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SUPERINTENDENCIA Y COMERCIO

Radicación : 00090145 / 00000001 Folios: 2
Fecha (RAD): 2003-07-07 12:14:17
Trámite : 002 PATENTES D 1 REGISTRO/ 538 PETICION
Dependencia: 2020 DIVISION DE NUEVAS CREACIONES

SEÑORES
SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIVISIÓN DE NUEVAS CREACIONES
MINISTERIO DE DESARROLLO ECONOMICO

REF: EXPEDIENTE : **00090145**
SOLICITANTE: BP EXPLORATION OPERATING COMPANY
 LIMITED

FECHA DE LA SOLICITUD: NOVIEMBRE 24, 2000

TITULO: PROCEDIMIENTO PARA CONVERTIR GAS
DE SINTESIS EN HIDROCARBUROS SUPERIORES

ASUNTO: SOLICITUD ESTUDIO DE FONDO

DILIA RODRÍGUEZ D'ALEMAN, en mi condición de apoderada de la Sociedad solicitante, por el presente escrito atentamente solicito a Usted que habiéndose surtido la publicación de la presente solicitud, en la Gaceta de la Propiedad Industrial N°.520 de fecha Septiembre 27 de 2002 se proceda con el estudio de Fondo.

Para tal fin me permito anexar la tasa correspondiente.

Agradezco continuar con el presente trámite.

Señor Jefe,


DILIA RODRÍGUEZ D'ALEMAN
T.P.No. 20824 del CSJ

P-383

NIT : 800176089-2

Industria y Comercio

SUPERINTENDENCIA

SUPERINDUSTRIA Y COMERCIO

Folios: 2

RECIBO OFICIAL DE CAJA : 03 - 10,288
FECHA : FEBRERO 11 DE 2003

Radicación : 80038145 - 80000234

Fecha (MD): 2003-02-07 12:14:17

Trámite : PRE PATENTES D 1 REGISTRO/ 538 PETICION

Dependencia: 2300 DIVISION DE NUEVAS CREACIONES

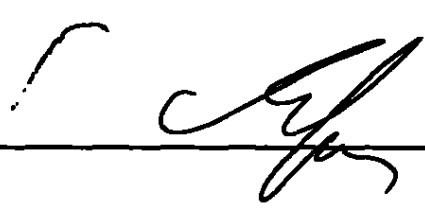
***** CONSIGNACION

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PGO	Vr. PAGO
CLARKE NODET Y CO. COLOMBIA	CONSIGNACION	BANCO POPULAR	050-00110-6	9932982	11/02/2003	2,692,000.00

***** CONCEPTO *****

CANT. RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1 50005-01-01 SOLICITUDES	85 EXAMEN DE PATENTABILIDAD DE INVEN	335,000.00
	TOTAL :	\$ 335,000.00

SON: TRESCIENTOS TREINTA Y CINCO MIL PESOS

RESPONSABLE : 

RECIBO DE CAJA APLICADO AL EXPEDIENTE No. _____

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2-303

**SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIVISIÓN DE NUEVAS CREACIONES**

2020

Bogotá, D. C., 24 de Agosto de 2005

Doctora

DILIA MARIA RODRIGUEZ D'ALEMAN

Representante BP EXPLORATION OPERATING COMPANY

ASUNTO	Radicación No.	00 - 90145
	Trámite	002
	Evento	001
	Actuación	430, 7738
	Oficio	
	Folios	015

Como resultado del examen de fondo, realizado con fundamento en el artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica

1) Documentos estudiados:

- a) Para el presente estudio se tendrán en cuenta el capítulo descriptivo, comprendido en los folios 3 a 15 de la solicitud en estudio.
- b) Para el presente estudio se tendrán en cuenta los dibujos comprendidos en el folio 21 de la solicitud en estudio.
- c) Para el presente estudio se tendrá en cuenta el capítulo reivindicatorio que comprende 25 reivindicaciones en los folios 16 a 19 de la solicitud en estudio.
- d) Conforme lo establece los artículos 9, 10 y 11 de la decisión 486 de la Comisión de la Comunidad Andina, la presente solicitud en estudio fue presentada el 24 de noviembre de 2000, y en el momento de la radicación SI se reclamo prioridad de la primera solicitud presentada en Gran Bretaña GB9928132.1

2) Objeto de la invención

- a) Las reivindicaciones 1 a 25 de la solicitud en estudio se refieren a
 - i) (1.-) Un procedimiento para la conversión de gas de síntesis a productos hidrocarbonados superiores en un sistema que comprende una zona de mezcla a elevado esfuerzo cortante y una zona de post-mezcla, cuyo procedimiento comprende:
 - a) pasar una suspensión de catalizador en un medio líquido a través de la zona de mezcla a elevado esfuerzo cortante en donde la suspensión se mezcla con gas de síntesis;

