistance of the accompanying drawing, of which Fig. 1 is a diagram of the entire plant used.

Water gas or Dowson gas is passed through a serpentine heater coil. This heated gas traverses from top to bottom retorts 2 containing solid fuel, lignites for example. A low temperature distillation of the lignites occurs in these retorts. The gases coming from this distillation contain carbon monoxide hydrogen and from 15 to 20% for example of unsaturated gaseous hydrocarbons.

A complex gas mixture is thus obtained containing a considerable proportion of unstable acetylenic hydrocarbons, a certain number of these hydrocarbons tending to condense to form tars. The tem-

perature of the retort 2 and of the neighbouring piping is maintained sufficiently high fully to avoid any such condensation.

5 The entire gas mixture, *i.e.* the gas mixture containing both the permanent gases and the easily condensable vapours, passes at 3 into a purifying apparatus charged with the Laming's mixture heated to a suitable temperature. This mixture relieves the current of gas of the major portion of the sulphur which it contains and which is derived more particularly from the distillation of the lignites.

10 The temperature to which the purifying apparatus is raised prevents any condensation of the heavy hydrocarbons of the gas mixture.

15 Thus on leaving the purifying apparatus 3 a gas mixture is obtained freed of the major portion of its impurities, its sulphur in particular, and charged with acetylenic hydrocarbons, which have the effect of initiating the catalytic operations hereinafter described, of facilitating them and of rendering uniform the transformation of the gas mixture into liquid fuel.

20 The gas mixture issuing from the purifying apparatus 3 is passed over a succession of heated metal catalysts as follows: The mixture passes first at 4 through a first catalyst tube containing pumice stone impregnated with nickel powder and heated to between 180 and 200° C. The formation of a considerable quantity of methane in the gas mixture is thereby obtained.

25 The mixture thus charged with methane yet always containing nevertheless a certain proportion of acetylenic hydrocarbons, passes at 5 over vanadium and nickel charged pumice stone heated to a temperature varying from 200 to 230° C.; the methane is dehydrogenated with the formation of acetylene and liberation of nascent hydrogen.

30 Finally the gas mixture which has become very rich in acetylenic hydrocarbons passes at 6 over pumice stone charged with nickel and cobalt and heated to about 180° C., which effects a polymerisation of the acetylenic hydrocarbons. Finally on issue from the catalyst tube 6 a mixture of polymerised acetylenic hydrocarbons is obtained which can readily be condensed in a cooled worm 7, and collected in a receiver 8.

35 The residual uncondensed gases in the receiver 8, are either returned to the serpentine coil 1, if they are still sufficiently rich in hydrocarbons, or burnt to heat apparatuses.

40 These liquid products are of variable

composition which render them more or less similar to America, Caucasian or Galician petrols, of which they have approximately the composition, smell, appearance and density.

70 Numerous modifications can be made in the processes described by way of example.

75 For example water gas or Dowson gas may be obtained from the carbon residue from the distillation of the lignites in the retorts 2, which residue is similar to wood charcoal. The gasification of such carbon in the gas generator is very easy to conduct whereas on the contrary the gasification of lignites in a gas generator would be practically very difficult to effect.

80 Numerous modifications may be made in the selection of the catalysts. In the third catalysis stage, pumice stone either with nickel, or with cobalt, or with iron, or with a mixture of these metals, may be used.

85 Also solid fuels other than lignite, peat for example, may be treated in the retort 2.

90 The present invention extends to the above described processes in themselves, *i.e.* whatever be the apparatus selected for carrying them out. In all cases the arrangement shown in Fig. 2 in diagrammatic vertical section can with advantage be used for carrying out the process.

95 In this arrangement the gas generator 100 1* (in which steam is introduced for the formation in the well known manner of water gas or Dowson gas), the distillation retorts 2, the Laming's tubes 3, the catalyst tubes 4, 5 and 6 are grouped as a unit in such manner that the heat liberated by the gas generator suffices to effect at the same time the distillation in the retorts 2 and the reactions in the purifying and catalyst tubes 3, 4, 5 and 6. 105 110 Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:— 115

1. A process for the manufacture of liquid fuel having the general properties of petrols and benzols, consisting in adding to water gas or Dowson gas issuing from a gas producer, gases rich in hydrocarbons particularly of the acetylene series and in passing the complex gas mixture thus obtained over a hydrogenation catalyst, then over a dehydrogenation catalyst and finally over the catalysts herein described to effect polymerisation of the acetylene hydrocarbons.

