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Van Hengel

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[54] **EVAPORATORS WITH MIXING CONDENSERS**

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[73] Assignee: **Hulett's Sugar Corporation Limited**

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[52] **U.S. Cl.** ..... **202/185,** 202/185 A, 202/189

[51] **Int. Cl.** **B01d 3/00**

[58] **Field of Search** ..... 159/31, 15, 27, 17; 202/185, 185 A, 187–189

[56] **References Cited**

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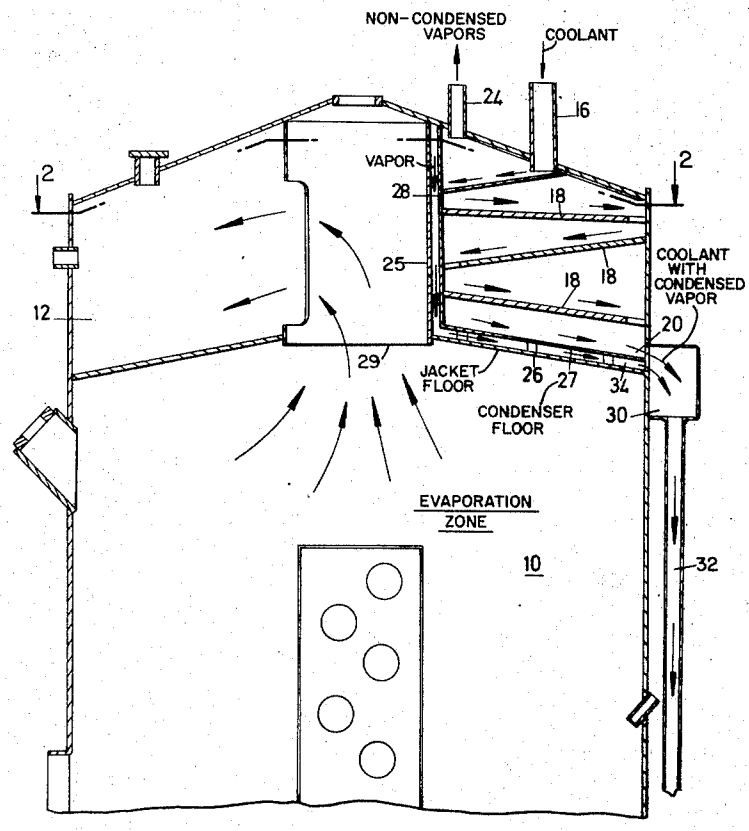
[57] **ABSTRACT**

A condenser zone is located inside an evaporator above an evaporation zone, the condenser zone having an inlet for coolant and an outlet for condensate, the condenser zone being insulated on those surfaces that are cooled to prevent condensed vapours falling back into the evaporation zone.

