

Description

The present invention relates to a draw-off device comprising a horizontal layer of a plurality of parallel, uniformly spaced gutters which are in fluid communication with a collecting gutter which is connected to a fluid outlet. Such a draw-off device is sometimes called a draw-off tray or a chimney tray.

Such a draw-off device is used in a gas/liquid contacting column such as a distillation column to remove liquid from the column.

In a distillation column the draw-off device is usually arranged between the inlet of the distillation column and a contacting device arranged above the inlet, wherein the contacting device can be a spray section, a section provided with packing material or a section provided with contacting trays. During normal operation the vapour fraction of the feed passes upwardly through the spaces between adjacent gutters of the draw-off device and is contacted with liquid in the contacting device. The liquid is introduced into the column to remove entrained liquid from the vapour fraction and/or to condense condensable components. Liquid is collected in the gutters and flows into the collecting gutter. From there the liquid is removed from the column through the fluid outlet.

The temperature of the liquid in the gutters is lower than the temperature of the vapour passing along the gutters. Thus the outer surfaces of the walls of the gutters are cooler than the vapour. Consequently condensation starts at the outer surfaces of the walls of the gutters. Condensed liquid falls into the bottom part of the distillation column and is removed therefrom through a bottom outlet. This results in a loss of production. In particular in a vacuum distillation process this loss is considerable, since the liquid from the bottom outlet is generally not further treated but simply used as fuel. Moreover, there is a tendency to supply the feed at a higher inlet temperature. Such a higher feed inlet temperature is made possible by employing the vacuum distillation device as described in British patent application No. 89 03 007.6 filed on 10th February, 1989.

It is an object of the present invention to reduce this loss of production.

To this end the draw-off device according to the invention comprises a horizontal layer of a plurality of parallel, uniformly spaced gutters which are in fluid communication with a collecting gutter which is connected to a fluid outlet, wherein the walls of the gutters are provided with heat-insulating means.

The invention will now be described in more detail by way of example with reference to the drawings, wherein

Figure 1 shows schematically a longitudinal section of the lower end of a vacuum distillation column provided with the draw-off device according to the invention; and

Figure 2 shows section II-II of Figure 1.

The vacuum distillation column 1 comprises a cylindrical housing 2 provided with a feed inlet 3, a bottom outlet 5 and a top outlet (not shown).

In the housing 2 there is arranged a de-entrainment device comprising contacting means 9 in the form of structured or random packing, and a liquid spray device 12 provided with nozzles 14.

The housing further contains the draw-off device according to the invention. The draw-off device comprising a horizontal layer of a plurality of parallel, uniformly spaced gutters 17 having walls 18. The gutters 17 are in fluid communication with a collecting gutter 19 which is provided with side walls 20. The collecting gutter is connected to fluid outlet 22. Each gutter 17 comprises a first longitudinal part 17' and a second longitudinal part 17'', wherein the ends of the longitudinal parts 17 and 17'' near the inner surface of the wall of the column 1 are closed (see Figure 2), and wherein the open ends extend through the side walls 20 of the collecting gutter 19.

The walls 18 of the gutters 17 are provided with heat-insulating means in the form of a secondary wall arranged in the gutter 17.

The draw-off device further comprises a layer of secondary gutters 26 arranged above the gutters 17. The secondary gutters 26 are arranged staggered with respect to the parallel gutters 17. The secondary gutters 26 are provided with drip strips 30 arranged at the lower parts of the sidewalls of the secondary gutters 26 and extending below the bottom walls of the secondary gutters 26. Each secondary gutter 26 comprises two longitudinal parts (not shown) which debouch into the collector gutter 19 through the side walls 20 of the gutter 19.

During normal operation feed is introduced through the feed inlet 1 and overhead vapours are withdrawn through the top outlet (not shown) which is connected to a vacuum pump (not shown) to maintain a predetermined subatmospheric pressure in the column 1. The vapour fraction of the feed passes upwardly through the spaces between adjacent gutters 17 and is contacted in the contacting means 9 of the de-entrainment section with liquid sprayed out of the liquid spray device 12 to remove entrained liquid from the vapour fraction. Liquid is collected in the gutters 26 and 17 and flows into the collecting gutter 19 and out of the column through the fluid outlet 22.

