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(54) **METHOD AND APPARATUS FOR TREATING A HYDROCARBON STREAM**

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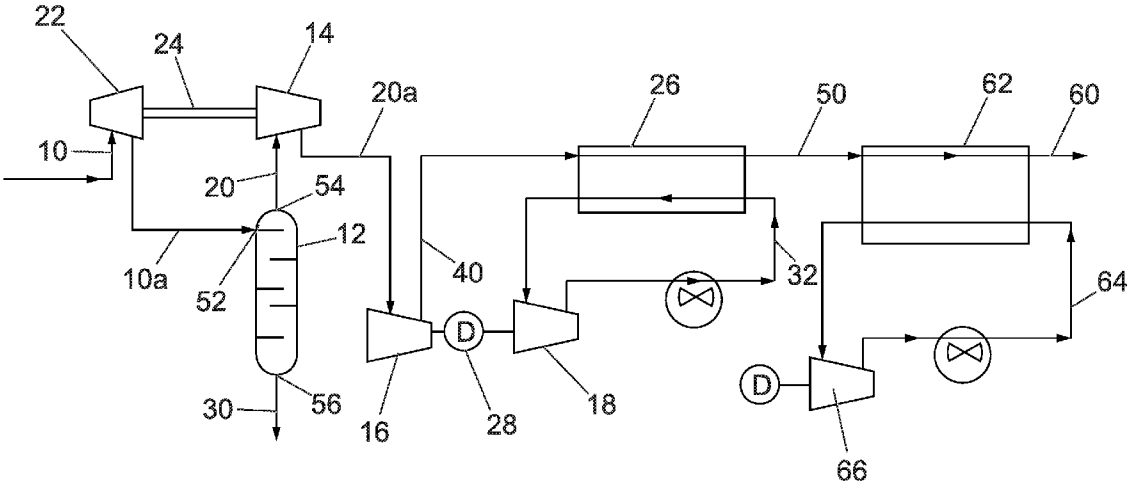
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(57) **ABSTRACT**

A method of treating a hydrocarbon stream such as natural gas from a feed stream (**10**) comprising at least the steps of: a) passing the feed stream (**10**) through a distillation column (**12**) to provide a gaseous stream (**20**) and a C_{2+} liquid stream (**30**); b) compressing at least part of the gaseous stream (**20**) through one or more feed compressors (**14**, **16**) to provide a compressed stream (**40**); and c) commonly driving (**28**) at least one of the feed compressors with one or more separate refrigerant compressors for one or more separate refrigerant circuits, by mechanically interconnecting said compressors.