5 Claims, 4 Drawing Figures



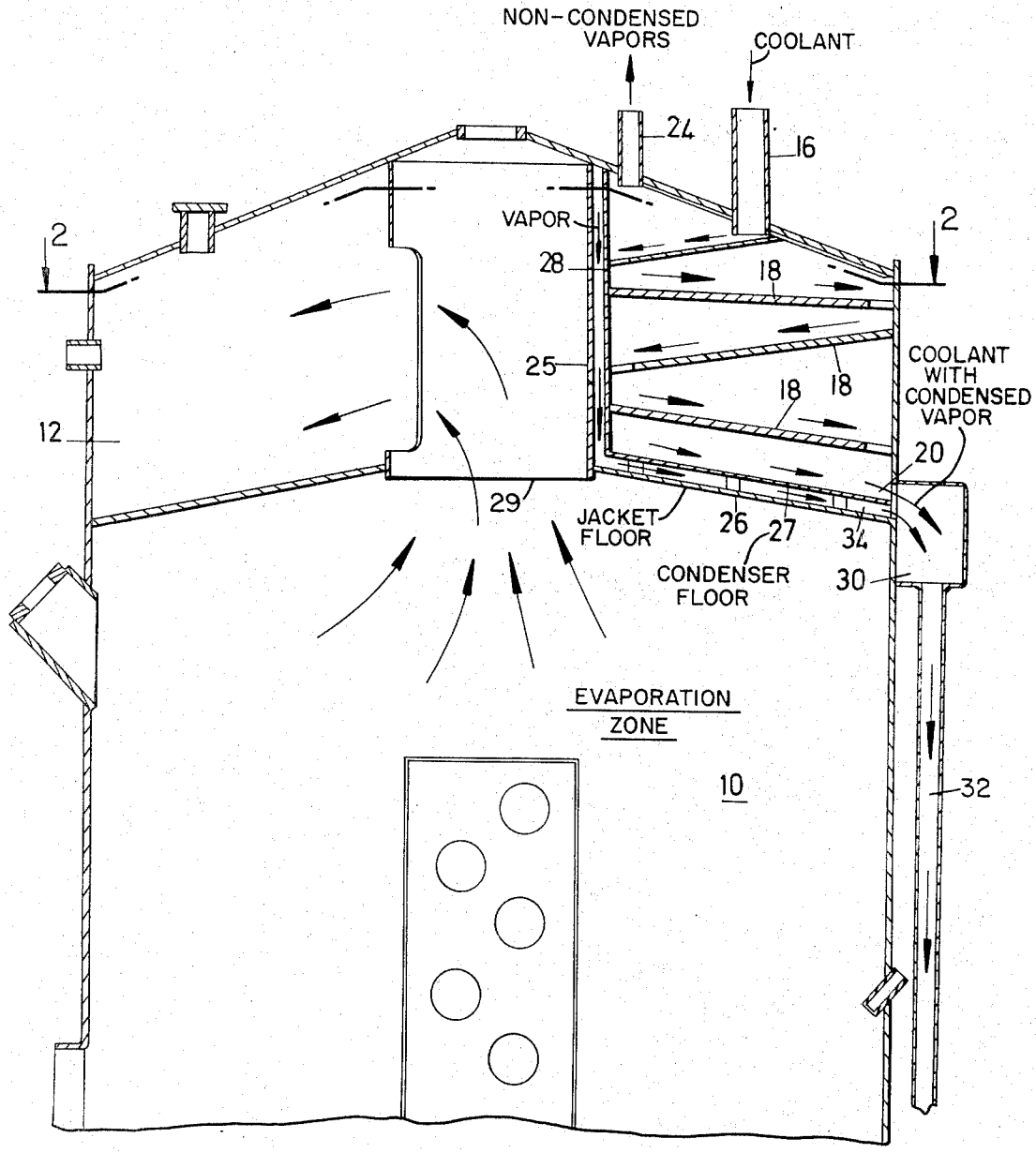

NON-CONDENSED VAPORS
COOLANT
24
16
2
2
VAPOR
28
18
25
18
18
COOLANT WITH CONDENSED VAPOR
12
20
29
JACKET FLOOR
26
27
34
CONDENSER FLOOR
30
EVAPORATION ZONE
10
32

