

PATENT SPECIFICATION

269,521

Convention Date (Germany): April 14, 1926.

Application Date (in United Kingdom): April 4, 1927. No. 9196/27.

Complete Accepted: July 4, 1928.

1286



COMPLETE SPECIFICATION

Improvements in the Production of Liquid Hydrocarbons.

We, I. G. FARBENINDUSTRIE AKTIEN-
 GESELLSCHAFT, of Frankfort-on-Main,
 Germany, a corporation organized accord-
 ing to German laws, 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:—

In the British Patent No. 20,488/1913
 there is described a process for the pro-
 duction of liquid or easily liquefiable
 hydrocarbons or their derivatives by the
 reaction of oxides of carbon with hydro-
 gen, in the presence of catalysts under
 high pressures.

We have now found that hydrocarbons
 and more especially liquid hydrocarbons
 may be produced without difficulty and
 with a good yield, even at comparatively
 low temperatures, and under a pressure
 not exceeding 50 atmospheres, from
 gaseous mixtures consisting substantially
 of oxides of carbon and hydrogen when the
 catalysts employed consist wholly or par-
 tially of metallic sulphides. According
 to this method of working there is the
 special advantage that the contact is
 immune to toxic influences, and is not
 rendered inactive by sulphur or other
 impurities. Moreover, with the said
 catalysts it is possible to work at elevated
 temperatures and pressures which are com-
 paratively low in comparison with those
 employed according to the said Patent
 No. 20,488/1913. Those parts of the
 apparatus, especially any heated parts,
 which come into contact with the gases,
 should preferably be free from iron.

The following example will further
 illustrate how the said invention may be
 carried into practical effect but the in-
 vention is not limited to the example.

EXAMPLE.

Water gas is passed, under a pressure

of about 20 atmospheres, through a pres-
 sure apparatus, the contact chamber of
 which is lined with aluminium, main-
 tained at a temperature of 270° Centi-
 grade, and charged with cobalt sulphide
 compressed to lumps. An oil similar to
 petroleum is obtained, in association with
 water, on cooling the effluent gases. The
 pressure may be reduced still further.
 The residual gases may be returned in a
 circulatory system by means of a pump,
 the consumed portions being replaced by
 fresh gas.

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

1. A process for the production of liquid
 hydrocarbons, which consists in passing
 gaseous mixtures consisting substantially
 of oxides of carbon and hydrogen at ele-
 vated temperatures and pressures not
 exceeding 50 atmospheres, over contact
 masses consisting wholly or partially of
 metallic sulphides.

2. A method of carrying out the process
 claimed in Claim 1, which consists in
 keeping free from iron those parts and
 especially the heated parts of the appa-
 ratus which come into contact with the
 gases.

3. The process for the production of
 liquid hydrocarbons substantially as
 described in the foregoing example.

4. Liquid hydrocarbons when prepared
 in accordance with the preceding claim-
 ing clauses.

Dated this 4th day of April, 1927.

JOHNSONS & WILLCOX,
 47, Lincoln's Inn Fields, London, W.C. 2,
 Agents.

PATENT SPECIFICATION



Convention Date (Germany): April 15, 1926.

269,547

Application Date (in United Kingdom): April 12, 1927. No. 10,040/27.

Complete Specification Accepted: Feb. 16, 1928.

COMPLETE SPECIFICATION.

**Improvements in the Manufacture and Production of
Unsaturated Gaseous Hydrocarbons and Mixtures of Carbon
Monoxide and Hydrogen.**

We, I. G. FARBENINDUSTRIE AKTIEN-
GESELLSCHAFT, of Frankfurt-on-Main,
Germany, a corporation organized accord-
ing to German laws, do hereby declare
5 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 the
10 manufacture and production of valuable
unsaturated gaseous hydrocarbons and of
mixtures of carbon monoxide and
hydrogen from saturated hydrocarbons or
gas mixtures containing the same.