- b) descargar una mezcla de gas de síntesis y suspensión desde la zona de mezcla a elevado esfuerzo cortante a la zona de post-mezcla;
- c) convertir al menos una porción del gas de síntesis a hidrocarburos superiores en la zona de post-mezcla, para formar una suspensión de producto que comprende catalizador suspendido en el medio líquido y los hidrocarburos superiores;
- d) separar una corriente gaseosa que comprende gas de síntesis sin convertir de la suspensión de producto;
- e) reciclar la corriente gaseosa separada a la zona de mezcla a elevado esfuerzo cortante; y
- f) reciclar al menos una porción de la suspensión de producto a la zona de mezcla a elevado esfuerzo cortante

ii) (21.-) Aparato que comprende una pluralidad de zonas de mezclado a elevado esfuerzo...

- b) El anterior procedimiento y el aparato para su funcionamiento buscan mejores formas de obtener hidrocarburos líquidos.
- c) Según la Clasificación Internacional de Patentes, la codificación para esta solicitud corresponde a C 10 G 5/00

3) Claridad de la Solicitud

- a) El artículo 28 de la Decisión 486 de la Comisión de la Comunidad Andina de Naciones establece

"La descripción deberá divulgar la invención de manera suficientemente clara y completa para su comprensión y para que una persona capacitada en la materia técnica correspondiente pueda ejecutarla"

La descripción no es clara toda vez que el empleo de unidades de medida no es adecuado. Debe recordarse que las unidades de presión son los Pascales y no los bares. De acuerdo a la norma 1000 de uso obligatorio en Colombia, las unidades bar solo se usan en casos excepcionales y solo referidas a presión en líquidos. De la misma forma, expresiones como μ no representan ninguna unidad de medida. Deben estarse refiriendo a μm . Se debe revisar todo el documento.

- b) El artículo 30 de la Decisión 486 de la Comisión de la Comunidad Andina establece que

"Las reivindicaciones definirán la materia que se desea proteger mediante la patente. Deben ser claras y concisas y estar enteramente sustentadas por la descripción. Las reivindicaciones podrán ser independientes o dependientes. Una reivindicación será independiente cuando defina la materia que se desea proteger sin referencia a otra reivindicación anterior. Una reivindicación será dependiente cuando defina la materia que se desea proteger refiriéndose a una reivindicación anterior. Una reivindicación será dependiente cuando defina la materia que se desea proteger"

refiriéndose a una reivindicación anterior.- Una reivindicación que se refiera a dos o más reivindicaciones anteriores se considerará reivindicación dependiente múltiple."

El capítulo reivindicatorio no es claro toda vez que:

- i) El solicitante encabeza el objeto de la solicitud en la reivindicación principal como procedimiento para la conversión de reactantes gaseosos, cuando a través de toda la descripción y de la solicitud original británica se refieren expresamente al gas de síntesis. Por tanto, dicha reivindicación principal no tendría sustento en la descripción. La reivindicación debe limitarse sólo al gas de síntesis.
- ii) El término "elevado esfuerzo cortante" es ambiguo ya que no permite entender con claridad a que tanto esfuerzo se refiere. Esta variable se puede medir y el solicitante puede indicar a que tanto esfuerzo se refiere.
- iii) El término "bajo punto de ebullición" es ambiguo ya que no permite entender con claridad a que hidrocarburos se refiere. Esta variable (temperatura) se puede medir y el solicitante puede indicar a que denomina bajo punto de ebullición.
- iv) No se admiten expresiones como "aproximadamente" o "cerca de..." o similares.
- v) El empleo de unidades de medida no es adecuado. Debe recordarse que las unidades de presión son los Pascales y no los bares. De acuerdo a la norma 1000 de uso obligatorio en Colombia, las unidades bar solo se usan en casos excepcionales y solo referidas a presión en líquidos, no siendo este dicho caso. De la misma forma, expresiones como μ no representan ninguna unidad de medida. Deben estarse refiriendo a μm .
- vi) Son ambiguos los términos "cerca de la parte inferior" o "cerca de la parte superior". Deben reemplazarse por unos que sí definan la materia que se desee proteger.
- vii) No se precisa la materia sobre la cual se solicita protección. Cómo se explicará en el punto 4), la presente solicitud no posee unidad de invención, por lo que no está definida la materia sobre la cual se solicita protección.

De acuerdo a lo anterior, el capítulo reivindicatorio no cumple con el requisito de claridad de acuerdo a lo establecido en el Art. 30 de la Decisión 486.