Fig. 1

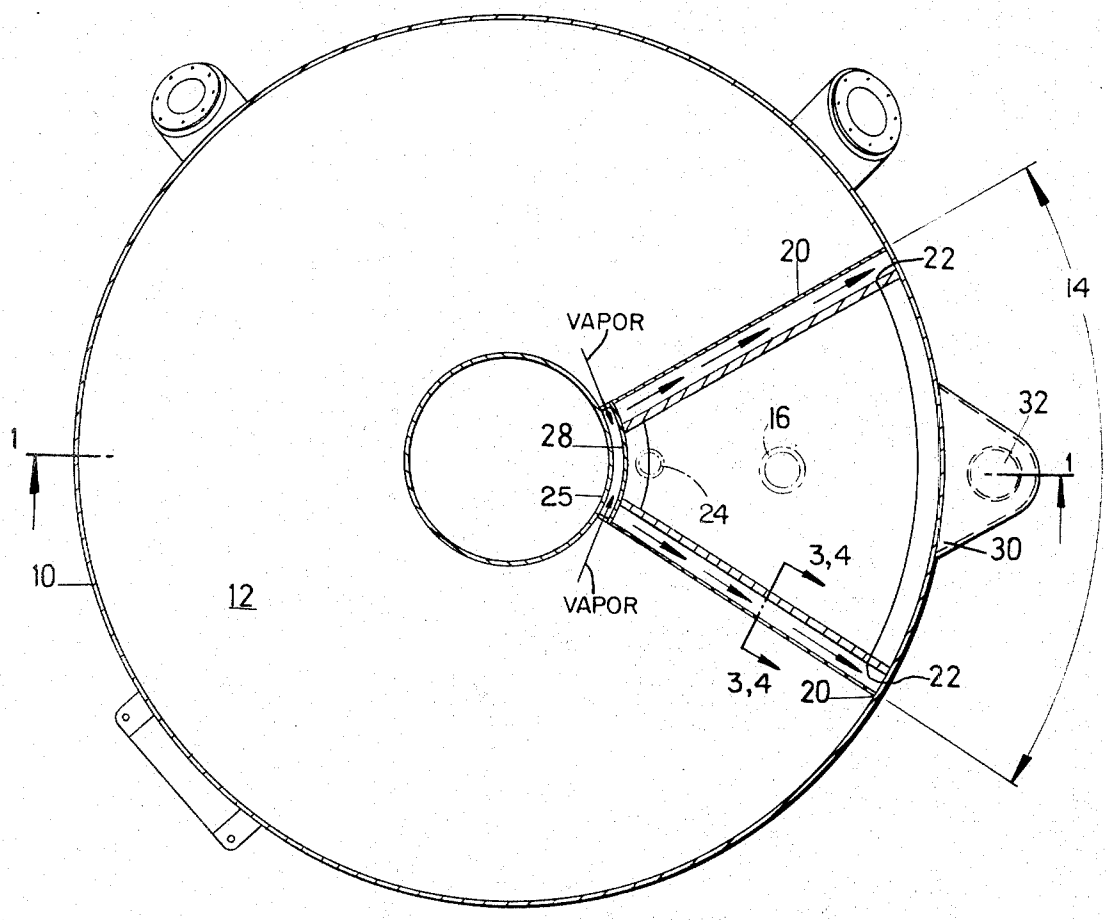


Fig. 2

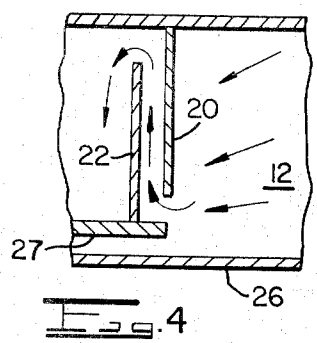


Fig. 4

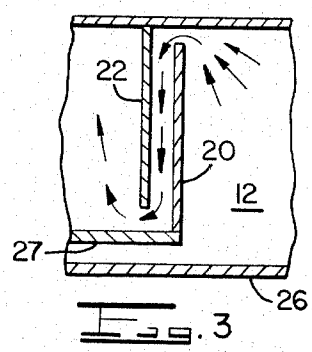


Fig. 3

EVAPORATORS WITH MIXING CONDENSERS

This invention relates to evaporators with direct contact condensers. In this specification the term "direct contact condenser" means a condenser in which the condensate and cooling medium are mixed and which is normally sealed off by a barometric leg.

In the prior art, sugar vacuum pans include a zone at the top through which the vapour was conducted to a condenser located outside the pan. The condenser was usually either a co-current or counter-current condenser and its requirements were considerable. For example, it occupied much space and the walls and the pipe joints had to be very strong to withstand the vacuum. Its erection and maintenance were major operations. In addition, the conditions prevailing in the condenser were very conducive to metal corrosion with the result that some condensers were manufactured of very heavy cast iron, and later of stainless steel.

It is an object of the present invention to provide an evaporator in which these disadvantages are greatly minimized and, in some cases, avoided altogether.

According to the invention there is provided an evaporator including an evaporation zone, a condensing zone located above the evaporation zone, an inlet for vapour from the evaporation zone to the condensing zone, an inlet for supplying coolant to condensing zone to effect condensation, and an outlet for the condensate.

Further, according to the invention, the condensing zone is insulated on those surfaces that would otherwise be cooled and from which condensed vapours may fall back into the evaporator.

The insulator may take the form of an evacuated space, or else the space may be filled with a suitable insulating material, such as expanded polystryrene. However, in the preferred form of the invention a jacket is provided through which the vapour can pass so that the surfaces referred to above will be maintained at the same temperature as the vapour.