The liquid fraction of the feed drops into the lower part of the column 1 and is removed therefrom through bottom outlet 5.

The vapour fraction having passed the de-entrainment device is passed through condensation sections (not shown) in which condensable components are removed from the vapour fraction. These condensable fractions are removed from the column through a draw-off device (not shown).

Two experiments were carried out in a vacuum

distillation column having a diameter of 8.4 m, the column was provided with the gutters as shown in Figure 1, wherein each layer of gutters included 15 gutters having a width of 0.3 m and a height of 0.2 m, wherein the distance between adjacent gutters was 0.2 m and wherein the distance between the two layers was 0.15 m. In the first experiment the column was provided with the draw-off device according to the invention, and in the second experiment the column was provided with gutters not having the heat-insulating means.

In both experiments the vacuum distillation column was maintained at a pressure of 2.67 kPa (20 mm Hg). To the feed inlet 3 was supplied 200 M/T (M/T is used to refer to unit mass per unit time) of hydrocarbon-containing feed comprising 50 %w vapour at a temperature of 390 °C, 10 M/T liquid having a boiling point of 290 °C at 2.67 kPa (20 mm Hg) was supplied to the liquid spray device 12 at a temperature of 290 °C (in the column 50 %w of the liquid vaporized), and 6 M/T liquid, which was removed from the column through liquid outlet 22, was added to the feed so that 206 M/T was introduced into the column.

In the first experiment, according to the invention 100 M/T liquid was removed from the bottom outlet and from the de-entrainment section passed upwards 110 M/T of vapour.

In the second experiment 105 M/T liquid was removed from the bottom outlet 5 and from the de-entrainment section passed upwards only 105 M/T of vapour. It was found that in this case 5 M/T liquid was condensed on the outer surfaces of the gutters without the heat-insulating means.

From the experiments can be concluded that using the draw-off device according to the present invention 5% more vapours pass the de-entrainment device and are thereafter removed as product.

The gutters 17 can be provided with a splash baffle shown as a dashed line indicated with reference numeral 50, and the secondary gutters 26 can be provided with a splash baffle shown as a dashed line indicated with reference numeral 51.

For applications where a low pressure drop is a prerequisite, the width of the gutters is between 20 and 35 cm, and the net free area of the layer of gutters is between 0.3 and 0.5.

For a draw-off device arranged below a de-entrainment section, where it is required that the gas flowing upwards to the contacting means is uniformly distributed, the width of the gutters and of the secondary gutters is between 5 and 10 cm, and the net free area of the layer of gutters and of the layer of secondary gutters is between 0.2 and 0.3.

Claims

1. Draw-off device comprising a horizontal layer of

a plurality of parallel, uniformly spaced gutters (17) which are in fluid communication with a collecting gutter (19) which is connected to a fluid outlet (22), wherein the walls (18) of the gutters (17) are provided with heat-insulating means.

2. Draw-off device as claimed in claim 1, wherein the heat-insulating means comprises a secondary wall (25) arranged in the gutter (17).
3. Draw-off device as claimed in claim 1 or 2, further comprising a layer of secondary gutters (26), arranged above the parallel gutters (17) and staggered with respect to the parallel gutters (17).
4. Draw-off device as claimed in claim 3, wherein the secondary gutters (26) are provided with drip strips (30) arranged at the lower parts of the side walls of the secondary gutters (26) and extending below the bottom walls of the secondary gutters (26).
5. Draw-off device as claimed in any one of the claims 1-4, wherein the width of the gutters (17) is between 20 and 35 cm, and wherein the net free area of the layer of gutters (17) is between 0.3 and 0.5.
6. Draw-off device as claimed in any one of the claims 3-5, wherein the width of the gutters (17) and of the secondary gutters (26) is between 5 and 10 cm, and wherein the net free area of the layer of gutters (17) and of the layer of secondary gutters (26) is between 0.2 and 0.3.
7. Draw-off device as claimed in any one of the claims 1-6, wherein the gutters (17) and the secondary gutters (26) are provided with a splash baffle (50; 51).