4) Evaluación de la Unidad de Invención

El artículo 25 de la Decisión 486 de la Comisión de la Comunidad Andina establece

"La solicitud de patente sólo podrá comprender una invención o un grupo de invenciones relacionadas entre sí, de manera que conformen un único concepto inventivo"

La presente solicitud carece de unidad de invención toda vez que configura DOS diferentes objetos. La definición de la materia que caracteriza a cada una de las reivindicaciones independientes es diferente entre sí dado que lo que los relaciona, un aparato con múltiples zonas de mezclado y con toberas, es muy conocido en la técnica Eso indica que no existirían un único concepto común inventivo.

De acuerdo a lo anterior, la presente solicitud no cumple con el requisito de unidad de invención de acuerdo al Art. 25 de la Decisión 486.

5) Determinación del Estado de la Técnica

El artículo 16 de la Decisión 486 de la Comisión establece:

"El estado de la técnica comprenderá todo lo que haya sido accesible al público por una descripción escrita u oral, utilización, comercialización o cualquier otro medio antes de la fecha de presentación de la solicitud de patente o, en su caso, de la prioridad reconocida."

"Sólo para el efecto de la determinación de la novedad, también se considerará dentro del estado de la técnica, el contenido de una solicitud de patente en trámite ante la oficina nacional competente cuya fecha de presentación o de prioridad fuese anterior a la fecha de presentación o de prioridad de la solicitud de patente que se estuviese examinando, siempre que dicho contenido este incluido en la solicitud de fecha anterior cuando ella se publique o hubiese transcurrido el plazo previsto en el artículo 40."

Consultadas las bases de datos y los archivos con que cuenta la entidad, especialmente bajo las clasificaciones C 10 G 5/00 y las más cercanas a ellas, se encontró que antes del 26 de noviembre de 1999 (fecha para determinar el estado de la técnica) habían sido publicados los documentos que se enumeran en la siguiente tabla los cuales se relacionan con procedimientos y aparatos para procesar gas de síntesis.

De acuerdo con o establecido en el artículo 16 se determinó el estado de la técnica y se encontró el siguiente antecedente:

Nº	Documento	Título	Fecha de Publicación
D1	GB 728543	Process for synthesis of hydrocarbons	1953.03.03

6) Evaluación de los requisitos de patentabilidad

El artículo 14 de la Decisión 486 de la Comisión de la Comunidad Andina establece:

"Los Países Miembros otorgarán patentes para las invenciones, sean de producto o procedimiento, en todos los campos de la tecnología, siempre que sean nuevas tengan nivel inventivo y sean susceptibles de aplicación industrial".

En cumplimiento con este artículo, se procedió a evaluar los requisitos de novedad, nivel inventivo y aplicación industrial con el fin de establecer la patentabilidad de la invención reivindicada en la solicitud en estudio.

a) Evaluación del Nivel Inventivo

El art. 18 de la Decisión 486 de la Comisión de la Comunidad Andina establece:

"Se considerará que una invención tiene nivel inventivo, si para una persona del oficio normalmente versada en el arte en la materia técnica correspondiente, esa invención no hubiese resultado obvia ni se hubiese derivado de manera evidente del estado de la técnica".

D1 GB 728543, relaciona procesos que incluyen las características técnicas más importantes de la presente solicitud: diferentes zonas de mezcla, toberas para mejorar la mezcla, etc. La diferencia se presentaría solamente en las opciones de recirculación, lo cual resulta evidente para una persona que conozca del arte. De la misma el aparato de D1 se diferencia de la presente solicitud en la opción de recirculación, que a todas luces resulta demasiado evidente para un técnico medio.

b) Resumen

En conclusión los requisitos de patentabilidad de la presente solicitud se podrían ver afectados así:

Nº	Documento	Reivindicaciones afectadas	Requisito que afecta
D1	GB 728543	1 - 25	Nivel inventivo

7) Notificación

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que dentro del término de sesenta días contados a partir de la fecha de la notificación de la presente comunicación debe responder a la notificación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Notifíquese el presente oficio conforme a lo dispuesto por el numeral 5.2, literal e) del capítulo quinto del título primero de la Circular Única N° 10 de 2001


ALIX CARMENZA CÉSPEDES DE VERGEL
Jefe División de Nuevas Creaciones

El anterior requerimiento fue notificado por fijación en la lista, de fecha

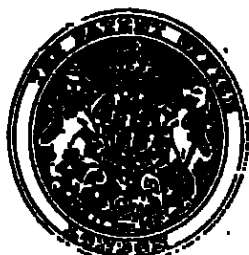
10.9 SET. 2005

Concepto Técnico N°	EXAMINADOR TÉCNICO	EXAMINADOR JURÍDICO
1272	Código No. 202003	Código No.

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PATENT SPECIFICATION

728.543



Date of Application and filing Complete Specification: March 3, 1953.
No. 5933/53.
Application made in Germany on March 5, 1952.
Application made in Germany on Feb. 19, 1953.
Complete Specification Published: April 20, 1955.

