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(54) TWIN REFLUX PROCESS AND CONFIGURATIONS FOR IMPROVED NATURAL GAS LIQUIDS RECOVERY

DOPPELRÜCKFLUSSVERFAHREN UND KONFIGURATIONEN FÜR VERBESSERTE ERDGASKONDENSATGEWINNUNG

PROCEDE A DEUX REFLUX ET CONFIGURATIONS DE RECUPERATION DE LIQUIDES GAZEUX NATURELS

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(73) Proprietor: **FLUOR CORPORATION**
Aliso Viejo, CA 92698 (US)

(72) Inventors:
- **MAK, John,**
Fluor Corporation
Aliso Viejo, CA 92656-2606 (US)
- **GRAHAM, Curt,**
Fluor Corporation
Aliso Viejo, CA 92656-2606 (US)
- **CHUNG, Wayne Chengwen,**
Fluor Corporation
Aliso Viejo, CA 92656-2606 (US)

(74) Representative: **Dr. Graf & Partner**
Intellectual Property,
Postfach 518
8200 Schaffhausen (CH)

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Description

Field of The Invention

[0001] The field of the invention is natural gas liquids (NGL) recovery.

Background of The Invention

[0002] Many natural and man-made gases comprise a variety of different hydrocarbons, and numerous gas separation processes and configurations are known in the art to produce commercially relevant fractions from such gases. In a typical gas separation process, a feed gas stream under pressure is cooled by heat exchanger and as the gas cools, liquids condense from the cooled gas. The liquids are then expanded and fractionated in a distillation column (*e.g.*, de-deethanizer or demethanizer) to separate residual components such as methane, nitrogen and other volatile gases as overhead vapor from the desired C_2, C_3 and heavier components.

[0003] For example, Rambo et al. describe in U.S. Pat. No. 5,890,378 a system in which the absorber is refluxed, in which the deethanizer condenser provides the reflux for both the absorber and the deethanizer while the cooling requirements are met using a turbo expander, and in which the absorber and the deethanizer operate at substantially the same pressure. Although *Rambo's* configuration advantageously reduces capital cost for equipment associated with providing reflux for the absorption section and the de-deethanizer, propane recovery significantly decreases as the operating pressure in the absorber rises, especially at a pressure above 34,47 bar (500 psig) where separation of ethane from propane in the de-deethanizer becomes increasingly difficult. Consequently, *Rambo's* system is generally limited by the upper operating limit of the de-deethanizer pressure. Increasing of the absorber pressure while maintaining desirable propane recovery becomes difficult, if not impossible in *Rambo's* process configuration. Moreover, operating the absorber and deethanizer at a pressure at or below 34,47 bar (500 psig) typically necessitates higher residue gas recompression, thereby incurring relatively high operating cost.

[0004] To circumvent at least some of the problems associated with relatively high cost associated with residue gas recompression, Sorensen describes in U.S. Pat. No. 5,953,935 a plant configuration in which the absorber reflux is produced by compressing, cooling, and Joule-Thomson expansion of a slipstream of feed gas. Although *Sorensen's* configuration generally provides an improved propane recovery with substantially no increase in plant residue compression horsepower, propane recovery significantly decreases as the operating pressure in the absorber rises, especially at a pressure above about 500 psig. Furthermore, ethane recovery using such known systems designed for propane recovery is normally limited to about 20% recovery.

[0005] In order to improve ethane recovery with a low CO_2 content in the ethane product, Campbell describes in U.S. Pat. No. 6,182,469 a tower reboiling scheme in which one or more tower liquid distillation streams from a point higher in the absorber are employed for stripping of undesirable components (*e.g.*, carbon dioxide in a demethanizer). *Campbell's* scheme typically requires over-stripping of the ethane product, and CO_2 removal is generally limited to about 6%. Moreover, additional CO_2 removal using *Campbell's* process will significantly reduce ethane recovery, and increase power consumption. Furthermore, and especially where the ethane product is used for chemical production, the product in *Campbell's* configuration typically requires further treatment to remove CO_2 to or below a level of 500 ppmv, which often requires substantial capital and operating expenditure.