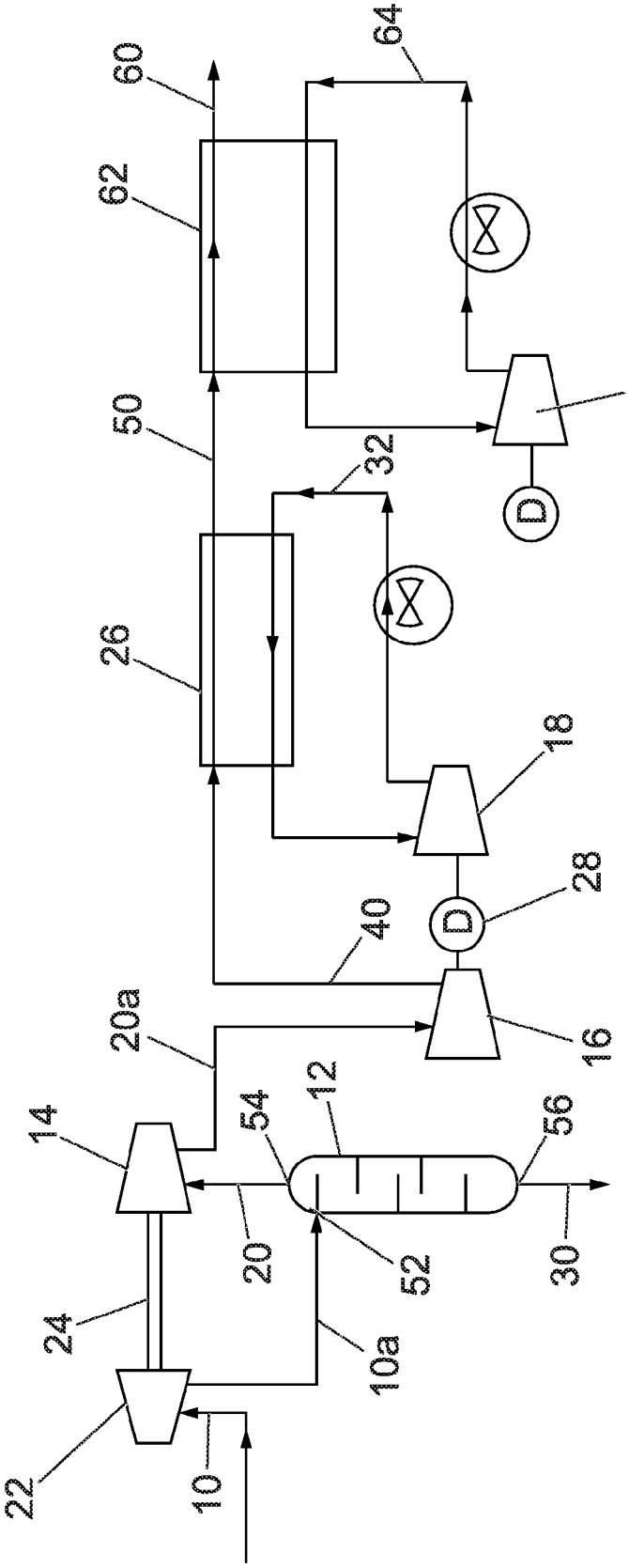

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Fig. 1

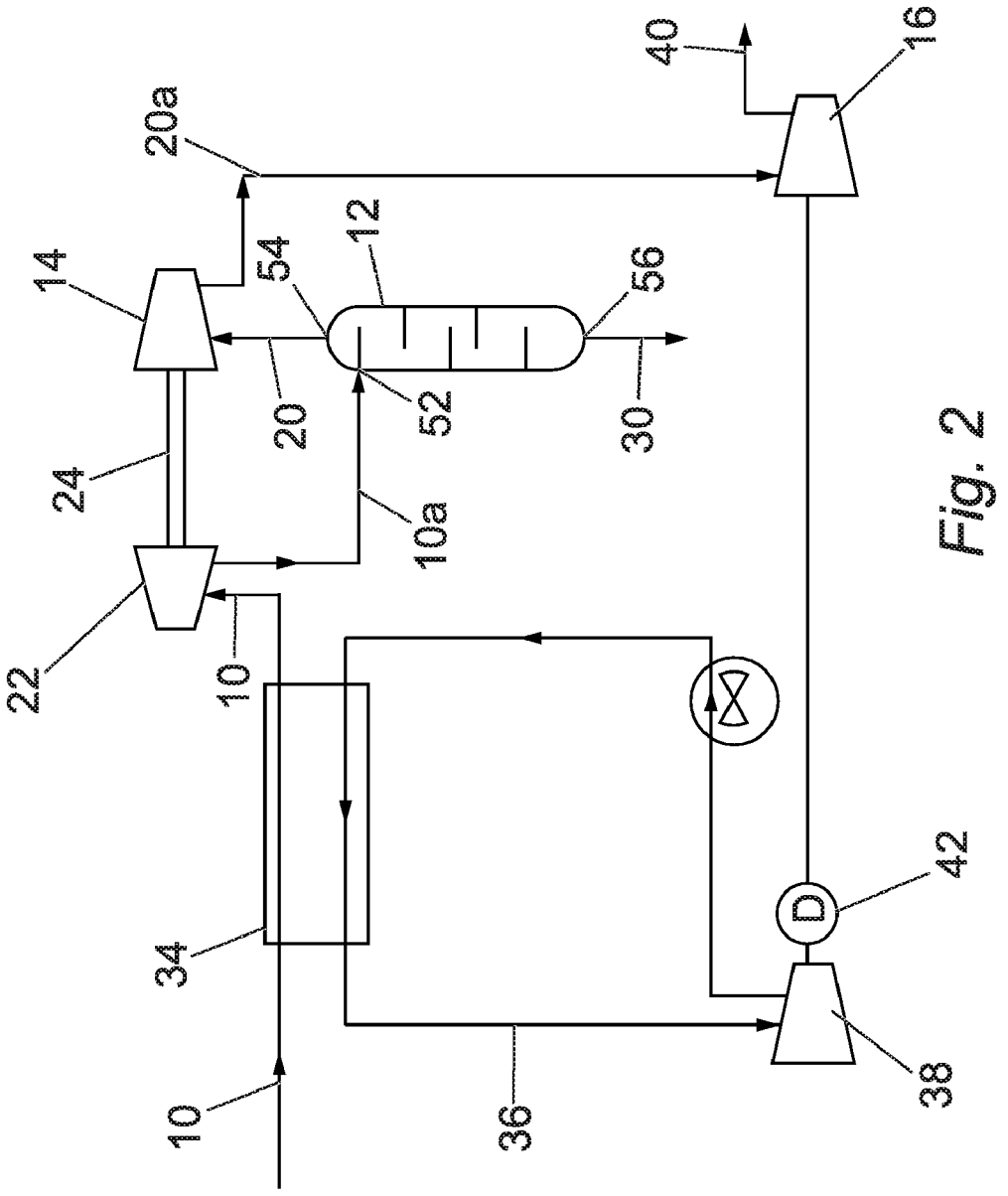


Fig. 2

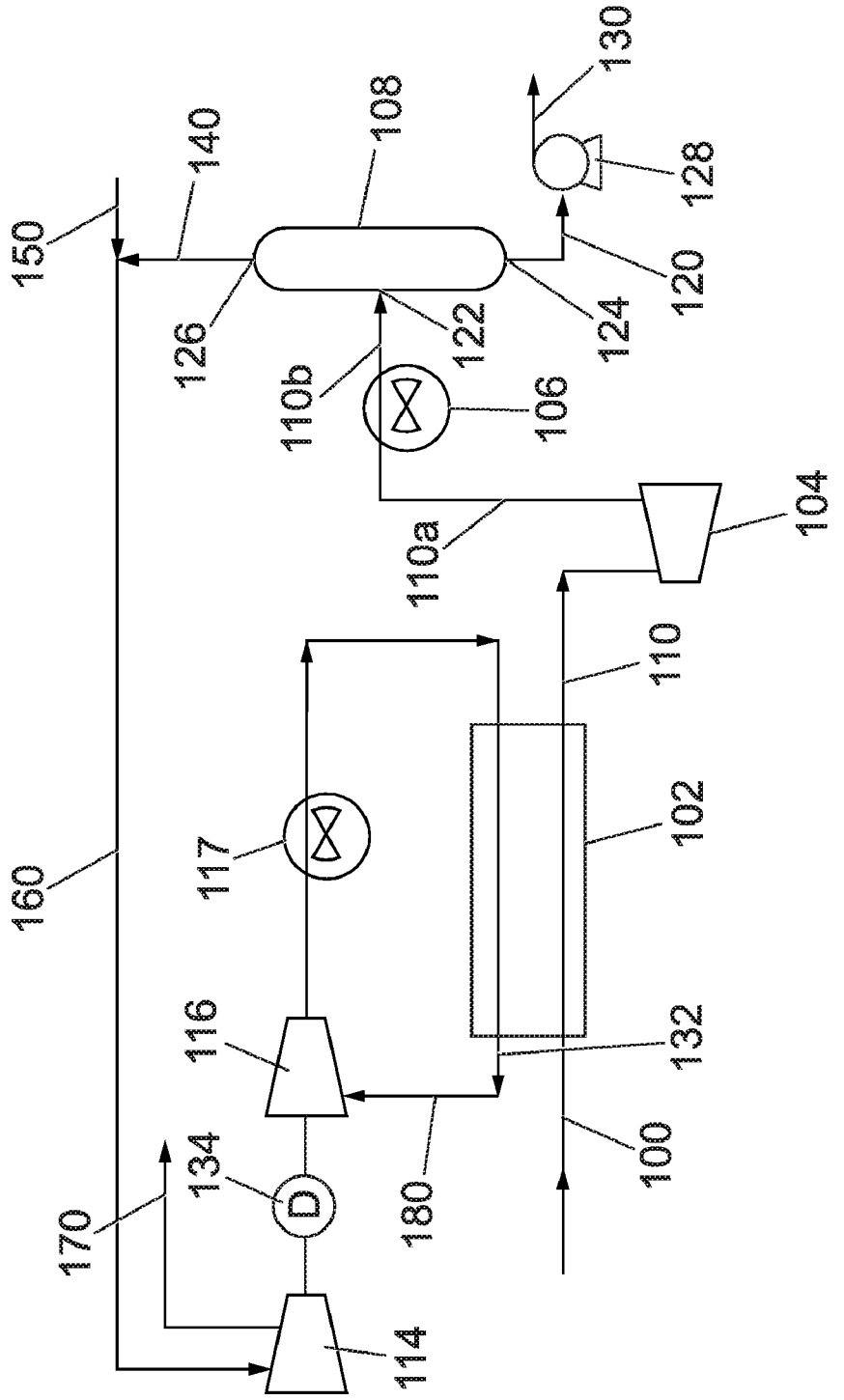

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100
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114

Fig. 3

METHOD AND APPARATUS FOR TREATING A HYDROCARBON STREAM

[0001] The present invention relates to a method and apparatus for treating a hydrocarbon stream such as natural gas, in particular in a process for the production of liquefied natural gas.

[0002] Several methods of liquefying a natural gas stream thereby obtaining liquefied natural gas (LNG) are known. It is desirable to liquefy a natural gas stream for a number of reasons. As an example, natural gas can be stored and transported over long distances more readily as a liquid than in gaseous form because it occupies a smaller volume and does not need to be stored at high pressures.

[0003] U.S. Pat. No. 6,401,486 B1 relates to a method and apparatus for high recovery of hydrocarbon liquids from methane-rich natural gases in association with liquefied natural gas production. FIG. **1** of U.S. Pat. No. 6,401,486 shows a pre-treatment process in a liquefaction plant in which the lighter stream from the NGL recovery column can be re-compressed by an expander/compressor. A problem of the arrangement in FIG. **1** is that the expander/compressor requires a separate driver prior to the refrigeration system. A driver is an expensive item both in terms of capital and running costs.

[0004] It is an object of the present invention to reduce the capital and/or running costs of a liquefaction plant involving liquefying apparatus.

[0005] It is a further object to provide an alternative method and apparatus for liquefying natural gas.

[0006] One or more of the above or other objects can be achieved by the present invention providing a method of treating a hydrocarbon stream such as natural gas from a feed stream comprising at least the steps of:

[0007] (a) passing the feed stream through a distillation column to provide a gaseous stream and a C_2^+ liquid stream;

[0008] (b) compressing at least part of the gaseous stream through one or more feed compressors to provide a compressed stream; and

[0009] (c) commonly driving at least one of the feed compressors with one or more separate refrigerant compressors for one or more separate refrigerant circuits, by mechanically interconnecting said compressors.

[0010] Refrigerant circuit(s) use large compressors which can be driven by powerful drivers. Gas turbines are usually used to drive the compressors as the gas turbines can be fuelled by feed gas, and in particular methane extracted from feed gas.

[0011] It is also common to perform a number of pre-treatment processes on a feed stream such as natural gas liquid extraction prior to liquefaction, including separation or extraction of heavier hydrocarbon fractions. Many of such pre-treatment processes also require the use of compressors driven by drivers such as gas turbines.