2. A process according to Claim 1, in which the gases rich in hydrocarbons are derived from the distillation of a solid 130

fuel, such distillation taking place in the upper layers of solid fuel in the generator above the reducing zone in which the water gas or Dowson gas is produced.

5 3. A process of manufacture of liquid fuel according to Claim 2, in which a current of hot gas derived from the gasification of solid fuels, is passed through a heated mass of solid fuel, effecting a
10 low temperature distillation such mass of solid fuel.

15 4. A process according to Claim 3, in which the solid fuel submitted to a low temperature distillation under the action of the current of hot gas is a lignite or a peat, such lignite or peat leaving after

distillation a kind of wood charcoal, which can be readily gasified in a gas generator in order to pass the gas so-produced through fresh masses of lignite or peat to be distilled. 20

5. A process according to any of the foregoing Claims 1 to 4, in which the gas mixture is passed over a purifying mixture heated to a temperature sufficient to present condensation of the heavy hydrocarbons. 25

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2nd Edition

Fig. 1

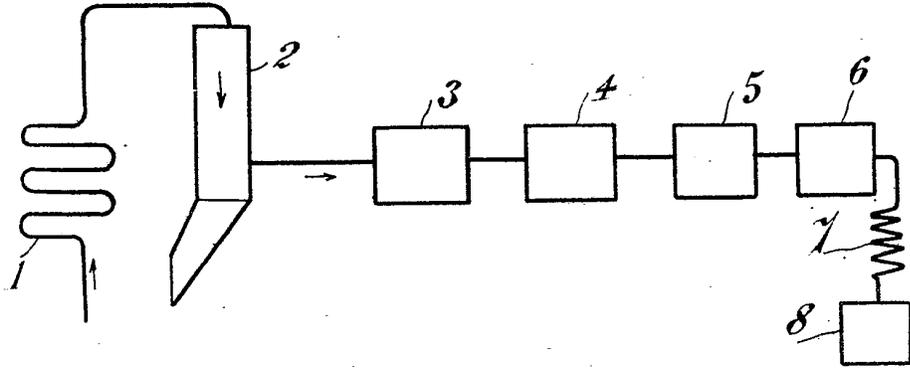
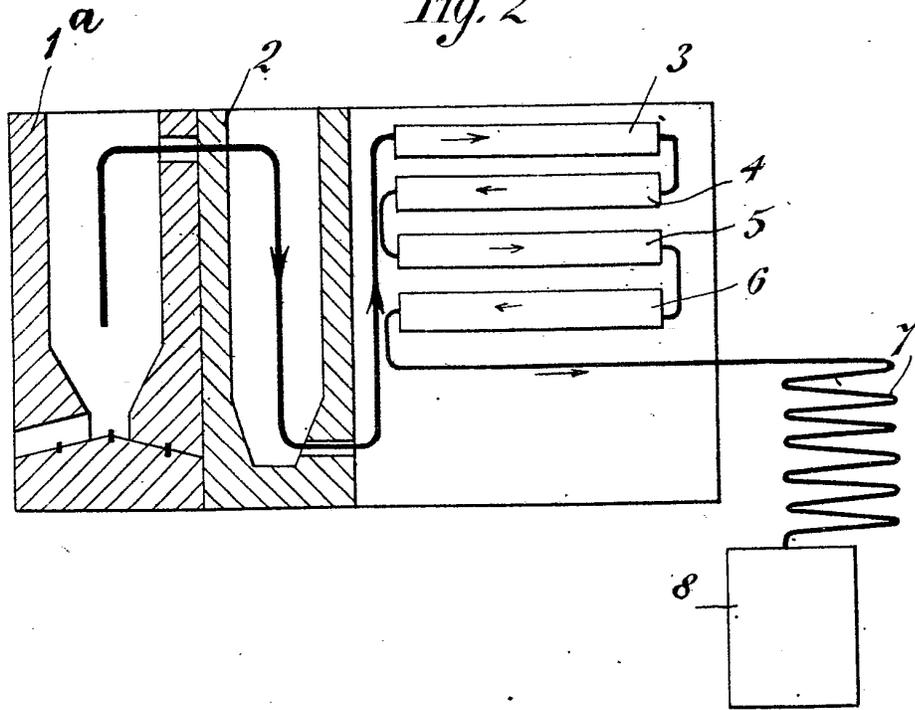


Fig. 2



[This Drawing is a reproduction of the Original on a reduced scale.]