[0006] In yet other configurations, a turbo-expander is employed to provide the cooling of the feed gas in order to achieve a high propane or ethane recovery. Exemplary configurations are described, for example, in U.S. Pat. No. 4,278,457, and U.S. Pat. No. 4,854,955, to Campbell et al., in U.S. Pat. No. 5,953,935 to McDermott et al., in U.S. Pat. No. 6,244,070 to Elliott et al., or in U.S. Pat. No. 5,890,377 to Foglietta. While such configurations may provide at least some advantages over other processes, they typically require changes in existing expanders when the plant is upgraded to higher throughputs. Moreover, in such configurations the liquids separated are fed to the demethanizer operating at cryogenic temperature.

[0007] *Lee* describes in U.S. Pat. No. 6,224,070 configurations and methods in which methane is separated from heavier components in a cryogenic distillation column in which its top reflux is generated by a lean reflux absorber that is operated at a lower pressure than the distillation column and that receives a lean portion of the feed gas as absorber feed stream. It is therefore also the demethanizer that forms the methane product.

[0008] WO-A-01 88447, which can be considered as the closest prior art, discloses in figure 5 a plant comprising a distillation column coupled to an absorber that receives a first reflux stream and that further receives a second reflux stream, the first reflux stream comprising a cooled lean overhead product from the distillation column and the second reflux stream comprising a cooled vapour portion of a natural gas feed that is reduced in pressure via a Joule Thomson valve and wherein the absorber is further configured to receive a liquid portion of the natural gas feed and a second vapour portion of the natural gas feed wherein the second portion is reduced in pressure via a turbo expander.

[0009] Thus, although various configurations and methods are known to recover various fractions from natural gas liquids, all or almost all of them suffer from one or more disadvantages. Therefore, there is still a need to provide methods and configurations for improved natural gas liquids recovery.

Summary of the Invention

[0010] The present invention concerns a plant and a method according to claims 1 and 6, respectively.

[0011] The absorber receives a liquid portion of the natural gas feed and a second vapor portion of the natural gas feed wherein the second portion is reduced in pressure via a turbo expander. The absorber further produces a bottom product that cools the first and second reflux streams, and at least a portion of the bottom product may be fed into the distillation column. Contemplated absorber overhead products are employed to cool the first and second reflux streams, and further cool a vapor portion of the natural gas feed. They may further cool the natural gas feed. Preferred devices other than the turbo expander include a Joule-Thomson valve, and preferred distillation columns comprise a demethanizer or deethanizer. Where C_2 recovery is particularly preferred, it is contemplated that the first lean reflux stream may be fed into the absorber as a liquid feed, wherein the distillation column comprises a demethanizer. Preferred configurations are especially useful in a retrofit of an existing NGL plant to improve throughput while increasing the C_2 and C_3 recovery.

Brief Description of the Drawing

[0012] Figure 1 is a schematic diagram of an exemplary plant configuration according to the inventive subject matter.

Detailed Description

[0013] The inventors have discovered that high NGL recovery (*e.g.*, at least 99%C_3 and at least 90%C_2) may be achieved in new and upgrade configurations in which an absorber receives two reflux streams. Furthermore, contemplated configurations will advantageously allow change in component recovery by changing process temperature and changing the feed point of one of the reflux streams into the absorber.

[0014] More specifically the plant configurations include an absorber that receives a first reflux stream and a second reflux stream, the first reflux stream comprising a cooled lean overhead product from a distillation column, and the second reflux stream comprising a cooled vapor portion of a natural gas feed that is reduced in pressure via a device other than a turbo expander.

[0015] In a particularly preferred configuration as depicted in **Figure 1**, a plant 100 comprises an absorber 110 that is fluidly coupled to a distillation column 140. A natural gas feed 101, with a typical composition by mole percent of 85% C1, 6% C2, 3% C3, 3% C4+ and 3% CO2 a 32,22°C (90°F) and 648,88°C (1200) psig, is cooled in a heat exchanger 124 to cooled natural gas feed 102 at 31,66°C (25°F). The condensed liquid portion of the cooled natural gas feed is separated in the separator 170 to form cooled liquid stream 103, while the cooled vapor portion 106 is further cooled via heat exchanger 122 to typically -37,22°C (35°F) to form further cooled vapor portion 107. The liquid from the further cooled vapor portion 107 are separated from the vapors in separator 180, which produces further cooled vapor stream 108 and further cooled liquid stream 104. The cooled liquid stream 103 and the further cooled liquid stream 104 are combined to form combined cooled liquid stream 105 at typically -59,44°C (-75°F) and 28,26 bar (410 psig), which is subsequently introduced as feed to the lower section of absorber 110.