[0012] As each and every gas turbine or other driver in a liquefaction plant is expensive, this contributes a considerable percentage to the overall capital and running costs of the cooling.

[0013] It has been surprisingly found that by combining the driver of at least one of the feed compressors and at least one of refrigerant compressors, the capital costs can be reduced. Furthermore it has been found that the resultant ratio of compressor power input for the compressors can be brought closer to an optimum ratio, hence reducing capital and running costs.

[0014] Refrigerant circuits are known in the art. They generally involve one or more heat exchangers, one or more expansion devices or units, and one or more compressors. Whilst each refrigerant circuit can be separate from other refrigerant circuits, one or more parts of a refrigerant circuit can be connected or interconnected with another refrigerant circuit(s), or at least involve an interconnection of actions or combination of materials and/or flow with other circuit(s).

[0015] Each refrigerant circuit is separate from the pathway of the hydrocarbon stream and its treated and/or subsequent cooled and/or liquefied forms. Thus the or each refrigerant is not mixed with or directly derived from the hydrocarbon stream and its subsequent forms. That is, the fluid passing through the or each relevant feed compressor is different to the fluid passing through the or each commonly driven refrigerant compressor.

[0016] Preferably, the method further comprises the step of: cooling the compressed stream by passing the compressed stream against one or more refrigerants being in one or more of the refrigerant circuits.

[0017] In one embodiment of the present invention, the method of treating a hydrocarbon stream such as natural gas from a feed stream comprises at least the steps of:

[0018] (a) passing the feed stream through a distillation column to provide a gaseous stream and a C_2^+ liquid stream;

[0019] (b) compressing at least part of the gaseous stream through one or more feed compressors to provide a compressed stream; and

[0020] (c) cooling the compressed stream by passing the compressed stream against one or more refrigerants being in one or more refrigerant circuits involving one or more refrigerant compressors;

wherein at least one of the feed compressors in step (b) and at least one of the refrigerant compressors in step (c) are mechanically interconnected and are arranged to be driven by a common driver.

[0021] Although the method according to the present invention is applicable to various hydrocarbon feed streams, it is particularly suitable for natural gas streams to be cooled, and in particular liquefied. As the person skilled in the art readily understands how to cool and liquefy a hydrocarbon stream, this is not further discussed here in detail.

[0022] Preferably, the cooling of the compressed stream involves at least two cooling stages, each stage including at least one refrigerant circuit.

[0023] More preferably, the cooling of the compressed stream involves one pre-cooling stage and one main cooling stage, and the or a feed compressor of step (b) is mechanically interconnected with a refrigerant compressor of the pre-cooling refrigerant circuit.

[0024] Pre-cooling of the feed stream can be carried out to reduce its temperature to below 0° C., such as between −10° C. to −50° C. Preferably, the feed stream is cooled upstream of step (a) against at least part of the gaseous stream produced in step (a).

[0025] Main cooling of a pre-cooled stream can be to further reduce its temperature to below −100° C., such as between −120° C. to −170° C.

[0026] The person skilled in the art will readily understand that after liquefaction, the liquefied natural gas may be further

processed, if desired. As an example, the obtained LNG may be depressurized by means of a Joule-Thomson valve or by means of a cryogenic turbo-expander. Also, further intermediate processing steps between the gas/liquid separation in the distillation column and the cooling may be performed.

[0027] The hydrocarbon stream may be any suitable feed stream to be treated, but is usually a natural gas stream obtained from natural gas or petroleum reservoirs. As an alternative the natural gas stream may also be obtained from another source, also including a synthetic source such as a Fischer-Tropsch process.

[0028] Usually the natural gas stream is comprised substantially of methane. Preferably the feed stream comprises at least 60 mol % methane, more preferably at least 80 mol % methane.

[0029] Depending on the source, the natural gas may contain varying amounts of hydrocarbons heavier than methane such as ethane, propane, butanes and pentanes as well as some aromatic hydrocarbons. The natural gas stream may also contain non-hydrocarbons such as H_2O, N_2, CO_2, H_2S and other sulphur compounds, and the like.

[0030] If desired, the feed stream containing the natural gas may be pre-treated before passing it to the distillation unit. This pre-treatment may comprise removal of undesired components such as CO_2 and H_2S, or other steps such as upstream cooling, pre-pressurizing or the like. These steps are well known to the person skilled in the art, they are not further discussed here.

[0031] Where upstream cooling is included, another embodiment of the present invention is a method of treating a hydrocarbon stream such as natural gas from a feed stream further the step of:

cooling the feed stream upstream of step (a) by passing the feed stream against one or more refrigerants being in one or more of the refrigerant circuits.

[0032] In this way, the present invention also provides a method of treating comprising at least the steps of:

[0033] (a) cooling the feed stream against one or more refrigerants being in one or more refrigerant circuits involving one or more refrigerant compressors;

[0034] (b) passing the cooled feed stream through a distillation column to provide a gaseous stream and a C_2^+ liquid stream;

[0035] (c) compressing at least part of the gaseous stream through one or more feed compressors to provide a compressed stream; and

[0036] (d) cooling the compressed stream;

wherein at least one of the feed compressors in step (c) and at least one of the refrigerant compressors in step (a) are mechanically interconnected and are arranged to be driven by a common driver.