Ind

ERRATUM

SPECIFICATION No. 728,543

Page 4, line 14, for "50" read "20"

THE PATENT OFFICE,
16th June, 1955.

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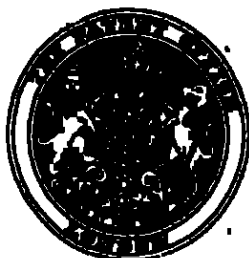
fashion within a hydrocarbon oil (contact oil) or is suspended in finely divided form in the contact oil.
The synthesis gas is passed through the hydrocarbon oil in finely divided form, there being formed by an exothermic reaction with the assistance of the fixed or suspended catalysts, hydrocarbons which partially dissolve in the hydrocarbon oil and partially form a mixture of gas and vapours with the residual gas. When the reaction has ended, the hydrocarbons formed are separated from the hydrocarbon oil.
The hydrocarbon oil may form a liquid column in the reaction chamber, through which the synthesis gas is then passed so as to come into contact with the contact substance situated in suspension or in fixed fashion in the oil. A so-called internal return then takes place, that is to say, the oil moves upwards in the centre of the reaction chamber and down again along the walls. It has also been proposed to guide the contact oil from the bottom upwards through a reaction chamber in a continuous stream, in which case an external circuit is formed, in which the means for effecting the circulation and any additional devices for cooling and purifying the contact oil are situated.
It has now been found that the actual synthesising operation can be improved and

in addition to the
aforesaid advantages, further advantages residing in a more even distribution of the gas in the contact oil. It is known that a certain volume of contact oil must be available for the reaction of the synthesis gas. In the existing reaction chambers provided for these purposes, the contact oil has been situated in wide but relatively low reaction vessels. It has now been found that a substantially more uniform distribution of the gas in the contact oil can be obtained by employing, with the same ratio of volume of contact oil to synthesis gas, a tower-like reaction vessel of small diameter and correspondingly great height and effecting the cooling of the contact oil or mixture of contact oil and gas in the reaction chamber in a number of stages in such manner that the mixture of synthesis gas and contact oil successively flows through cooling stages at increasing temperature. The increased speed of flow of the synthesis gas within the reaction chamber resulting from the tower-like construction of the reaction chamber produces, as already stated, a more uniform distribution of the gas in the contact oil and a correspondingly higher reaction rate.
A further advantage of the subdivision of the cooling means provided within the reaction chambers into a number of separate cooling stages resides in that the reaction of the synthesis gas is uniformly distributed over

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PATENT SPECIFICATION

728.543



Date of Application and filing Complete Specification: March 3, 1953.

No. 5933/53.

Application made in Germany on March 5, 1952.

Application made in Germany on Feb. 19, 1953.

Complete Specification Published: April 20, 1955.

Index at acceptance:—Class 2(3), B1G.

COMPLETE SPECIFICATION

Process for the Synthesis of Hydrocarbons

We, HEINRICH KOPFERS GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, a German Company, of Moltkestrasse 29, Essen, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates generally to the production of hydrocarbons by the reaction of carbon monoxide and hydrogen (synthesis gas), or gas mixtures containing these substances, in the presence of catalysts. The invention concerns more particularly a process in which the catalyst is disposed in fixed fashion within a hydrocarbon oil (contact oil) or is suspended in finely divided form in the contact oil.

The synthesis gas is passed through the hydrocarbon oil in finely divided form, there being formed by an exothermic reaction with the assistance of the fixed or suspended catalysts, hydrocarbons which partially dissolve in the hydrocarbon oil and partially form a mixture of gas and vapours with the residual gas. When the reaction has ended, the hydrocarbons formed are separated from the hydrocarbon oil.

The hydrocarbon oil may form a liquid column in the reaction chamber, through which the synthesis gas is then passed so as to come into contact with the contact substance situated in suspension or in fixed fashion in the oil. A so-called internal return then takes place, that is to say, the oil moves upwards in the centre of the reaction chamber and down again along the walls. It has also been proposed to guide the contact oil from the bottom upwards through a reaction chamber in a continuous stream, in which case an external circuit is formed, in which the means for effecting the circulation and any additional devices for cooling and purifying the contact oil are situated.

It has now been found that the actual synthesising operation can be improved and

in particular the nature of the hydrocarbons produced may be more effectively influenced by providing within the reaction chamber a fixed cooling arrangement with which the circulating contact oil and the synthesis gas can be brought into contact during their passage through the reaction chamber.

In accordance with the invention, therefore, the mechanically moved stream of contact oil circulating after the separation of the gas, and the synthesis gas are introduced into the reaction chamber below a cooling arrangement disposed therein.

