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COMPLETE SPECIFICATION.

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Improvements in Synthetic Liquid Fuels.

We, COMPAGNIE GÉNÉRALE DES PRODUITS DE SYNTHÈSE, residing No. 40, rue Louis Blanc, Paris, France, a corporate body organized under the laws of the French Republic, 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 new process for the manufacture of a synthetic liquid fuel analogous to the petrols, and also, as a new manufactured product, to the liquid fuel obtained by this process.

The said process is based upon the formation and the polymerisation of hydrocarbons in the carbon gases obtained chiefly from gasifying of any suitable fuel.

One advantage of the process consists in the possibility of using fuel of all kinds, and chiefly fuel of an inexpensive nature such as the low grade coals, the schists, lignites, peat, and others.

The gas is produced in a manner which will be further specified, and hence the hydrogenation required for the production of the hydrocarbons will result from the action of a special catalyst which permits the obtainment of hydrocarbons corresponding to the formulæ C_nH_{2n+2}, C_nH_{2n}, etc. . . which are mixed with other oxygenated organic compounds in small quantities, and especially the ketones, $C_nH_{2n}O$.

The mean percentage composition of the resulting product is approximately as follows:

Hydrocarbon C_nH_m = 90 per cent.
Other oxygenated organic compounds ($C_nH_{2n}O$) etc. 10 per cent.

The first operation to be performed thus consists in the production of the gases to be treated, which should have the greatest possible uniformity of composition and should also be sufficiently rich in hydrogen, so that no external supply of this gas will be required. It is necessary on the other hand, to take account during the operations, of the steam which is admitted with the air, and of the volatile substances contained in the distilled gas.

The phenomena of moderate combustion and of distillation give rise to the usual series of reactions, and chiefly:

(1) $C+2O=CO$
(2) $C+CO_2=2CO$
(3) $C+H_2O=CO+2H$
(4) $C+2H_2O=CO_2+4H$

and among these reactions, only the first two are exothermic.

To the products of these reactions may be added the carbides of hydrogen, and principally C_2H_2 and CH_4.

Each of the aforesaid reactions is produced at a given temperature, for instance reaction (2) commences at 350° C., reaction (3) somewhat below 800°, etc. . .

By these different reactions, the required gases are formed in a gas producer which is suitably operated according to the nature of the fuel employed.

After the resulting gases have been purified and cooled, they are supplied to a compressor by which they are given a pressure of about 0.8 kg. per sq. cm. above atmospheric pressure. When delivered by the compressor, the gases are subjected to the catalytic treatment necessary for the formation and the polymerisation of the available hydrocarbons.

This treatment is effected in tubes of the proper size, for instance 1.50 m. length and 0.025 m. diameter, which figures are given only as an example and are not of a limitative nature, and they correspond to the flow of the gas at the rate of about 16 cu.m. per hour in each of the tubes. These latter, which contain the catalyst, are heated to a temperature of some 80° C. by the use of hot air, or by a small electric furnace of the resistance type, or by other means.

The catalyst consists chiefly of a mixture of sulphate of cerium and sulphate of cobalt, treated by a process which forms one of the essential objects of the invention.

The said catalyst can be obtained from monazite, which is a mineral containing especially cerium and thorium, and is found in abundance, chiefly in Mexico and Canada, it being employed in the

manufacture of incandescent gas mantles.

To produce the catalyst used in the process according to the present invention, the monazite is subjected to the following treatment. It is first freed from its impurities such as iron, antimony etc. . . and is then subjected to a moderate roasting, by which the oxidation of the constituents is completed. The residue is dissolved in concentrated hydrochloric acid and the greater part of the thorium is separated by the known method. The liquor is then neutralised by ammonia. To this is added nitric acid of 1/10 strength, then evaporating to dryness and dissolving in sulphuric acid of 1/2 strength. Evaporate, and dissolve is concentrated sulphuric acid, then evaporate for the last time until white fumes are produced.

When the mass swells up considerably, add a solution of sulphate of cobalt of 7.5 per cent. strength, in the proportion of 1/4 of the weight of the salt treated. Then evaporate until white fumes are produced, dissolve in water, and effect the electrolysis of the dissolved salt at about 2.4 volts, with a current density of three amperes per square decimeter of cathode surface. The cathode is dried, and the resulting electrolytic deposit is scraped off. This deposit has a dull appearance and a slightly metallic aspect. It is subjected to the action of X-rays for about 1/2 hour, and is then ready for use as a catalyst, in the proportion of about 0.5 per cent. of the weight of the gas under treatment.

The mixture of the carbon gases which have been produced, as above described, by a distillation and a moderate combustion, is subjected in the aforesaid conditions to a transformation due to the effect of the catalyst, and this transformation, when once commenced, will continue as long as the temperature remains constant.

After it has been discharged from the said tubes, the fuel substance is distilled in a set of retorts, and it is then ready for use.

The said fuel is chiefly characterised by its small density, which is about 0.680, and also by the fact that it can be readily lighted by a match. It is chemically neutral, and begins distillation at about 61° C. It also has a special odour.

In addition to its qualities as a fuel the said substance is a remarkable solvent for the fatty bodies, also for india rubber, cellulose acetate, etc.

Obviously, certain details of the said operations can be modified without departing from the principle of the invention, provided the essential features are maintained, which consist in the treatment, in the presence of the aforesaid catalyst, of the carbon gases such as are obtained by the distillation and the moderate combustion of any suitable fuel substance.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A process for the manufacture of a synthetic fuel, which consists in the production of hydrocarbon compounds C_nH_m, C_nH_mO by the treatment, at a temperature of some 80° C. and at a pressure near atmospheric pressure, of carbon gases analogous to the gases obtained by the treatment of a fuel substance in a gas producer in the presence of a catalyst produced by electrolysis of a mixture of sulphates of cerium and cobalt.

2. A process for the manufacture of a synthetic fuel as claimed in Claim 1 wherein the catalyst is produced by the use of monazite which is roasted and then treated by acid, then neutralised by an alkali, and subsequently dissolved in various acids substantially as described, and finally in sulphuric acid, then subjected to evaporations until white fumes are produced, after which cobalt sulphate is added to the residue and the mixture is electrolysed, and the electrolytic deposite, after an X-ray treatment, constitutes the catalyst employed in the said process.

3. A new manufactured product when obtained by the process claimed in claims 1 and 2 and adapted for use as a liquid fuel and as a solvent.

Dated this 2nd day of August, 1929.

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