[0037] The term "natural gas" as used herein relates to any hydrocarbon-containing composition which is at least substantially methane. This includes a composition prior to any treatment, such treatment including cleaning or scrubbing, as well as any composition having been partly, substantially or wholly treated for the reduction and/or removal of one or more compounds or substances, including but not limited to sulfur, carbon dioxide, water, and C_2^+ hydrocarbons.

[0038] The compressors are mechanically interconnected in the sense that there is physical linkage therebetween which relates motion therebetween. Preferably said mechanically interconnected compressors are arranged on a common drive shaft of the driver, further reducing the capital infrastructure.

[0039] The distillation column may be any column or arrangement adapted to separate the feed gas into a gaseous stream, which will generally be methane-enriched, and a C_2^+ liquid stream, which will generally have >40 mol % of one or more hydrocarbons heavier than methane, such as ethane, propane, butanes, pentanes, C_6^+, etc, as well as usually a proportion of methane. At least part of the heavier stream is commonly used to produce a natural gas liquid product or products, such as usually C_3, C_4, etc.

[0040] The distillation column is preferably a natural gas liquid recovery column, generally for C_3 and C_4 hydrocarbons, optionally C_5^+ hydrocarbons, and which generally operates at a low pressure.

[0041] Following its separation in the distillation column, at least a part of the gaseous stream, usually all of the gaseous stream, is compressed. Said compression may be considered a 'recompression' where the feed gas is provided in a pressurized form. It is desirable to compress or recompress the gaseous stream as it is easier to liquefy natural gas at high pressure.

[0042] The compression of the gaseous stream can be carried out by one or more feed compressors such as natural gas booster compressors. In one embodiment of the present invention there are two feed compressors.

[0043] In another embodiment to the present invention, one, usually the first, feed compressor is mechanically interconnected to an expander adapted to expand the feed gas prior to its passage through the distillation column, so as to be partly, substantially or wholly driven thereby. This provides a more efficient arrangement.

[0044] Drivers for a compressor are known in the art. They may be a single generator, or a combination of generators. They include gas turbines, steam turbines and electric motors, and the generator or combination can be adapted to suit the apparatus, arrangement or system, some of which may include generator assistance from one or more other parts of the apparatus. In one arrangement, there is an auxiliary engine such as an electric motor to help start-up, and a gas turbine for the main running for the driver.

[0045] In one embodiment of the present invention, the cooling of the compressed stream involves liquefying the compressed stream thereby obtaining a liquefied hydrocarbon stream such as liquefied natural gas.

[0046] The present invention also provides a method of treating a hydrocarbon stream such as natural gas from a feed stream comprising at least the steps of:

[0047] (a) liquefying the feed stream by cooling the feed stream against one or more refrigerants being in one or more refrigerants circuits involving one or more refrigerant compressors, to provide a liquefied feed stream;

[0048] (b) passing the liquefied feed stream through an end separation vessel to provide an end gaseous stream and an end liquid stream; and

[0049] (c) compressing at least a part of the end gaseous stream through one or more end compressors to provide a compressed end gaseous stream;

wherein at least one of the refrigerant compressors in step (b) at least one of the end compressors in step (c) are mechanically interconnected and are arranged to be driven by a common driver.

[0050] This method has similar advantages as hereinbefore described, in particular higher process efficiency and lower capital and running costs.

[0051] The present invention includes a combination of any and all of the methods hereinbefore described, and mechanical interconnection of more than two compressors with a common driver.

[0052] The present invention also provides apparatus for treating a hydrocarbon feed stream such as natural gas, the apparatus at least comprising:

[0053] a distillation column having an inlet for the feed stream and a first outlet for a gaseous stream and a second outlet for a C_2^+ liquid stream;

[0054] one or more feed compressors for compressing at least a part of the gaseous stream; and

[0055] a common driver for driving one or more of the feed compressors with one or more separate refrigerant compressors for one or more separate refrigerant circuits.

[0056] Preferably, the apparatus includes a cooling system which may involve at least one pre-cooling stage and at least one main cooling stage, each stage including at least one refrigerant circuit and at least one compressor.

[0057] Also preferably, the cooling system involves or comprises a liquefying system, more preferably able to provide an LNG stream.

[0058] Optionally, at least one compressor of both the pre-cooling and main cooling refrigerant circuits are also mechanically interconnected and are arranged to be driven by a common driver.

[0059] Embodiments of the present invention will now be described by way of example only, and with reference to the accompanying non-limiting drawings, in which:

[0060] FIG. **1** is a general scheme of a treatment process according to one embodiment of the present invention;

[0061] FIG. **2** is a general scheme of a treatment process according to a second embodiment of the present invention; and

[0062] FIG. **3** is a general scheme of a treatment process according to a third embodiment of the present invention.

[0063] For the purpose of this description, a single reference number will be assigned to a line as well as a stream carried in that line. The same reference numbers refer to similar components.

[0064] Referring to the drawings, FIG. **1** shows a treatment process for a hydrocarbon feed stream, such as a pre-treated natural gas stream wherein one or more substances or compounds, such as sulfur, sulfur compounds, carbon dioxide, and moisture or water, are reduced, preferably wholly or substantially removed, as is known in the art.