Further experiments have shown that the arrangement of the cooling means within the reaction chamber affords, in addition to the aforesaid advantages, further advantages residing in a more even distribution of the gas in the contact oil. It is known that a certain volume of contact oil must be available for the reaction of the synthesis gas. In the existing reaction chambers provided for these purposes, the contact oil has been situated in wide but relatively low reaction vessels. It has now been found that a substantially more uniform distribution of the gas in the contact oil can be obtained by employing, with the same ratio of volume of contact oil to synthesis gas, a tower-like reaction vessel of small diameter and correspondingly great height and effecting the cooling of the contact oil or mixture of contact oil and gas in the reaction chamber in a number of stages in such manner that the mixture of synthesis gas and contact oil successively flows through cooling stages at increasing temperature. The increased speed of flow of the synthesis gas within the reaction chamber resulting from the tower-like construction of the reaction chamber produces, as already stated, a more uniform distribution of the gas in the contact oil and a correspondingly higher reaction rate.

A further advantage of the subdivision of the cooling means provided within the reaction chambers into a number of separate cooling stages resides in that the reaction of the synthesis gas is uniformly distributed over

the entire height of the reaction tower or the entire quantity of contact oil. Moreover, owing to the fact that the individual cooling stages have a temperature increasing from the bottom upwards, the reaction can be retarded in the places where the concentration of carbon monoxide and hydrogen is highest, namely in the lower part of the reaction tower, by the application of low temperatures. In accordance with the reduction of the concentration of the reaction substances, the temperature is then increased in the higher zones of the reaction tower, so that the complete reaction between the carbon monoxide and the hydrogen, corresponding substantially to equilibrium, is obtained in the neighbourhood of the top of the reaction tower.

The subdivision of the cooling means provided within the reaction chamber into a number of cooling stages independently fed with cooling medium can be effected in various ways. All the cooling stages may be arranged one above the other within the same tower. Alternatively, the reaction tower may be subdivided into two or more units in such manner that a circulation of contact oil takes place in each unit, the synthesis gas flowing successively through the individual reaction chambers. At least one internal cooling means is then provided in association with each of these reaction chambers. If the process is carried out in such an arrangement, not only is it possible to maintain different temperatures in the individual reaction chamber units, but the concentration of catalyst therein may also be varied. It is thus possible to vary the chemical nature of the hydrocarbons produced within relatively wide limits by variation of the temperature and the concentration of the catalyst, so that hydrocarbons may be obtained which it has hitherto been impossible to produce by the processes and arrangements hitherto normally employed for the synthesis of hydrocarbons, or which could not hitherto be produced in sufficient quantities by such processes and arrangements.

While a uniform distribution of the gas within the volume of contact oil can be obtained to a certain extent by the subdivision of the internal cooling means into a number of cooling stages and by the tower-like construction of the reaction chamber in accordance with the invention, this distribution can be further improved by providing for feeding the synthesis gas to the reaction chamber at the lower end of the tower-like reaction chamber, one or a series of nozzles associated with liquid nozzles for the supply of the contact oil, the latter being introduced in such manner that the speed of flow of the contact oil in the region of the gas inlet points is different from the speed of flow of the synthesis gas passing into the liquid, and is more

especially greater than the speed of the synthesis gas.

Hitherto, the synthesis gas has been introduced through ceramic filter plates or the like from below into the unbroken column of contact oil, and the contact oil escaping at the top has been fed back at the bottom independently thereof. If the contact oil and the synthesis gas are introduced into the reaction chamber in the manner proposed in accordance with the invention, the current of gas leaving the nozzle apertures will be broken up or divided, immediately after leaving the nozzles, into fine bubbles which are uniformly distributed through the liquid column, it having been found that such bubbles do not tend to recombine to form larger gas bubbles or gas pockets.

It is expedient at the same time so to arrange the pump by which the contact oil is circulated that it produces the pressure necessary for the required inlet speed of the oil. If the catalyst is suspended in the contact oil, impeller pumps are particularly suitable for this purpose because they have not the property of centrifuging the specifically heavier finely divided catalyst from the contact oil.

In accordance with a further proposal of the invention a branch stream of the synthesis gas or, if desired, other gases containing carbon monoxide and hydrogen may be introduced in finely divided form into the return pipe for the contact oil, preferably in the direction of flow beyond the circulating pump, for example the impeller pump, in order thus to counteract any excessive reduction of the quantity of dissolved carbon monoxide and hydrogen in the contact oil. In this case, regard must be had to the fact that the reaction taking place at the catalyst also takes place in the return pipe or condenser, although at lower speed than in the reaction vessel itself, so that the quantity of carbon monoxide and hydrogen in the contact oil may in some cases fall to a value at which the action of the catalyst is not ensured, or is not maintained at the required level.

