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C5E
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(54) **Producing synthesis gas**

(57) A feed hydrocarbon, e.g. gas leaving a Fischer Tropsch synthesis reactor containing carbon monoxide, is mixed with recycled CO_2, passed to a CO_2 removal unit where a calculated amount of CO_2 is removed and the effluent is then passed to a reformer to produce synthesis gas, tail gas from the reformer is passed through a CO shift catalyst and the effluent therefrom is combined with the feed hydrocarbon. Proper operation of the shift converter allows control over the carbon oxides/hydrogen ratio in to the systhesis reactor.

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SPECIFICATION

A process to produce a desired synthesis gas composition

There are in the world many cheap sources of hydrocarbons such as flared natural gas and also other cheap sources of carbon-containing fuels. This process utilises these to produce a synthesis gas, that is a gas containing an oxide or oxides of carbon and hydrogen which gas is often used for, e.g. the production of synthetic crude utilising Fischer-Tropsch technology, methanol, OXO alcohols. The invention is described by way of the Fischer-Tropsch synthesis gas but the invention may be applied to other technology wherein a tail gas which mav be recycled is produced.

Taking; as typical hydrocarbon, natural gas, at a suitable pressure, this is combined with a recycle stream containing carbon dioxide and passed to a carbon dioxide removal unit which removes a carefully calculated portion of the carbon dioxide, and sulphur compounds such as H_2S. The gases from which some of the carbon dioxide has been removed may be compressed and pre-heated and may pass through a guard desulphurisation unit and is then passed to either a tubular steam reformer or, preferably, a partial oxidation unit, in which the said gas is reacted with an oxygen-containing gas at high temperature. The effluent from the reforming device may be cooled and is then fed to the synthesis gas utilisation device such as Fischer-Tropsch synthesis (FTS) reactor. As part of the FTS unit operation a tail gas containing carbon monoxide arises and this tail gas, possibly after pre-heating, may be combined with some steam and passed through a carbon monoxide water gas shift reactor (shift reactor) of carefully designed performance, which reactor may also be equipped with a by-pass so as better to control the amount of carbon monoxide shifted. The effluent from the shift reactor is recycled upstream of the carbon dioxide removal unit.

By carefully controlling the amount of carbon monoxide shift and the amount of carbon dioxide removed, the carbon/hydrogen balance in the effluent from the reformer is controlled.

Should the feed gas contain inert gas such as nitrogen, it may be necessary to take a purge stream off the tail gas in order to prevent a build up of inert gas in the system.

If there is a requirement for hydrogen or a high hydrogen containing gas, then the amount of carbon monoxide shifted and carbon dioxide removed, may be altered so as to give extra hydrogen in the reforming device effluent which may be removed by means such as a permeable membrane unit or a pressure swing adsorption or cryogenic unit.

In the case of tail gas arising from an FTS unit such tail gas may well contain olefins which, in the case of the reforming device being a partial oxidation unit, do not have to be separately hydrogenated as would be the case if the reforming device is a tubular steam reformer.

Thus by means of this invention synthesis gas of a desired composition may easily be obtained without necessarily further processing the effluent from the reforming device unless such further processing takes the form of removing hydrogen for which there is a specific application as opposed to having to remove hydrogen in order to alter the hydrogen: carbon ratio to the desired level.

In this application there is provided an invention characterised by:

A. the addition of a carbon dioxide containing stream to a feed hydrocarbon

B. passing the mixture to a carbon dioxide removal unit

C. passing the effluent from B. into a reforming device

D. passing the effluent from the reforming device into synthesis gas utilisation unit

E. passing the tail gas arising from D. through a carbon monoxide shift catalyst in a controlled way

F. combining the effluent from E with the feed as in A.

CLAIMS

1. A process for the production of a synthesis gas containing carbon monoxide and hydrogen of a desired ratio which is characterised by:

A. the addition of a carbon dioxide containing stream to a feed hydrocarbon

B. passing the mixture to a carbon dioxide removal unit

C. passing the effluent from B. into a reforming device

D. passing the effluent from the reforming device into a synthesis gas utilisation unit

E. passing the tail gas arising from D. through a carbon monoxide shift catalyst in a controlled way

F. combining the effluent from E with the feed as in A.

2. A process as claimed in claim 1 wherein the amount of carbon monoxide shift and carbon dioxide recovery are adjusted so as to produce an excess of hydrogen which excess is removed from the effluent from the reforming device so as to leave synthesis gas of the desired composition and give the desired quantity of hydrogen.

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