[0016] In especially preferred configurations ranging from propane recovery to ethane recovery, the typical temperature ranges are illustrated as follows. The further cooled vapor stream 108 is split into a first portion that is expanded in a turbo-expander 150 to form expanded stream 109, typically at -73,33°C (-100°F) to -81,66°C (-115° F), which is introduced into the absorber 110, and a second portion stream 130 is still further cooled in heat exchanger 120 to typically -67,77°C (-90°F) to -92,77°C (-135°F) and reduced in pressure via a Joule-Thomson valve 132 before entering the absorber 110 as a reflux stream, typically at -87,22°C (-125°F) to -95,55°C (-140°F).

[0017] Absorber 110 forms an overhead product 114, typically at -73,33°C (-100°F) to -92,77°C (135°), which is employed as a refrigerant in heat exchangers 120, 122, and 124 before a residue gas re-compressor 160 recompresses the residue gas. Thus, it should be recognized that the overhead product cools the first and second absorber reflux, 146 and 130, respectively, and is further employed as refrigerant to cool at least one of the vapor portions of the natural gas feed from the first and second separators. The absorber 110 further produces bottoms product 112, typically at -73,33°C (-100°F) to -81,66°C (-115°F), which also acts as a refrigerant in heat exchanger 120 to further cool the first and second reflux streams 146 and 130. The heated bottoms product 112, typically at -53,88°C (-65°F) to -65°C (-85°F), is then introduced into the distillation column 140, which separates the desired bottom product 142 (*e.g.*, propane, or ethane/propane) from lean residue gas 144. The lean residue gas 144 may then be cooled with a cooler before entering separator 190 that produces a distillation column reflux 148 and the lean absorber reflux stream 146, typically at -65°C (-85°F) to -81,66°C (-115°F).

[0018] It should be particularly appreciated that contemplated configurations may be employed for high propane recovery as well as for high ethane recovery. For example, where high ethane recovery is desired, the cooler for distillation column overhead stream 144 is typically not required and can be bypassed, and the lean absorber reflux stream 146 will be introduced into the bottom of absorber 110 as a bottom feed stream as indicated by the dashed lines in Figure 1.

[0019] With respect to suitable feed gas streams, it is contemplated that various feed gas streams are appropriate, and especially suitable feed gas streams may include various hydrocarbons of different molecular weight. With respect to the molecular weight of contemplated hydrocarbons, it is generally preferred that the feed gas stream predominantly includes C_1-C_6 hydrocarbons. However, suitable feed gas streams may additionally comprise acid gases (*e.g.*, carbon dioxide, hydrogen sulfide) and other gaseous components (*e.g.*, hydrogen). Consequently, particularly preferred feed gas streams are natural gas and natural gas liquids.

[0020] In further preferred aspects of the inventive subject matter, the feed gas streams cooled to condense at least a portion of the heavier components in the feed gas stream, and in especially preferred configurations, the feed gas stream is cooled, separated into a vapor portion and a liquid portion, wherein the vapor portion is further cooled and separated into a second vapor portion and second liquid portion. These cooling steps are achieved using the refrigerant content of the absorber overhead product and/or the absorber bottom product.

[0021] In contemplated configurations, it is further preferred that the separated liquids from the feed gas stream are (combined and) fed into the absorber. With respect to the vapor portions, it should be recognized that the second vapor portion is split into a bypass stream and a turbo-expander stream, wherein the turbo-expander stream is fed into a turbo-expander and subsequently into the absorber, and wherein the bypass stream is (a) further cooled, using the refrigerant content of the absorber overhead product and the absorber bottom product, and then (b) let down in pressure via a device other than a turbo-expander before entering the upper section of absorber as a first reflux stream. Especially suitable devices include Joule-Thomson valves, however, all other known configurations and methods to reduce pressure are also considered suitable for use herein. For example, suitable alternative devices might include power recovery turbines and expansion nozzle devices.

[0022] The absorber overhead and bottom products are employed as refrigerant in a heat exchanger, wherein the heat exchanger provides cooling for the first and second reflux streams. Furthermore, it is preferred that the absorber overhead product may act as a refrigerant in at least one, and preferably at least two additional heat exchangers, wherein the absorber overhead product cools the separated vapor portion of the feed gas and the feed gas stream before recompression to residue gas pressure. Similarly, the absorber bottom product is employed (preferably in the same heat exchanger) as a refrigerant to cool at least one of the first and second reflux streams before entering the distillation column as column feed. Suitable absorbers may vary depending on the particular configurations, however, it is generally preferred that the absorber is a tray or packed bed type absorber.