Patentansprüche

1. Abnahmevorrichtung, die eine horizontale Schicht einer Vielzahl von parallelen, mit gleichmäßigen Abständen versehenen Abflußbecken (17) aufweist, die in einer Fluidverbindung mit einem Abflußsammelbecken (19) stehen, das mit einem Fluidauslaß (22) verbunden ist, wobei die Wände (18) der Abflußbecken (17) mit wärmeisolierenden Mitteln versehen sind.
2. Abnahmevorrichtung nach Anspruch 1, wobei die wärmeisolierenden Mittel eine sekundäre Wand (25) aufweisen, die in dem Abflußbecken (17) angeordnet ist.
3. Abnahmevorrichtung nach Anspruch 1 oder 2,



distillation column having a diameter of 8.4 m, the column was provided with the gutters as shown in Figure 1, wherein each layer of gutters included 15 gutters having a width of 0.3 m and a height of 0.2 m, wherein the distance between adjacent gutters was 0.2 m and wherein the distance between the two layers was 0.15 m. In the first experiment the column was provided with the draw-off device according to the invention, and in the second experiment the column was provided with gutters not having the heat-insulating means.

In both experiments the vacuum distillation column was maintained at a pressure of 2.67 kPa (20 mm Hg). To the feed inlet 3 was supplied 200 M/T (M/T is used to refer to unit mass per unit time) of hydrocarbon-containing feed comprising 50 %w vapour at a temperature of 390 °C, 10 M/T liquid having a boiling point of 290 °C at 2.67 kPa (20 mm Hg) was supplied to the liquid spray device 12 at a temperature of 290 °C (in the column 50 %w of the liquid vaporized), and 6 M/T liquid, which was removed from the column through liquid outlet 22, was added to the feed so that 206 M/T was introduced into the column.

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From the experiments can be concluded that using the draw-off device according to the present invention 5% more vapours pass the de-entrainment device and are thereafter removed as product.

The gutters 17 can be provided with a splash baffle shown as a dashed line indicated with reference numeral 50, and the secondary gutters 26 can be provided with a splash baffle shown as a dashed line indicated with reference numeral 51.

For applications where a low pressure drop is a prerequisite, the width of the gutters is between 20 and 35 cm, and the net free area of the layer of gutters is between 0.3 and 0.5.

For a draw-off device arranged below a de-entrainment section, where it is required that the gas flowing upwards to the contacting means is uniformly distributed, the width of the gutters and of the secondary gutters is between 5 and 10 cm, and the net free area of the layer of gutters and of the layer of secondary gutters is between 0.2 and 0.3.

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2. Draw-off device as claimed in claim 1, wherein the heat-insulating means comprises a secondary wall (25) arranged in the gutter (17).
3. Draw-off device as claimed in claim 1 or 2, further comprising a layer of secondary gutters (26), arranged above the parallel gutters (17) and staggered with respect to the parallel gutters (17).
4. Draw-off device as claimed in claim 3, wherein the secondary gutters (26) are provided with drip strips (30) arranged at the lower parts of the side-walls of the secondary gutters (26) and extending below the bottom walls of the secondary gutters (26).
5. Draw-off device as claimed in any one of the claims 1-4, wherein the width of the gutters (17) is between 20 and 35 cm, and wherein the net free area of the layer of gutters (17) is between 0.3 and 0.5.
6. Draw-off device as claimed in any one of the claims 3-5, wherein the width of the gutters (17) and of the secondary gutters (26) is between 5 and 10 cm, and wherein the net free area of the layer of gutters (17) and of the layer of secondary gutters (26) is between 0.2 and 0.3.
7. Draw-off device as claimed in any one of the claims 1-6, wherein the gutters (17) and the secondary gutters (26) are provided with a splash baffle (50; 51).

