Therefore, the object of the present invention is to improve a multistage distillation system of the kind described at the outset in such a way as to lower power consumption during operation. Another object of the present invention is to describe a method that implements such a distillation, as well as controller for its operation.

The object is achieved by the features in the independent claims for the respective categories.

According to the invention, the distillation system described at the outset encompasses a pressure-tight steam line, which at a first end is connected with one of the pressure-tight liquid lines between two adjacent condensers or with the pressure-tight liquid line between the last and first evaporator. In addition, the second end of the pressure-tight steam line is connected with a steam space, which during operation has a higher pressure than the pressure in the pressure-tight liquid line for pressurizing the liquid with a higher pressure as well as for conveying the liquid.

This pressurization exposes the liquid in the liquid line to a higher pressure, which allows it to evaporate in a stage with a higher temperature. In addition, the pressurization can convey the liquid into a container arranged at a higher potential without having to use electrical current for this purpose. As a result, no pump whatsoever is required during continuous operation.

temperatures T2,1 in the evaporator E2 and T2,2 in the condenser C2, wherein the adjoining chambers C1 and E2 are set to the same temperature. Therefore, the following applies: T1,2 = T2,1. In order to achieve this temperature uniformity, the lower areas of the chambers C1 and E2 are designed as heat exchangers 14. The same holds true for chambers C2 and E3, which are also interconnected with a heat exchanger, so that the temperature T2,2 of the condenser C2 and temperature T3,1 of the evaporator E3 always keep the same temperatures.

Temperature and pressure measuring devices 26, 27 in each steam space 6 are used for process monitoring. In addition, a vacuum pump V at the end of each condensation path makes it possible to siphon away incondensable gases in the system. This is important for the process to run efficiently.

In prior art, the individual stages are only interconnected with heat exchangers, so that no exchange or flow of liquids or steam can arise between the various stages S. The stages are only connected with each other via heat exchangers. While the individual stages S do operate in different, respectively adjacent temperature ranges, each does so on its own.

Preferred Exemplary Embodiment

Fig. 2 shows an exemplary embodiment according to the invention. The illustration depicts a multistage distillation system 1 with stages Si where i=1,…n, (n=4), wherein each stage Si works in a higher pressure and temperature range Pi, Ti than its ensuing stage Si+1 during operation. Fig. 3 presents a system according to Fig. 2, which indicates examples of pressure and

temperature values for the individual containers and pressure chambers that might set in according to the invention.

Each stage Si encompasses an evaporator Ei and a condenser Ci, wherein each evaporator Ei and each condenser Ci comprises a pressure-tight container 2 with an upper spray inlet 3 for introducing and spraying added liquid 4a in the container 2, as well as with a lower outlet 5 for letting out liquid 4b captured in the container 2. In addition, each container 2 encompasses a steam space 6 between the spray inlet 3 and captured liquid 4b, wherein the steam space 6 of each evaporator Ei is connected in terms of pressure with the steam space 6 of the condenser Ci of the same stage Si by means of a pressure-tight steam pipe 7 having a large enough cross section that the pressure Pi in the two steam spaces 6 of a stage Si can always balance out during operation. The outlet 5 of each evaporator Ei is connected with the spray inlet 3 of the next evaporator Ei+1 and the outlet 5 of the last evaporator En is connected with the spray inlet 3 of the first evaporator E1 by way of a pressure-tight liquid line 8 to yield an evaporator circuit. Analogously thereto, the outlet 5 of each condenser Ci is connected with the spray inlet 3 of the preceding condenser Ci-1 and the outlet 5 of the first condenser C1 is connected with the spray inlet 3 of the last condenser Cn by means of a pressure-tight liquid line 9 to yield a condenser circuit. According to the invention, the distillation system encompasses at least one pressure-tight steam line 10, which at a first end is connected with one of the pressure-tight liquid lines 9 between the condensers Cl+1 and Ci[i=1 to 3] or with the pressure-tight liquid line 8 between the evaporators En and E1, and at a second end with a

steam space having a higher pressure P during operation than the pressure Pi in the steam space 6 of the condenser Ci or, respectively, than the pressure Pn in the steam space 6 of the evaporator En, so as to pressurize the liquid 4 with a higher pressure and convey the liquid 4.

In particular, the configuration of containers 2 can also be modified in such a way that the circuits of the evaporators and condensers are situated at the same level. For example, the condenser Cn and evaporator E1 would be at the same or similar level, just as the condenser C1 and evaporator En. This shortens the length of the connecting steam spaces 6. The indicated Fig. 2 and 3 were depicted in this way for reasons of clarity, and must be understood as schematic illustrations.

According to the invention, the evaporators E and condensers C are spatially separated from each other in the distillation system 1 described here, and connected with each other by pipes having a cross section large enough that the pressure difference in the two chambers 2 measures less than 10 mbar. It is important that this pressure compensation always be ensured. This spatial separation of the chambers 2 now opens up options for interconnecting and spatially arranging chambers of the same kind, specifically the respective evaporators and condensers, in such a way that the liquids 4 flow into the next chamber 2 without the assistance of pumps as a result of the potential energy of the individual chambers 2 taking into account the respective steam pressures in the different stages Si. In particular, this takes place between the evaporators E1 to En, and between the condensers C1 and Cn. Consequently, support is now

liquid line (8) between the evaporators En and E1, and at a second end with a steam space having a higher pressure P during operation than the pressure Pi in the steam space (6) of the condenser Ci or, respectively, than the pressure Pn in the steam space (6) of the evaporator En, so as to pressurize the liquid (4) with a higher pressure and convey the liquid (4).

2. The distillation system according to claim 1, characterized in that the steam space with pressure P is a steam space (6) of the distillation system.

3. The distillation system according to claim 1 or 2, characterized by a respective pump (11) in the liquid line (8) of the evaporator circuit, as well as in the liquid line (9) of the condenser circuit, for achieving the prescribed pressures of the liquids (4) at the beginning of the process.

4. The distillation system according to one of the preceding claims, characterized by a heater (12) in the liquid line (8) of the evaporator circuit before the evaporator E1 and a cooling aggregate (13) in the liquid line of the condenser circuit before the condenser Cn for achieving the prescribed temperatures in the evaporator E1 and in the condenser Cn.

5. The distillation system according to claim 4, characterized in that the heater (12) and cooling aggregate (13) are together at least partially configured as a heat exchanger (14).

6. The distillation system according to one of the preceding claims, characterized in that siphons (15) are arranged in the liquid lines (9, 8) between the condensers Cn to C1 and/or between the evaporators E1