[0023] The absorber bottom product is separated in a distillation column to form the desired bottom product (*e.g.*, C_2/C_3 or, C_3 and C_4^+). Consequently, depending on the desired bottom product, appropriate distillation columns include a demethanizer and a deethanizer. Where the desired bottom product is C_3 and C_4^+, it is contemplated that the distillation column overhead product is cooled in a cooler (*e.g.*, using external refrigerant) and separated into a distillation column reflux portion and a vapor portion. Thus, it should be especially appreciated that the vapor overhead product from the distillation column is employed as first reflux stream for the absorber, wherein the first reflux stream is a lean reflux stream that is fed to the top tray of the absorber

[0024] Similarly, where the desired bottom product is C_2/ C_3^+, it is contemplated that the distillation column overhead product bypasses the cooler and, after separation in a separator, the liquid portion is employed as reflux for the distillation column while the vapor portion is employed as a bottom feed to the absorber. Again, it should be especially appreciated that in such configurations of ethane recovery, the vapor overhead product from the distillation column is recycled back to the absorber for re-absorption of the C_2 plus components resulting in high ethane recovery.

[0025] Thus, it should be especially recognized that in contemplated configurations, the cooling requirements for the absorber are at least partially provided by the reflux streams (via cooling by absorber bottom and overhead products), and that the C_2/C_3 recovery significantly improves by employing a first and a second reflux stream. With respect to the C_2 recovery, it is contemplated that such configurations provide at least 85%, more typically at least 88%, and most typically at least 90% recovery, while it is contemplated that C_3 recovery will be at least 95%, more typically at least 98%, and most typically at least 99%.

[0026] In yet another aspect of the inventive subject matter, it should be recognized that contemplated configurations are especially advantageous as an upgrade into an existing natural gas treating plant, wherein the capacity of the upgraded plant significantly increases without rewheeling the expander or replacing the absorber and/or distillation column. Additional equipment for such upgrades will typically include a heat exchanger and piping.

[0027] Consequently, a method of increasing throughput in a natural gas recovery plant having an absorber and a distillation column will include a step in which a first reflux stream is provided to the absorber, wherein the first reflux stream comprises an overhead product from the distillation column. In another step, a bypass is provided upstream of a turbo expander, wherein the bypass receives a vapor portion of a cooled natural gas liquid and provides the vapor portion to the absorber. In a still further step, pressure of the vapor portion is reduced before the vapor portion enters the absorber as a second reflux stream, and in yet another step, a heat exchanger is provided that cools at least one of the first and second reflux streams using at least one of an absorber bottom product and an absorber overhead product.

[0028] The method includes a step in which a second vapor portion of the cooled natural gas liquid is expanded in a turbo expander and fed into the absorber, wherein a liquid portion of the cooled natural gas liquid is fed into the absorber. Furthermore, the absorber overhead product may further cool the natural gas liquid and/or a vapor portion of the natural gas liquid, and the reflux stream may be fed into the absorber as a liquid or vapor/liquid feed, wherein the distillation column comprises a deethanizer. Alternatively, the distillation column can also perform as a demethanizer when liquid ethane product is preferred.

[0029] Thus, a method of operating a plant includes a step in which an absorber and a distillation column are provided. In another step, a cooled lean overhead product from the distillation column is fed to the absorber as a first reflux stream, and the pressure of a cooled vapor portion of a natural gas feed is reduced via a device other than a turbo expander. In still another step, the cooled vapor portion that is reduced in pressure is fed to the absorber as a second reflux stream. The method includes a step in a liquid portion of the natural gas feed and a second vapor portion of the natural gas feed are fed into the absorber, wherein the second portion is reduced in pressure via a turbo expander.

[0030] Additionally, a heat exchanger is provided in which a bottom product and an overhead product of the absorber cool the first and second reflux streams. Furthermore, it is generally preferred that in such methods at least part of the bottom product is fed from the absorber into the distillation column, and that the device other than the turbo expander comprises a Joule-Thomson valve. Furthermore, where C_2 recovery is desired, it is contemplated that the lean reflux stream is provided by the separator vapor and fed into the absorber as a liquid feed and the vapor overhead stream from the distillation column is fed to the bottom of the absorber, wherein the distillation column comprises a demethanizer.