[0065] Following any pre-treatment, the feed stream **10** could be expanded through a vapour expander **22** and then fed via inlet **52** into a distillation column **12** being a natural gas liquid recovery column, which preferably operates between 0° C. and −100° C., and at an above ambient pressure such as 10-30 bar.

[0066] The expander **22** can be in the form of a turbine. It reduces the pressure of the feed gas **10**.

[0067] In the distillation column **12**, the expanded feed stream **10***a* is separated into a gaseous stream **20**, generally being a methane enriched stream and provided through a first outlet **54**, and a C_2^+ liquid stream **30**, generally being a heavier hydrocarbon rich stream and provided through a second outlet **56**.

[0068] The gaseous stream **20** from the first outlet **54** can then be re-compressed to make its subsequent cooling, preferably liquefaction, easier. Preferably, prior to re-compression, the gaseous stream **20** is heat-exchanged (not shown) against feed stream **10** to cool feed stream **10**. The recompression may be to the same or similar pressure of the feed stream **10** before it entered the expander **22**, or may be different. In FIG. **1**, the recompression can be achieved in two stages. Firstly, the gaseous stream **20** is passed through a first feed compressor **14**. This first compressor **14** is driven by the expander **22** via an interconnecting drive shaft **24**, so recovering at least some of the energy created by the expansion of the feed gas **10** passing through the expander **22**.

[0069] Thereafter, the part-compressed gaseous stream **20***a* is passed through a second feed compressor **16**. Such second compressor **16** is usually larger than the first feed compressor **14**.

[0070] Hitherto, the second feed compressor **16** has been driven by its own dedicated driver, generally being a gas or steam turbine, and usually with an electric start-up motor as well. As mentioned above, every separate driver increases the capital and running costs of the plant. Indeed, thirty to forty percent of the capital cost in a liquefied natural gas (LNG) plant lies in the cooling plant proper. Thus minimizing the capital cost of a cooling operation is particularly advantageous.

[0071] An advantage of the present invention is to mechanically interconnect the second feed compressor **16** with a refrigerant compressor **18** of one of the refrigerant circuits described hereinafter. Preferably, the two interconnected compressors **16**, **18** are driven by a common driver **28**. The driver **28** could be a gas turbine having an associated starter/helper motor.

[0072] According to an embodiment of the present invention involving two or more feed compressors, at least one of the feed compressors is mechanically interconnected with at least one of the refrigerant compressors. Where there are multiple feed compressors and the first is mechanically interconnected with an expander adapted to expand the feed stream prior to separation, then it is the largest feed compressor which is preferably driven with the refrigerant compressor.

[0073] Following recompression of the gaseous stream **20** through the first and second compressors **14**, **16**, the compressed stream **40** is optionally first cooled by one or more ambient water and/or air coolers (not shown) known in the art, followed by cooling against one or more refrigerants as discussed further below.

[0074] The cooling of the compressed stream **40** can be carried out by a cooling system having or including any number of cooling stages. One common arrangement involves a pre-cooling or first cooling stage, and one or more, usually one, main cooling stages. Each cooling stage generally involves at least one refrigerant, which refrigerant(s) are generally being circulated in a refrigerant circuit(s). Each cooling stage may also involve one or more steps, levels or sections, and there may also be a final sub-cooling stage.

[0075] In the embodiment shown in FIG. **1**, the cooling is or involves liquefying of the compressed stream **40** by a liquefying system which has one or more cooling and/or liquefying stages. This could involve a pre-cooling stage **26** and a main cooling stage **62**. The pre-cooling stage **26** involves a pre-cooling refrigerant circuit **32** which has at least one separate refrigerant compressor **18** for compressing its refrigerant, such as propane or a mixed refrigerant, to a higher pressure. A heat exchanger, which could be one or more air coolers or other condensers, is provided downstream of the compressor **18** to cool the refrigerant with heat exchanged with a coolant, typically air and/or water.

[0076] Whilst a single refrigerant compressor **18** is shown in the pre-cooling refrigerant circuit **32** in FIG. **1**, it is envisaged that two or more separate or single casing compressors, which could optionally also be mechanically interconnected, may be used, optionally arranged on a common drive shaft.

[0077] The refrigerant compressor **18** of the pre-cooling refrigerant circuit **32** is driven by a gas turbine **28** which could have an associated starter/helper motor. The second (and main) feed compressor **16** is mechanically interconnected to the separate refrigerant compressor **18** of the pre-cooling refrigerant circuit **32**, preferably by being provided on a com-

mon drive shaft, whereby the gas turbine **28** also drives the second feed compressor **16**, thus avoiding the need for two separate gas turbines or other drivers and associated capital and running costs.

[0078] The distribution of power from the gas turbine **28** between the pre-cooling refrigerant compressor **18** and the second feed compressor **16** can be freely chosen, such that the optimal power balance can be achieved. In particular, it is desired for the compressor power input from the gas turbine **28** to be as close as possible to the optimal ratio for natural gas liquefaction. Large industrial gas turbines are known which are able to provide such power, and a changeable power input allows for variation in loads of the compressors where non-steady state conditions are involved.