Patentansprüche

1. Abnahmevorrichtung, die eine horizontale Schicht einer Vielzahl von parallelen, mit gleichmäßigen Abständen versehenen Abflußbecken (17) aufweist, die in einer Fluidverbindung mit einem Abflusssammelbecken (19) stehen, das mit einem Fluidauslaß (22) verbunden ist, wobei die Wände (18) der Abflußbecken (17) mit wärmeisolierenden Mitteln versehen sind.
2. Abnahmevorrichtung nach Anspruch 1, wobei die wärmeisolierenden Mittel eine sekundäre Wand (25) aufweisen, die in dem Abflußbecken (17) angeordnet ist.
3. Abnahmevorrichtung nach Anspruch 1 oder 2,



die weiterhin eine Schicht von sekundären Abflußbecken (26) aufweist, die oberhalb der parallelen Abflußbecken (17) angeordnet ist und bezüglich der parallelen Abflußbecken (17) versetzt ist.

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4. Abnahmevorrichtung nach Anspruch 3, wobei die sekundären Abflußbecken (26) mit Abtropfflächen bzw. -streifen (30) versehen sind, die an den unteren Teilen der Seitenwände der sekundären Abflußbecken (26) angeordnet sind und sich unterhalb der Bodenwände der sekundären Abflußbecken (26) erstrecken.

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5. Abnahmevorrichtung nach einem der Ansprüche 1 bis 4, wobei die Breite der Abflußbecken (17) zwischen 20 und 35 cm liegt und wobei die effektive freie Fläche der Schicht von Abflußbecken (17) zwischen 0,3 und 0,5 liegt.

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6. Abnahmevorrichtung nach einem der Ansprüche 3 bis 5, wobei die Breite der Abflußbecken (17) und der sekundären Abflußbecken (26) zwischen 5 und 10 cm liegt und wobei die effektive freie Fläche der Schicht vom Abflußbecken (17) und der Schicht von sekundären Abflußbecken (26) zwischen 0,2 und 0,3 liegt.

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7. Abnahmevorrichtung nach einem der Ansprüche 1 bis 6, wobei die Abflußbecken (17) und die sekundären Abflußbecken (26) mit einer Spritzablenkplatte (50;51) versehen sind.

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Revendications

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1. Dispositif de soutirage comprenant une assise horizontale formée d'une pluralité de gouttières parallèles (17) uniformément espacées qui sont en communication fluïdique avec une gouttière collectrice (19) qui est reliée à une sortie de fluïde (22), dans laquelle les parois (18) des gouttières (17) sont équipées de moyens d'isolation thermique.

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2. Dispositif de soutirage selon la revendication 2, dans lequel les moyens d'isolation thermique comprennent une paroi secondaire (25) agencée dans la gouttière (17).

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3. Dispositif de soutirage selon la revendication 1 ou 2, comprenant en outre une assise de gouttières secondaires (26) disposées au-dessus des gouttières parallèles (17) et décalées par rapport aux gouttières parallèles (17).

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4. Dispositif de soutirage selon la revendication 3, dans lequel les gouttières secondaires (26) sont

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équipées de languettes d'égouttage (30) disposées au niveau des parties inférieures des parois latérales des gouttières secondaires (26) et qui se prolongent au-dessous des parois de fond des gouttières secondaires (26).

5. Dispositif de soutirage selon une quelconque des revendications 1 à 4, dans lequel la largeur des gouttières (17) est d'entre 20 et 30 cm et dans lequel la surface libre nette de l'assise de gouttières (17) est d'entre 0,3 et 0,5.

6. Dispositif de soutirage selon une quelconque des revendications 3 à 5, dans lequel la largeur des gouttières (17) et des gouttières secondaires (26) est d'entre 5 et 10 cm, et dans lequel la surface libre nette de l'assise de gouttières (17) et de l'assise de gouttières secondaires (26) est d'entre 0,2 et 0,3.

7. Dispositif de soutirage selon une quelconque des revendications 1 à 6, dans lequel les gouttières (17) et les gouttières secondaires (26) sont équipées d'une chicane anti-projections (50 ; 51).