It is furthermore advantageous to provide in the reaction chamber, means for preventing at the upper end of the reaction chamber, that is at the point at which the synthesis gas and the contact oil are separated, deposition of contact oil and especially catalyst on the walls. These means may reside, for example, in introducing at the upper end of the reaction chamber an additional quantity of contact oil which uniformly washes the walls of the reaction chamber and continuously carries away any deposit of catalyst.

In order to facilitate the separation of the contact oil and the gases dissolved therein at the upper end of the reaction chamber, it is proposed in accordance with the invention to reduce the speed of flow of the gas-

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oil mixture at the upper end of the reaction tower in order thus to effect a general steady-
ing of the flow of liquid. This object may
be achieved by increasing that cross-sectional
area of the reaction chamber which is avail-
able for the flow of liquid at the upper end,
for example by increasing the diameter of the
tower in this region, or, with a constant dia-
meter, by leaving the upper part of the re-
action tower free from inserted elements, for
example free from cooling tubes.

As has already been mentioned at the
beginning, a comparatively large ratio of
height to diameter is advantageous for the
dimensions of the tower-like reaction chamber,
because if this ratio is high, that is to say,
if the tower is relatively slender, a particularly
favourable distribution of the synthesis gas
in the volume of contact oil is obtained. It
has been found that the ratio of height to
diameter is preferably chosen as about 10:1,
but higher and lower values may quite well
be chosen for the ratio of height to dia-
meter.

The temperatures at which the process
according to the invention is carried out depend
upon the catalyst employed and also
upon the product which it is desired to
obtain by the synthesis. Moreover, the tem-
perature to be chosen depends upon the pres-
sure in the reaction chamber. It has been
found that favourable results have been ob-
tained at temperatures below 280° C. if a
reaction pressure of about 14—20 atm. is
chosen, but economically useful results can
be obtained by varying these values in accord-
ance with the particular operating conditions.

The process is illustrated in the accom-
panying drawings.

Figure 1 is a vertical longitudinal section
through a reaction chamber constructed in
the manner of a tower having a total of
four cooling stages,

Figure 2 shows a nozzle for the simulta-
neous introduction of synthesis gas and con-
tact oil into the reaction chamber shown in
Figure 1,

Figure 3 is a horizontal section through
the nozzle base of the reaction tower illus-
trated in Figure 1, and

Figure 4 is a vertical section correspond-
ing to Figure 3.

The reaction tower consists, in accordance
with Figure 1, of an elongated cylindrical
vessel 1 of substantially circular cross-section.
Situated at the base of the tower are a
number of nozzles 2, to which synthesis gas
is fed through the pipe 3 and to which con-
tact oil circulated by a pump 5 is fed through
the pipe 4. Provided within the reaction
chamber 1 are four cooling devices 6, 7, 8
and 9, which preferably consist of vertical
tubes through which a suitable cooling
medium, for example water is passed. The
cooling medium is supplied through the pipe

10 and then flows through the cooling tubes
in the same direction as the mixture of con-
tact oil and synthesis gas introduced at the
bottom. The cooling medium absorbs heat
from the exothermic reaction of the synthesis
gas to form hydrocarbons, the said heat then
being discharged with the current of cooling
medium through the pipe 11. Part of the
cooling medium is directly returned into the
circuit through the pipe 12, while another
part of the heated cooling medium is fed
through the pipe 13 to an external cooling
device and thereafter re-introduced into the
cooling medium circuit. The mixture of con-
tact oil and synthesis gas is varied in its
composition as it travels upwards through
the contact tower 1, the hydrogen and carbon
monoxide disappearing and hydrocarbons be-
ing produced in their place. Provided at the
upper end of the contact tower is a widened
portion 14 in which a relatively steady flow
of liquid is maintained. The vapours pro-
duced and the unreacted gases leave the re-
action tower by way of the pipe 15, while
the contact oil is withdrawn through the pipe
16 and is returned into the bottom of the
reaction tower by means of the circulation
pump 5.

Figure 2 is a vertical longitudinal section
through a nozzle provided at the base of the
contact tower. The synthesis gas flows from
the gas pipe 3 into the inner nozzle tube
18, which terminates in a narrowed portion
17 serving to increase the speed of the current
of gas. The inner nozzle tube 18 is sur-
rounded by an outer nozzle tube 20, the
cross-section of which is considerably reduced
in the region of the mouth of the inner nozzle
tube 18 and is then widened again in the
manner of a Laval nozzle at 21. The con-
tact oil flows through the annular gap 22
between the inner nozzle tube 18 and the
Laval nozzle 21 at great speed and thus breaks
up the gas flowing through the inner nozzle
tube 18 into extremely fine bubbles, which
are then uniformly distributed throughout the
volume of contact oil. The contact oil is
supplied through the pipe 4, which is con-
trolled by a valve 24.