[0079] Typically, the liquefying system also includes a main cooling stage **62** which has a separate refrigeration circuit **64**, and which generally also includes one or more separate refrigerant compressors **66**. A non-limiting example of a typical main refrigerant is a mixture of compounds having different boiling points in order to obtain a well-distributed heat transfer. One mixture is nitrogen, ethane and propane. Like the refrigerant of the pre-cooling circuit **32**, the main refrigerant is separate from the feed stream **10**, compressed stream **40** and its downstream pre-cooled form **50**.

[0080] The main cooling stage **62** could have two or more compressors for compressing the main refrigerant. The main refrigerant could then be passed through a heat exchanger where it is cooled by heat exchange with a coolant, such as water. The main refrigerant could then be further cooled by heat exchange with the refrigerant of the pre-cooling refrigerant circuit **32**. In the or a heat exchanger of the main cooling stage **62**, the expansion of the main refrigerant further cools and optionally liquefies the pre-cooled stream **50** from the pre-cooling process by heat exchange, to provide a further cooled, preferably liquefied, product stream **60**.

[0081] It is possible that one or more of the main refrigerant compressors **66** could be mechanically interconnected with the pre-cooling refrigerant compressor **18** of the pre-cooling refrigerant circuit **32**, and/or the second feed compressor **16**, so as to be driven by a common driver, possibly on a common drive shaft.

[0082] FIG. **2** shows a second arrangement for treatment of a hydrocarbon stream prior to any cooling and/or liquefaction. Compared to the arrangement shown in FIG. **1**, the feed stream **10** is cooled prior to its expansion through the expander **22**. The cooling can be carried out by an upstream or prior cooling stage **34** wherein the feed stream **10** is cooled against an upstream refrigerant circuit **36**. The upstream refrigerant circuit **36** involves a compressor **38** for compressing its separate refrigerant media to a higher pressure.

[0083] Similar to FIG. **1**, in the arrangement in FIG. **2**, the expanded feed gas **10***a* is fed via an inlet **52** into a distillation column **12**, thereby providing a gaseous stream **20** via a first outlet **54**, and providing a C_2^+ liquid stream **30** via a second outlet **56**. The gaseous stream **20** can then be recompressed through a first feed compressor **14** and second feed compressor **16**. The compressed light stream **40** can then be cooled and/or liquefied as is known in the art, such as the liquefying system of FIG. **1**.

[0084] In the arrangement shown in FIG. **2**, the second feed compressor **16** is mechanically interconnected with the compressor **38** in the upstream refrigerant circuit **36** for the upstream cooling stage **34**. Preferably, the two interconnected compressors **16**, **38** are driven by a common driver **42**. The driver **42** could be a gas turbine having an associated starter/helper motor.

[0085] The arrangement shown in FIG. **2** has an advantage like that shown in FIG. **1**, that is avoiding the need for two separate gas turbines or other drivers for the second feed compressor **16** and an upstream refrigerant compressor **38**. As with the arrangement shown in FIG. **1**, the distribution of power from the gas turbine **42** between the compressors **16**, **38** can be freely chosen, such that the optimal power balance can be achieved.

[0086] Liquefied natural gas **60** from a liquefying system can be passed into a final separator wherein vapour can be removed for use as fuel in the plant, for example for the gas turbines running the various compressors, and a liquefied natural gas product can be transferred to a storage vessel or other storage or transportation apparatus.

[0087] FIGS. **1** and **2** exemplify two possible arrangements of the present invention for commonly driving at least one of the feed compressors with one or more separate refrigerant compressors for one or more separate refrigerant circuits.

[0088] FIG. **3** shows a third scheme for treating a hydrocarbon feed gas stream **100**, particularly the end flash processing of an LNG stream. One source of the hydrocarbon feed gas stream **100** is the compressed stream **40** shown in FIGS. **1** and **2**.

[0089] Liquefaction of a hydrocarbon stream **100** by a liquefying system is known by the skilled person in the art. Liquefaction can be carried out in a number of stages, and for the sake of simplicity only, FIG. **3** shows a final sub-cooling stage **102** only. The sub-cooled stream **110** can pass through an expander **104** to provide stream **110***a*, and a water and/or air cooler **106** to provide stream **110***b*, which passes via inlet **122** into an end separation vessel **108**, in this instance being an end flash vessel known in the art.

[0090] In general, an end flash system such as that shown in FIG. **3** can be used at the downstream end of the sub-cooling stage **102** to optimize liquefied natural gas (LNG) production. It usually includes an end compressor driven by a separate electric drive motor. The power needed to drive the end compressor is a usually smaller than the required compressor power for the sub-cooling stage.

[0091] The end separation vessel **108** has a first outlet **124** to provide a liquid stream **120** such as LNG, which, via a pump **128**, can create a final LNG stream **130** for storage and/or transportation.

[0092] From a second outlet **126** of the end separation vessel **108** there is provided an end gaseous stream **140**, which could be combined with, for example, a boil-off gas stream **150** known in the art. The combined stream **160** can be compressed by an end compressor **114** to provide a useable stream **170**, such as for fuel gas.

[0093] The sub-cooling stage **102**, involves a refrigerant circuit **132** having a first refrigerant compressor **116**. Optionally, the sub-cooling refrigerant circuit **132** also includes an air or water cooler **117**.

