i) a synthesis gas flow originating from a synthesis gas source is compressed in a compressor

ii) the compressed synthesis gas is purified in a purification unit to remove water and carbon monoxide

iii) the compressed purified synthesis gas flow is cooled

iv) the cooled synthesis gas flow is separated by scrubbing and/or distillation at a cryogenic temperature and possibly by adsorption in a separation unit, and

v) at least the following three gases are produced in the separation unit: a carbon monoxide-enriched gas, a hydrogen-enriched gas, a residual gas containing carbon monoxide and hydrogen which contains less carbon monoxide than the carbon-monoxide-enriched gas and less hydrogen than the hydrogen-enriched gas and possibly also a methane-enriched gas, and/or a nitrogen-enriched gas, characterized in that only if the synthesis gas flow passed to the compressor is below a threshold or zero, at least a portion of at least two or even each of the following three gases: the carbon monoxide-enriched gas, the hydrogen-enriched gas and the residual gas containing carbon monoxide and hydrogen, is passed downstream of the source, and possibly upstream of the compressor, to be purified in the purification unit and separated in the separation unit.

As claimed in another aspect of the invention, in the method:

a) at least one portion of the compressed synthesis gas is stored while the flow of synthesis gas is above the threshold and

b) at least one other portion of the compressed synthesis gas and at least a portion of at least each of the first three gases from stage v) are passed downstream of the source, and possibly upstream of the compressor, to be purified in the purification unit and separated in the separation unit.

As claimed in other optional aspects of the invention:

at least a portion of at least each of the first three gases from stage v) downstream of the source and possibly upstream of the compressor only if the flow of synthesis gas is below the threshold, or if no flow comes from the source.

- during nominal operation of the method, the outputs from the separation unit are nominal outputs

Claims

1. A method for separating a synthesis gas containing carbon monoxide and hydrogen wherein:

i) a synthesis gas flow (1) originating from a synthesis gas source is compressed in a compressor (3)

ii) the compressed synthesis gas (15) is purified in a purification unit (17) to remove water and/or carbon dioxide

iii) the compressed purified synthesis gas flow is cooled

iv) the cooled synthesis gas flow is separated by scrubbing and/or distillation at a cryogenic temperature and possibly by adsorption in a separation unit (16, 21, 41), and

v) at least the following three gases are produced in the separation unit: a carbon monoxide-enriched gas (26), a hydrogen-enriched gas (43), a residual gas containing carbon monoxide and hydrogen (32, 47) which contains less carbon monoxide than the carbon monoxide-enriched gas and less hydrogen than the hydrogen-enriched gas, characterized in that only if the synthesis gas flow passed to the compressor is below a threshold or zero, at least a portion of at least two or even each of the following three gases: the carbon monoxide-enriched gas (26), the hydrogen-enriched gas (43) and the residual gas containing carbon monoxide and hydrogen (32, 47) is passed downstream of the source, and upstream of the compressor, to be purified in the purification unit and separated in the separation unit.

2. The method as claimed in claim 1, wherein:

a) at least one portion of the compressed synthesis gas (6) is stored while the flow of synthesis gas is above the threshold and

b) at least one other portion of the compressed synthesis gas and at least a portion of at least each of the first three gases from stage v) are passed downstream of the source, and upstream of the compressor, to be purified in the purification unit

and separated in the separation unit while the flow of synthesis gas is below the threshold.

3. The method as claimed in claim 1 or 2, wherein at least a portion of at least each of the three gases (26, 32, 43, 47) from stage v) downstream of the source and upstream of the compressor (3) only if the flow of synthesis gas is below the threshold, or if no flow comes from the source.

4. The method as claimed in one of the preceding claims, wherein

i) x% of the nominal output of the carbon monoxide-enriched gas and y% of the nominal output of the hydrogen-enriched gas are passed to the separation unit (16, 21, 41) when the flow of synthesis gas is below a threshold, x and y differing by at most 5% and/or

ii°) y% of the nominal output of the hydrogen-enriched gas and z% of the nominal output of the residual gas are passed to the separation unit (16, 21, 41) when the flow of synthesis gas is below a threshold, y and z differing by at most 5% and/or

ii) x% of the nominal output of the carbon monoxide-enriched gas z% of the nominal output of the residual gas are passed to the separation unit (16, 21, 41) when the flow of synthesis gas is below a threshold, x and z differing by at most 5%.