[0031] Additionally, in another aspect of the invention subject matter, it should be recognized that contemplated configurations with the absorber operating at a higher pressure than the downstream distillation column prove especially advantageous. Such contemplated configuration would require a compressor that raises the pressure of the vapor stream from the distillation column to a pressure required by the absorber. Such a dual pressure column configuration should be recognized to provide significant overall compression horsepower savings as the compression horsepower required by the residue gas recompressor is greatly reduced.

Claims

1. A plant (100) comprising:

a distillation column (140) coupled to an absorber (110) that is configured to receive a first reflux stream (146), wherein the first reflux stream (146) comprises a lean overhead product from the distillation column (140), wherein a heat exchanger (120) is configured to cool the lean overhead product from the distillation column (140) prior to entry into the absorber (110); wherein

the absorber (110) is configured to receive a second reflux stream (130), wherein the second reflux stream (130) comprises a vapor portion of a natural gas feed (101);

wherein the absorber (110) produces a bottom product (112) and an overhead product (114) that cool the lean overhead product from the distillation column (140) and the vapor portion of the natural gas feed (101) in the heat exchanger (120) prior to entry into the absorber (110) as the first and second reflux streams (146, 130);

wherein an expansion device selected from the group consisting of a power recovery device, an expansion nozzle, and a Joule-Thomson valve (132) is coupled to the absorber (110) and configured to reduce the pressure of the vapor portion of the natural gas feed via expansion; and

wherein the absorber (110) is further configured to receive a liquid portion (105) of the natural gas feed (101) and a second vapor portion (109) of the natural gas feed (101) wherein the second portion is reduced in pressure via a turbo expander (150).

2. The plant of claim 1 wherein at least a portion of the bottom product (112) is fed into the distillation column (140).

3. The plant of claim 1 or 2 wherein the overhead product (114) further cools the natural gas feed (101).

4. The plant of claim 1 wherein the distillation column (140) comprises a demethanizer.

5. The plant of claim 1 wherein the first lean reflux stream (146) is fed into the absorber (110) as a vapour/liquid or liquid feed, and wherein the distillation column (140) comprises a deethanizer.

6. A method of operating a plant (100) comprising:

providing an absorber (110) and a distillation column (140); providing a heat changer (120) in which a bottom product (112) and an overhead product (114) of the absorber (110) cool a lean overhead product from the distillation column (140) and a vapor portion of natural gaz (130);

feeding the cooled lean overhead product from the distillation column (140) to the absorber (110) as a first reflux stream (146);

reducing pressure of the cooled vapor portion of natural gas feed via an expansion device se-

lected from the group consisting of a power recovery turbine, an expansion nozzle, and a Joule-Thomson valve (132);
feeding the cooled vapor portion that is reduced in pressure to the absorber as a second reflux stream in addition to the first reflux stream; and
feeding a liquid portion (105) of the natural gas feed (101) and a second vapor portion (109) of the natural gas feed (101) into the absorber (110), wherein the second portion (109) is reduced in pressure via a turbo expander (150).

7. The method of claim 6 further comprising feeding at least part of the bottom product (112) from the absorber (110) into the distillation column (140).

8. The method of claim 7 wherein the first lean reflux stream (146) is fed into the absorber (110) as a vapor/liquid feed, and wherein the distillation column (140) comprises a deethanizer.

9. The method of claim 6 wherein the absorber (110) is operated at a pressure higher than a pressure in the distillation column (140), and wherein a compressor is provided and configured to compress the distillation column overhead to the pressure of the absorber (110).