[0094] In the arrangement shown in FIG. **3**, the first refrigerant compressor **116** is mechanically interconnected with the end compressor **114**. Preferably, the two interconnected compressors **114**, **116** are driven by a common driver **134**. The driver **134** could be a gas turbine having an associated starter/helper motor.

[0095] The arrangement shown in FIG. **3** has an advantage like that shown in FIGS. **1** and **2**, that is avoiding the need for two separate gas turbines or other drivers for the end compressor **114** and first refrigerant compressor **116**. As with the arrangement shown in FIGS. **1** and **2**, the distribution of power from the driver **134** between the compressors **114**, **116** can be freely chosen, such that the optimal power balance can be achieved.

[0096] The liquefaction in FIG. **3** may involve other cooling stages such as pre-cooling and main cooling stages. Any or each such cooling stage of the liquefaction may involve one or more refrigerant circuits, and involve one or more refrigerant compressors. It is possible that one or more of the other refrigerant circuit compressors used in the liquefaction, from any stage thereof, could be mechanically interconnected with the end compressor **114**, so as to be driven by a common driver, possibly on a common drive shaft.

[0097] The following Table provides example temperature, pressure, flowrate and phase data for an embodiment of the present invention exemplified in FIG. **1**.

Stream	Temperature ° C.	Pressure Bar	Flowrate kmol/s	Phase —
10	−28	57	17	vapor
10a	−69	22	17	mixed
30	−58	22	3	liquid
20	−76	22	18	vapor
20a	48	29	18	vapor
40	88	73	18	vapor
50	−27	71	18	vapor
60	−150	66	18	liquid

[0098] The person skilled in the art will understand that the present invention can be carried out in many various ways without departing from the scope of the appended claims.

1. A method of treating a hydrocarbon stream from a feed stream comprising at least the steps of:

(a) passing the feed stream through a distillation column to provide a gaseous stream and a C2+ liquid stream;

(b) compressing at least part of the gaseous stream through one or more feed compressors to provide a compressed stream; and

(c) commonly driving at least one of the feed compressors with one or more separate refrigerant compressors for one or more separate refrigerant circuits, by mechanically interconnecting said compressors.

2. A method as claimed in claim **1** wherein the distillation column is a natural gas liquid recovery column.

3. A method as claimed in claim **1** wherein the feed stream is expanded prior to passing through the distillation column.

4. A method as claimed in claim **1** wherein the compressing of step (b) involves first and second feed compressors.

5. A method as claimed in claim **1** further comprising the step of:

cooling the compressed stream by passing the compressed stream against one or more refrigerants being in one or more of the refrigerant circuits.

6. A method as claimed in claim **5** wherein the second feed compressor is mechanically interconnected with a refrigerant compressor of one or more of the refrigerant circuits cooling the compressed stream.

7. A method as claimed in claim **5**, wherein the cooling of the compressed stream involves at least two cooling stages, each stage including at least one refrigerant circuit.

8. A method as claimed in claim **7** wherein the cooling of the compressed stream involves one pre-cooling stage and one main cooling stage, and the or a feed compressor of step (b) is mechanically interconnected with a refrigerant compressor of the pre-cooling refrigerant circuit.

9. A method as claimed in claim **5** wherein the cooling of the compressed stream involves liquefying the compressed stream thereby obtaining a liquefied hydrocarbon stream.

10. A method as claimed in claim **1** further comprising the step of:

cooling the feed stream upstream of step (a) by passing the feed stream against one or more refrigerants being in one or more of the refrigerant circuits.

11. A method as claimed in claim **10** wherein the or a feed compressor of step (b) is mechanically interconnected with a refrigerant compressor of the refrigerant circuit cooling the feed stream.

12. A method as claimed in claim **1** further comprising the step of: cooling the feed stream upstream of step (a) against at least part of the gaseous stream.

13. Apparatus for treating a hydrocarbon stream from a feed stream, the apparatus at least comprising:

a distillation column having an inlet for the feed stream and a first outlet for a gaseous stream and a second outlet for a C2+ liquid stream;

one or more feed compressors for compressing at least a part of the gaseous stream; and

a common driver for driving one or more of the feed compressors with one or more separate refrigerant compressors for one or more separate refrigerant circuits.

14. Apparatus as claimed in claim **13**, wherein the commonly driven compressors are mechanically interconnected and arranged on a common drive shaft of the driver.

15. Apparatus as claimed in claim **13**, wherein the apparatus includes an expander to expand the feed stream upstream of the distillation column.

16. Apparatus as claimed in claim **15** wherein the expander is mechanically interconnected to one or more of the feed compressors and is partly, substantially or wholly driven thereby.

17. Apparatus as claimed in claim **13**, wherein the apparatus further includes a cooling system for cooling the gaseous stream, which cooling system involves at least one pre-cooling stage and at least one main cooling stage, each stage including at least one refrigerant circuit and at least one refrigerant compressor.

18. Apparatus as claimed in claim **15**, wherein one feed compressor of step (b) is mechanically interconnected with a refrigerant compressor of a pre-cooling refrigerant circuit.

19. Apparatus as claimed in claim **15**, wherein at least one refrigerant compressor of both the pre-cooling and main cooling refrigerant circuits are mechanically interconnected and are arranged to be driven by said common driver.

20. Apparatus as claimed in claim **13**, wherein the cooling system includes a liquefying system to obtain a liquefied hydrocarbon stream.

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