15 We have found that the last named
hydrocarbons or gas mixtures containing
the same may be converted into the said
more valuable unsaturated gaseous hydro-
carbons and mixtures of carbon monoxide
20 and hydrogen in a simple and very
economical manner by subjecting them in
the first place to a treatment suitable for
producing gaseous unsaturated hydro-
carbons such as acetylene and ethylene.
25 This conversion may be effected in various
ways. It may for instance take place by
electric heating, as for example by means
of an electric arc. Such methods have
repeatedly been suggested and any such
30 known and suitable methods may be
employed according to the present inven-
tion. The said conversion may also be
effected by a process comprising a kind
of incomplete combustion, such as has
35 been suggested for instance in the Speci-
fications Nos. 264,845 and 265,284. The
gaseous unsaturated hydrocarbons formed
by this treatment are then separated from
the gas mixture, either as such or after
40 the said unsaturated hydrocarbons have
been subjected to further reactions, as for
example after having been converted into
acetaldehyde or benzene. The residual
gas is then converted into a mixture of
45 carbon monoxide and hydrogen by treat-
ing it in the manner already known with
steam, or with oxygen or gases containing
oxygen, or with both these agents at a
high temperature in the absence or
50 presence of catalysts. The resulting mix-

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ture of carbon monoxide and hydrogen
may be either directly employed as for
example for the catalytic manufacture of
methanol, or it may be decomposed with
steam to produce a mixture of carbon
55 dioxide and hydrogen, from which pure
hydrogen can readily be obtained which
may be employed for example for the
synthesis of ammonia.

As the conversion of saturated hydro-
60 carbons or gases containing the same into
unsaturated hydrocarbons cannot be car-
ried out in a quantitative manner at all
or at any rate only with great difficulty
the process according to our present
65 invention possesses the advantage that the
hydrocarbons can be completely converted
into much more valuable gases or gas
mixtures and thus be utilised for the
70 production of a great variety of com-
pounds.

The following examples will further
illustrate how our said invention may be
carried out in practice, but the invention
75 is not limited to these examples.

EXAMPLE 1.

A gas mixture consisting of 20 per cent.
of methane and 80 per cent. of hydrogen
is passed through an electric arc. The
80 resulting gas contains 3 per cent. of
acetylene which is absorbed by means of
active charcoal. The residual gas is pre-
heated in any suitable manner and then
subjected to partial combustion by means
of oxygen, whereby its temperature is
85 raised to about 1100° Centigrade; it is
then passed together with steam over a
catalyst consisting of nickel and alumina.
The resulting gas contains 7.6 per cent. of
90 carbon dioxide, 7.2 per cent. of carbon
monoxide, 84.8 per cent. of hydrogen and
0.4 per cent. of methane.

EXAMPLE 2.

1100 cubic metres of natural gas heated
to about 500° Centigrade are subjected to
95 an acetylene-forming treatment consist-
ing in an incomplete combustion with
about 400 cubic metres of oxygen. The
resulting gas mixture, composed of about
20 cubic metres of carbon dioxide, 96-100

cubic metres of acetylene, 400 cubic metres of carbon monoxide, 700 cubic metres of hydrogen, 500 cubic metres of methane and 20 cubic metres of nitrogen, is passed at 700° Centigrade over silica coated with graphite, whereby benzene is formed which is separated from the gas mixture by means of active charcoal at room temperature. The residual gas mixture is then passed through hot water and thus saturated with water vapour, then preheated to about 600° Centigrade and subjected to partial combustion with about 270 cubic metres of oxygen. The combustion gases are passed, after an addition of steam, over a catalyst consisting of nickel and magnesia. The resulting gas contains besides carbon dioxide nitrogen and small quantities of methane (about 0.4 per cent.) chiefly carbon monoxide and hydrogen in the proportion of about 1 to 2; after removing the carbon dioxide and traces of sulphuretted hydrogen present, it may directly be employed for the synthesis of methanol.

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 and production of unsaturated gaseous hydrocarbons and mixtures of carbon monoxide and hydrogen which consists in subjecting saturated hydrocarbons or gas mixtures containing the same in the first place to a treatment giving rise to the formation of unsaturated hydrocarbons, separating the latter from the gas mixture and converting the residual gas into a mixture substantially composed of carbon monoxide and hydrogen by treatment with steam or oxygen or both, in the absence or presence of catalysts.
2. The process for the manufacture and production of unsaturated gaseous hydrocarbons and mixtures of carbon monoxide and hydrogen substantially as described in each of the foregoing examples.
3. Unsaturated gaseous hydrocarbons and mixtures of carbon monoxide and hydrogen when prepared in accordance with the preceding claiming clauses.

Dated this 12th day of April, 1927.

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 Agents.