Patentansprüche

1. Anlage (100) umfassend
eine Destillationskolonne (140) verbunden mit einem Absorber (110), welcher ausgestaltet ist zum Erhalten eines ersten Rückflussstroms (146), wobei der erste Rückflussstrom (146) ein mageres Kopfprodukt von der Destillationskolonne (140) umfasst,
wobei ein Wärmetauscher (120) zum Kühlen des mageren Kopfproduktes der Destillationskolonne (140) ausgestaltet ist, bevor dieses in den Absorber (110) eintritt;
wobei der Absorber (110) zum Erhalten eines zweiten Rückflussstroms (130) ausgestaltet ist, wobei der zweite Rückflussstrom (130) einen Dampfanteil einer Erdgaszufuhr (101) umfasst;
wobei der Absorber (110) ein Sumpfprodukt (112) und ein Kopfprodukt (114) erzeugt, welche das magere Kopfprodukt der Destillationskolonne (140) und den Dampfanteil der Erdgaszufuhr (101) im Wärmetauscher (120) kühlen, bevor diese als der erste und zweite Rückflussstrom (146, 130) in den Absorber (110) eintreten;
wobei eine Expansionsvorrichtung ausgewählt aus der Gruppe bestehend aus einer Energierückgewinnungsvorrichtung, einer Expansionsdüse, und einem Joule-Thomson-Ventil (132), an den Absorber (110) gekoppelt ist und ausgestaltet ist den Druck des Dampfanteils der Erdgaszufuhr durch Expansion zu reduzieren;
und wobei der Absorber (110) weiter ausgestaltet ist einen Flüssiganteil (105) der Erdgaszufuhr (101) und einen zweiten Dampfanteil (109) der Erdgaszufuhr (101) zu erhalten,
wobei der zweite Anteil über einen Turboexpander (150) druckreduziert ist.

2. Anlage gemäss Anspruch 1, wobei zumindest ein Teil des Sumpfproduktes (112) in die Destillationskolonne (140) zugeführt ist.

3. Anlage gemäss Anspruch 1 oder 2, wobei das Kopfprodukt (114) zudem die Erdgaszufuhr (101) kühlt.

4. Anlage gemäss Anspruch 1, wobei die Destillationskolonne (140) einen Demethaniser umfasst.

5. Anlage gemäss Anspruch 1, wobei der erste magere Rückflussstrom (146) als eine Dampf/ Flüssigkeitszufuhr oder eine Flussigkeitszufuhr dem Absorber (110) zugeführt ist, und wobei die Destillationskolonne (140) einen Deethaniser umfasst.

6. Verfahren zum Betrieb der Anlage (100) umfassend:

zur Verfügungstellung eines Absorbers (110) und einer Destillationskolonne (140);
zur Verfügungstellung eines Wärmetauschers (120) in welchem ein Sumpfprodukt (112) und ein Kopfprodukt (114) des Absorbers (110) ein mageres Kopfprodukt der Destillationskolonne (140) und einen Dampfanteil des Erdgases (130) kühlen;
zuführen des gekühlten mageren Kopfproduktes von der Destillationskolonne (140) zum Absorber (110) als ein erster Rückflussstrom (146);
reduzieren des Druckes des gekühlten Dampfanteils der Erdgaszufuhr über eine Expansionsvorrichtung ausgewählt aus der Gruppe bestehend aus einer Energierückgewinnungsturbine, einer Expansionsdüse, einem Joule-Thomson-Ventil (132),
zuführen des gekühlten Dampfanteils, der zum Absorber bezüglich Druck reduziert ist, als ein zweiter Rückflussstrom zusätzlich zum ersten Rückflussstrom; und
zuführen eines Flüssiganteils (105) der Erdgaszufuhr (101) und eines zweiten Dampfanteils (109) der Erdgaszufuhr (101) in den Absorber (110), wobei der zweite Anteil (109) über einen Turboexpander (150) bezüglich Druck reduziert wird.

7. Verfahren nach Anspruch 6, zudem umfassend das Zuführen von zumindest einem Teil des Sumpfproduktes (112) vom Absorber (110) in die Destillationskolonne (140).

8. Verfahren nach Anspruch 7, wobei der erste magere Rückflussstrom (146) dem Absorber (110) als eine Dampf/Flüssigkeitszufuhr zugeführt wird, und wobei die Destillationskolonne (140) einen Deethaniser umfasst.

9. Verfahren nach Anspruch 6 wobei der Absorber (110) auf einem Druck betrieben wird, der höher ist als ein Druck in der Destillationskolonne (140), und wobei ein Kompressor vorgesehen und ausgestaltet ist zum Komprimieren des Destillationskolonnenkopfs auf den Druck des Absorbers (110).

