ensure that a stream of said distilled methanol can be used as a heat source for the preliminary topping step. This document claims to make it possible to reduce or eliminate the consumption of heat (for example from condensing steam) for the heating of the topping stage. It discloses that pressure p4, in the bottoming stage, is substantially higher than the topping pressure p1, so that the temperature of gaseous methanol, distilled in column 400, is substantially greater than the temperature of the liquid in the bottom of column 100. It also discloses that such temperature difference is at least 10 °C, i.e., the temperature of the gaseous methanol at the top of column 400 is at least 10 degrees Celsius higher than the temperature of the liquid in the bottom of column 100. This is what allows that at least part of said gaseous methanol can be used to heat, at least partially, the topping column 100.

CN108101748, and other documents, also mention an energy-saving process method and device for methanol purification, which is an energy-saving process and device for producing methanol from crude methanol using four towers and refers to a reduction of the operating energy consumption, however it is not clear or suggested how this is achieved and what are the process conditions.

Summary

In an aspect of the present disclosure, there is provided a process for distillation of methanol, comprising:

(i) pre-treatment of a crude stream A of methanol in a stabilizing column V0 at pressure P0, for separation of volatile components, obtaining a stream of light gases L from the upper section of V0 and a liquid stream B0 comprising methanol from the lower section of V0,

(ii) B0 is then directed towards concentration column V1, at pressure P1,

(iii) gaseous stream T1 recovered from the upper section of V1 is condensed in heat exchanger E2, supplying energy to concentration column V2,

(iv) part of the condensed methanol obtained in step (iii) is sent to product C1, and the remaining part of the condensed methanol is added to the upper section of V1 and used as reflux flow,

(v) a liquid stream B1 comprising methanol is recovered from the lower section of V1 and passed on to V2, at pressure P2,

(vi) gaseous stream T2 recovered from the upper section of V2 is split (S) in two separate streams, one stream being condensed in a heat exchanger E0, supplying energy to V0, and the other stream being condensed in a heat exchanger E3, supplying energy to concentration column V3,

(vii) part of the condensed methanol obtained in step (vi) is sent to product, C2, and the remaining part of the condensed methanol is added to the upper section of V2 and used as reflux flow,

(viii) a liquid stream B2 comprising methanol is recovered from V2 and passed on to V3, at pressure P3,

(ix) gaseous stream T3, recovered from the upper section of V3, is condensed, part of the condensed methanol being sent to product, C3, and the remaining part being added to the upper section of V3 and used as reflux flow,

(x) one or more side streams H comprising higher alcohols and other minor biproducts is withdrawn from V3 and a liquid stream B3, is drawn from V3,

wherein:

- Columns V1, V2 and V3 operate at decreasing pressures, such that P1>P2>P3
- P0> 0 barg and P3> 0 barg
- each column V0, V1, V2 and V3 is correspondingly associated to a heat exchanger E0, E1, E2 and E3, which is a reboiler for the same column,
- heat exchangers E0 and E3 are condensers for column V2;
- heat exchanger E2 is condenser for column V1.

characterized in that:

- P3<2 barg; and
- Heat exchanger E1 is supplied by an external energy source.

In another aspect of the present disclosure, there is provided an apparatus for distillation of methanol, comprising a stabilizing column V0, at pressure P0, connected in series with at least 3 distillation columns V1, V2 and V3 at correspondingly decreasing pressure P1, P2 and P3 wherein each column is associated to a heat exchanger E0, E1, E2 and E3, said heat exchanger being a reboiler for that column, characterized in that,

a) heat exchangers E0 and E3 are condensers of column V2;

b) heat exchanger E2 is condenser of column V1;

c) E1 has an incoming heat stream, external to said apparatus;

P3< 2 barg.

In a further aspect of the present disclosure, there is provided a plant for distillation of methanol according to a process disclosed herein, comprising at least one apparatus as disclosed herein, wherein the amount of steam required for E1 is less than 1.3 kg/kg of product methanol.

In another aspect of the present disclosure, there is provided a use of apparatus disclosed herein in a plant disclosed herein, for distillation of methanol according to a process as disclosed herein.

Description of the Invention

The present invention refers to an apparatus and process for distillation of methanol (Fig. 1), however may also be used in distillation of other products such as ethanol.

The present invention has the purpose of reducing the consumption of energy and of cooling water and/or electricity in a distillation process of crude intermediate products (e.g., methanol) comprising a pre-treatment stage, known as stabilizing stage, for the removal of the volatile components, and a concentration stage, comprising one or more columns for distillation.

Such a purpose is accomplished with a process for refining or distillation of a stream of crude methanol (A) comprising, in a preferred embodiment of the present invention:

(i) pre-treatment of a crude stream A of methanol in a stabilizing column V0 at pressure P0, for separation of volatile components, obtaining a stream of light gases L from