5. The method as claimed in one of the preceding claims wherein a portion (36) of the carbon monoxide-enriched gas is stored in a storage unit (38) and the rest of the carbon monoxide-enriched gas is passed to a customer if the flow of synthesis gas is above the threshold and the carbon monoxide-enriched gas originating from the storage unit is passed to the customer if the flow of synthesis gas is below the threshold.

6. The method as claimed in claim 5 wherein if the flow of synthesis gas is below the threshold, all the carbon monoxide-enriched gas passed to the customer originates from the storage unit (38).

7. The method as claimed in one of the preceding claims wherein the synthesis gas (1) is a residual gas from an acetylene production unit.

8. The method as claimed in one of the preceding claims wherein if the flow of synthesis gas is above the threshold, a portion of the synthesis gas is stored in a storage unit (8) and if the flow of synthesis gas is below the threshold, the synthesis gas is passed from the storage unit to the compressor (3).

9. The method as claimed in one of the preceding claims wherein if the synthesis gas flow is zero, the separation unit (16, 21, 41) is only fed by gases produced by the separation unit.

10. The method as claimed in one of the preceding claims wherein the carbon monoxide-enriched gas is compressed in a product compressor (33) and passed to the customer and, if the flow of synthesis gas is below the threshold and the carbon monoxide-enriched gas flow which has to be compressed is below another threshold, nitrogen gas (35) is passed to the product compressor to be compressed with the carbon monoxide-enriched gas.

11. The method as claimed in one of the preceding claims 1 to 8 or 10 wherein if the flow of synthesis gas is below a threshold, a gas rich in a component of the synthesis gas (2) originating from a source other than the separation unit is passed to the separation unit (16, 21, 41).

12. The method as claimed in one of the preceding claims wherein the carbon monoxide-enriched gas (26) is compressed in a product compressor (33), then divided into two, a compressed portion (39) serving as product and a compressed portion (51) being recycled downstream of the source and/or the hydrogen-enriched gas is

compressed in a product compressor (22), then divided into two, a compressed portion serving as product (20) and a compressed portion (14) being recycled downstream of the source (43).

13. An apparatus for separating a synthesis gas containing carbon monoxide and hydrogen comprising a compressor (3) to compress a synthesis gas flow (1) originating from a source of synthesis gas, a purification unit (17) to remove water and/or carbon dioxide from the compressed synthesis gas (15), means for cooling the flow of compressed purified synthesis gas, a unit (16, 21, 41) for separating the cooled synthesis gas flow by scrubbing and/or distillation at a cryogenic temperature possibly comprising an adsorption unit, means for producing at least the following three gases from the separation unit: a carbon monoxide-enriched gas (26), a hydrogen-enriched gas (43), a residual gas containing carbon monoxide and hydrogen (32, 47) which contains less carbon monoxide than the carbon monoxide-enriched gas and less hydrogen than the hydrogen-enriched gas, means for passing at least a portion of at least two or even each of the following three gases: the carbon monoxide-enriched gas (26), the hydrogen-enriched gas (43) and the residual gas containing carbon monoxide and hydrogen (32, 47) downstream of the source, upstream of the compressor, to be purified in the purification unit and separated in the separation unit, and means for initiating the return of at least a portion of the at least two gases as claimed in the flow of synthesis gas originating from the source upstream of the compressor.

14. The apparatus as claimed in claim 13 comprising a storage unit (8) downstream of the compressor (3) and upstream of the purification unit (17), this storage unit being connected to the feed pipe of the compressor by means (10) which do not pass through the compressor.

15. The apparatus as claimed in claim 14 comprising means for passing gas from the storage unit upstream of the compressor as claimed in the flow of synthesis gas originating from the source upstream of the compressor.