Revendications

1. Configuration ou installation de traitement (100), comprenant:

une colonne de distillation (140) couplée avec un absorbeur (110), qui est configuré pour recevoir un premier débit de reflux (146), le premier débit de reflux (146) comprenant un produit de tête appauvri provenant de la colonne de distillation (140), un échangeur de chaleur (120) étant configuré pour refroidir le produit de tête appauvri provenant de la colonne de distillation (140) avant son entrée dans l'absorbeur (110) ;

dans laquelle l'absorbeur (110) est configuré pour recevoir un deuxième débit de reflux (130), le deuxième débit de reflux (130) comprenant une portion de vapeur d'une alimentation en gaz naturel (101) ;
dans laquelle l'absorbeur (110) produit un produit de fond (112) et un produit de tête (114), qui refroidissent le produit de tête appauvri provenant de la colonne de distillation (140) et la portion de vapeur de l'alimentation en gaz naturel (101) dans l'échangeur de chaleur (120), avant leur entrée dans l'absorbeur (110) en tant que premier et deuxième débits de reflux (146, 130) ;
dans laquelle un dispositif d'expansion, qui est sélectionné parmi le groupe comprenant un dispositif de rendement en puissance, une buse d'expansion et une soupape Joule - Thomson (132), est couplé avec l'absorbeur (110) et est configuré pour réduire la pression de la portion de vapeur de l'alimentation en gaz naturel par expansion ; et
dans laquelle l'absorbeur (110) est en outre configuré pour recevoir une portion liquide (105) provenant de l'alimentation en gaz naturel (101) et une deuxième portion de vapeur (109) provenant de l'alimentation en gaz naturel (101), la pression de la deuxième portion étant réduite au moyen d'une turbine de détente (150).

2. Configuration de traitement selon la revendication 1, dans laquelle la colonne de distillation (140) est alimentée avec au moins une portion du produit de fond (112).

3. Configuration de traitement selon la revendication 1 ou 2, dans laquelle le produit de tête (114) refroidit en outre l'alimentation en gaz naturel (101).

4. Configuration de traitement selon la revendication 1, dans laquelle la colonne de distillation (140) comprend un dispositif d'élimination de méthane.

5. Configuration de traitement selon la revendication 1, dans laquelle l'absorbeur est alimenté avec le premier débit de reflux appauvri (146) sous forme d'alimentation vapeur/liquide ou liquide, et dans laquelle la colonne de distillation (140) comprend un dispositif d'élimination d'éthane.

6. Procédé d'opération d'une configuration ou installation de traitement (100), comprenant les étapes consistant à :

fournir un absorbeur (110) et une colonne de distillation (140) ;
fournir un échangeur de chaleur (120), dans lequel un produit de fond (112) et un produit de tête (114) de l'absorbeur (110) refroidissent un produit de tête appauvri provenant de la colonne de distillation (140) et une portion de vapeur de gaz naturel (130) ;
alimenter l'absorbeur (110) avec le produit de tête appauvri et refroidi qui provient de la colonne de distillation (140), en tant que premier débit de reflux (146) ;
réduire la pression de la portion de vapeur d'alimentation en gaz naturel refroidie au moyen d'un dispositif d'expansion, qui est sélectionné parmi le groupe comprenant une turbine de rendement en puissance, une buse d'expansion et une soupape Joule - Thomson (132) ;
alimenter l'absorbeur avec la portion de vapeur refroidie, dont la pression est réduite, en tant que deuxième débit de reflux, en plus du premier débit de reflux ; et
alimenter l'absorbeur (110) avec une portion liquide (105) de l'alimentation en gaz naturel (101) et une deuxième portion de vapeur (109) de l'alimentation en gaz naturel (101), la pression de la deuxième portion (109) étant réduite au moyen d'une turbine de détente (150).

7. Procédé selon la revendication 6, comprenant en outre l'étape consistant à alimenter la colonne de distillation (140) avec au moins une portion du produit de fond (112) provenant de l'absorbeur (110).

8. Procédé selon la revendication 7, dans lequel l'absorbeur (110) est alimenté avec le premier débit de reflux appauvri (146) sous forme d'alimentation vapeur/liquide, et dans lequel la colonne de distillation (140) comprend un dispositif d'élimination d'éthane.

9. Procédé selon la revendication 6, dans lequel l'absorbeur (110) fonctionne sous une pression qui est supérieure à une pression dans la colonne de distillation (140), et dans lequel un compresseur est fourni et est configuré pour compresser le produit de tête de la colonne de distillation jusqu'à la pression de l'absorbeur (110).