In Figures 3 and 4, the synthesis gas
flows through the pipe 3 into the inner nozzle
tubes 18, a valve 19 being provided to
ensure that synthesis gas is supplied as equally
as possible to all the nozzles. If desired, the
said nozzles may also be employed to vary
in the required manner the distribution of the
synthesis gas over the entire cross-section of
the reaction chamber. The contact oil passes
from the pipe 16 into the circulation pump
5, which is preferably constructed as an im-
peller pump. The said circulation pump may
also receive fresh contact oil through the pipe
25. The contact oil passes from the circula-
tion pump 5 by way of the pipe 4 and the
valves 26 into the annular gap between the

inner nozzle tube 18 and the outer nozzle tube 20, the required difference being produced between the speeds of the synthesis gas and the circulating oil by suitably dimensioning the cross-section of this annular gap.

A cooling device not shown here may be provided in the return pipe 16 in association with the cooling system or systems situated in the reaction chamber.

The application of the invention permits, for example, of working up in a reaction vessel having a diameter of 1 m. and a height of 18 m. more than 4,000 cm. of synthesis gas per hour at a reaction pressure of 50 atm.

If it is desirable or expedient to make the reaction tower 1 shorter, it may, for example, be divided at the centre (substantially in the region of the chain line) and the two halves of the tower may be disposed side-by-side, in which case each half must naturally be provided with a so-called nozzle base. The synthesis gas is then introduced into the second reaction unit after having passed through the first unit and does not leave the installation until it has also flowed completely through the second unit. The contact oil itself may also be maintained in circulation in the two halves of the reaction chamber. However, it is expedient to provide in association with each reaction chamber unit a separate contact oil circuit with the corresponding devices, because it is possible in this manner to maintain the circulation of contact oil separately for each unit and to vary the concentration of the catalyst independently in each of the reaction chamber units.

In this case, it may also be expedient to condense the hydrocarbon vapours formed in each unit of the installation and to separate off the condensed products before the synthesis gas is introduced into the next unit of the installation.

What we claim is:—

1. Process for the production of hydrocarbons by the reaction of carbon monoxide and hydrogen (synthesis gas) in the presence of hydrocarbon synthesis catalysts arranged in fixed fashion or in suspension in a hydrocarbon oil (contact oil), wherein the synthesis gas is introduced at the bottom into a liquid column formed by the contact oil moving in the same direction as the gas, characterised in that the mechanically moved stream of contact oil circulating after the separation of the gases and vapours comprising hydrocarbon products and residual gas, and the synthesis gas are introduced into the reaction chamber below cooling means arranged therein.

2. Process according to claim 1, characterised in that the cooling of the contact oil is effected in a number of stages by the cooling means provided within the reaction chamber, in such manner that the mixture of synthesis gas and contact oil flows successively

through cooling stages at increasing temperature.

3. Process according to claim 2, characterised in that the oil-gas mixture is passed through cooling stages which are arranged consecutively with regard to the direction of flow of the synthesis gas but are arranged structurally side-by-side, separate streams of contact oil, if necessary having different concentrations of catalyst, being maintained in circulation in the individual reaction chamber units corresponding to the cooling stages, and the hydrocarbon vapours formed in each reaction chamber unit being condensed and separated off, if desired, before the synthesis gas is introduced into the next unit.

4. Process according to claims 1 to 3, characterised in that the contact oil is introduced at the lower end of the liquid column through one or more substantially ejector-like devices at a higher speed than the synthesis gas entering at the bottom, and is withdrawn from the top of the reaction chamber.

5. Process according to claims 1 to 4, characterised in that the contact oil is circulated by means of a pump which produces the pressure necessary for the required speed of introduction.

6. Process according to claims 1 to 5, characterised in that an impeller pump is employed.

7. Process according to claims 1 to 6, characterised in that a branch stream of synthesis gas or the like is introduced in finely divided form into the return pipe for the contact oil.

8. Process according to claims 1 to 7, characterised in that the speed of flow of the mixture of gas, vapour and oil is reduced at the upper end of the reaction tower.

9. Apparatus for use in the production of hydrocarbons by the reaction of carbon monoxide and hydrogen (synthesis gas) in the presence of hydrocarbon synthesis catalysts and comprising a reaction chamber through which a hydrocarbon oil (contact oil) is circulated in the form of an upwardly moving stream or column, characterised by the provision of cooling means disposed within the reaction chamber and of means for introducing the synthesis gas and the contact oil, after separation of the formed hydrocarbons and residual gas, into the reaction chamber below said cooling means.

10. Apparatus as claimed in Claim 9, wherein means are also provided for directing an additional stream of contact oil onto the walls of the reaction chamber above the liquid column for the purpose of washing said walls to remove any deposits of contact oil and/or catalyst.