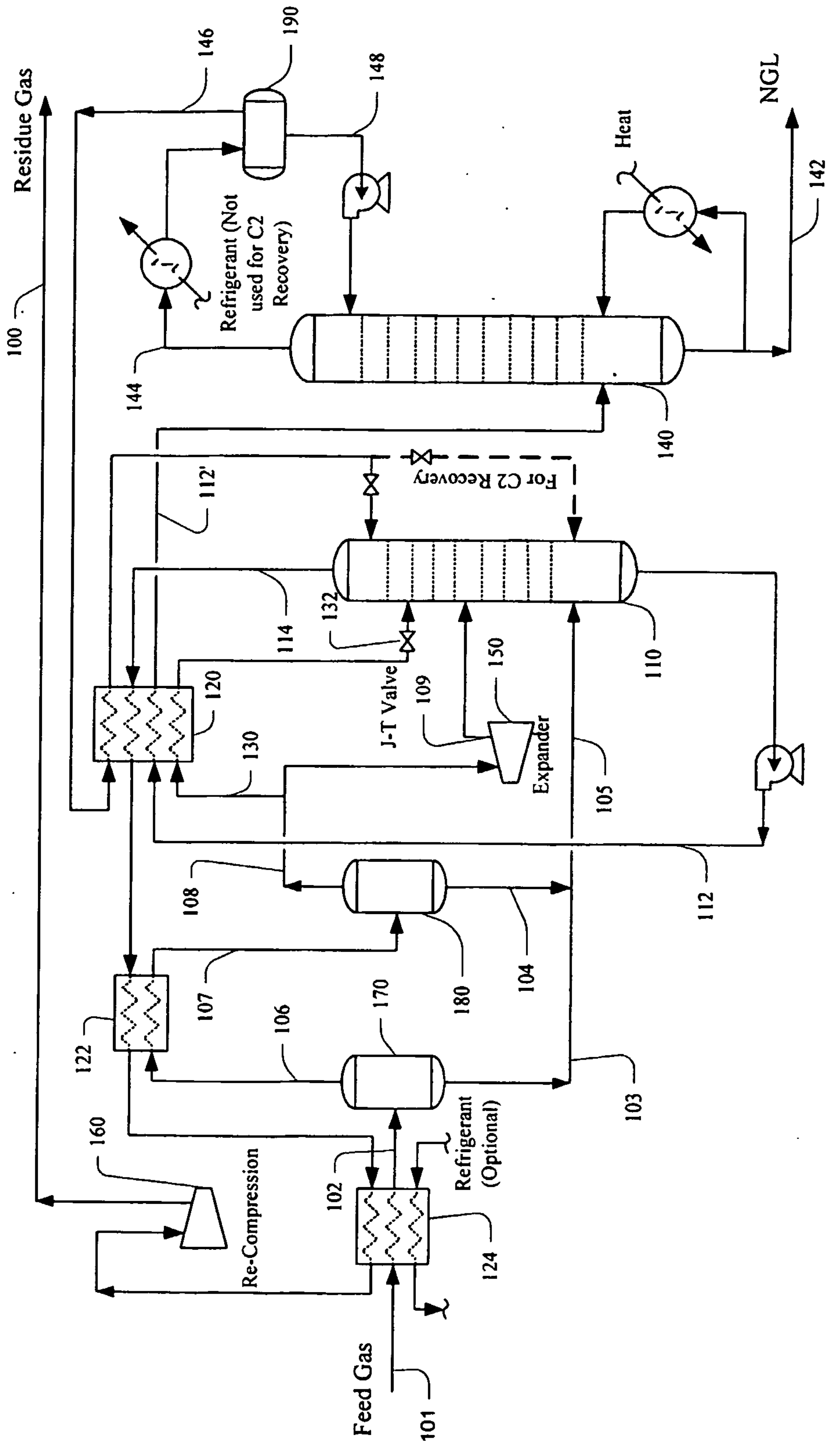
Residue Gas
100
146
190
148
Refrigerant (Not used for C2 Recovery)
144
Heat
NGL
142
140
112'
For C2 Recovery
114
132
120
J-T Valve
109
150
Expander
105
110
130
108
112
107
106
170
180
104
122
160
Re-Compression
102
Refrigerant (Optional)
103
124
Feed Gas
101

Figure 1

REFERENCES CITED IN THE DESCRIPTION

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