11. Apparatus as claimed in Claim 9 or 10, wherein the reaction chamber is of vertical, tower-like and preferably cylindrical form having a relatively high ratio of height to

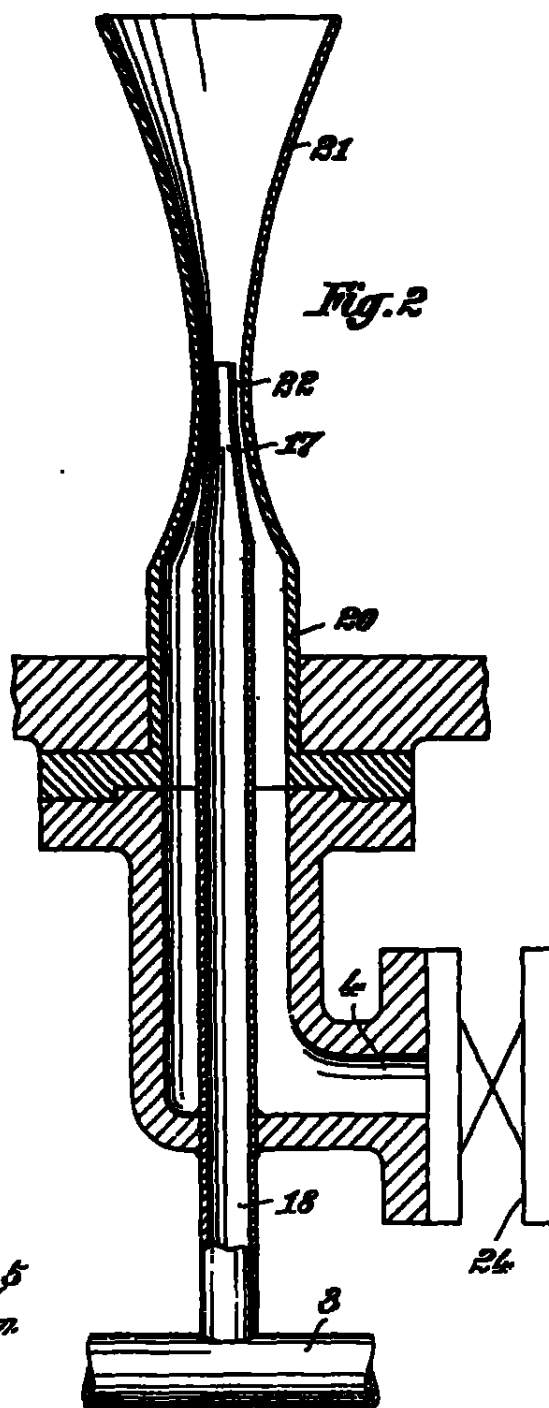
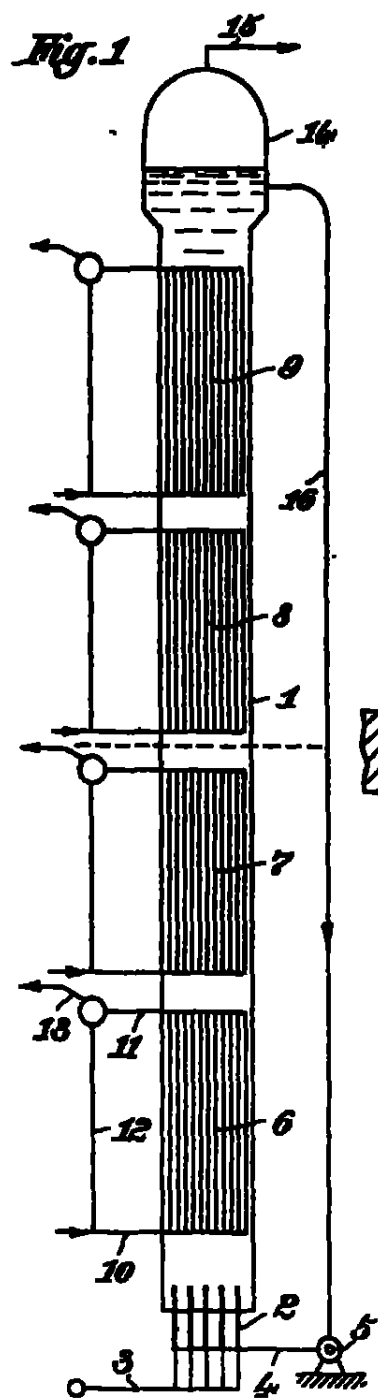
diameter (about 10:1) and within which at least two cooling systems are arranged, one above another, through which the contact oil flows successively for cooling in stages. arranged side by side, the synthesis gas being caused to flow successively through said chambers.

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- 5 12. Apparatus as claimed in any of Claims 9-11, wherein at least two reaction chambers structurally and functionally independent are

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