The condensing zone, may in plan, take the form of a sector of the pan and in one embodiment of the invention the angle of the sector is 60°, but it will be appreciated that greater angles may be selected depending upon the amount of condensation required which depends on the capacity of the pan.

The condensing zone may include a floor having vertical baffles and walls inside the baffles, the walls and baffles being so arranged as to define a passage through which vapour may enter the condensing zone. The walls are preferably removable for easy maintenance.

The condensing zone may be located in the usual annular space of the known vacuum pans.

The floor of the condensing zone and the vertical curved portion corresponding to the annular space may be jacketed, preferably by providing a space in communication with the vapours so that the surface presented to the vapours is at the temperature of the vapours.

The invention is described below with reference to the accompanying drawings in which,

FIG. 1 is a sectional side view of one form of a sugar vacuum pan and condenser according to the invention,

FIG. 2 is a sectional plan view of the pan and condenser,

FIG. 3 is a sectional view taken on line 3—3 in FIG. 2, and

FIG. 4 is a sectional view similar to FIG. 3 but showing a modified arrangement.

In the drawings, a sugar vacuum pan is shown generally at **10.** As in the prior art vacuum pans, an annular space **12** is provided which, in the prior art conducted the vapours to a condenser outside the pan. However, according to the present invention, a sector **14** of the annular space **12** is provided into which cooling water is introduced through opening **16** and runs down trays **18** (which, in FIG. **1** are inclined but which may be horizontal) to form the condensing zone. The zone is defined by a pair of vertical-radial baffles **20,** inside of which are suspended plates **22,** the bottom edges of the plates being above the level of the floor of the zone but below the upper edges of the baffles **20** as shown in FIG. **3.** The vapours enter the condensing zone through the gap between the edges of the baffles and the edges of the plates.

The plates **22** may be held in position by hooks or the like (not shown) and it will be appreciated that they may be very thin since the pressure on either side thereof will be equal.

By virtue of the fact that the plates **22** are suspended, they can easily be removed for cleaning or replacing. In fact, the complete condensing zone is easily enterable for cleaning and maintainance services.

Non-condensed gases are exhausted through the opening **24.**

Base plate **26** is spaced from the floor **27** of the condensing zone and also from the vertical curved portion **28** to provide a jacket for these surfaces. Vapors from the pan enter the jacket through opening **29** in a central duct **25,** and vapors pass through the aforesaid jacket thereby maintaining the surfaces **26** at the temperature of the vapours in the pan. Any condensation which takes place on the surface of the condensing zone surfaces is drained off at **34** and it will be appreciated that such condensate will be of identical temperature as the vapours passing through the jacket. It will also be appreciated that the plates **22** are not required to be insulated because any condensation occuring thereon will flow downwardly behind the baffles and thence along the floor to the outlet **30.**

The condensed vapours pass through outlet **30** together with the coolant into a downtake **32** and the insulating jacket carrying the vapours also exits into this downtake as shown at **34.**

The location of the inlet into the condensing zone and the cooling water arrangement are chosen as to whether countercurrent or co-current condensing is required. For co-current condensing, the plates **22** will rest on the floor of the condensing zone as shown in FIG. **4** and a gap will be left between the ceiling of the pan and the top edges of the plates.

We claim:

1. An evaporator comprising a casing including a lower evaporation zone and an upper condensing zone, an upper inlet for supplying coolant to the condensing zone, said condensing zone occupying that portion of the upper region of the evaporator depending on the amount of condensation required for the vapor capacity of the evaporation zone, said condensing zone extending to a central duct for evacuating vapors released in the evaporator, said condensing zone also including a floor, an interior vertical panel parallel to and spaced from the duct and two interior vertical side panels with a superposed array of trays therebetween to permit the

coolant to cascade down thereover, outer bottom and side panels spaced from and parallel to the floor and side panels of the condensing zone and extending to the duct and casing forming a jacket around the condensing zone and openings in the central duct and jacket side panels permitting vapors from the evaporator to flow thru the duct and jacket side panel openings and into the condensing zone to contact and be condensed by the coolant and an outlet to drain the coolant and condensate from the condensing zone.

2. The evaporator as claimed in claim **1** in which the condensing zone side panels are sealed to the casing roof and their lower edges spaced above the floor of the condensing zone, the jacket side panels being sealed to the condenser floor but the upper edges spaced from the casing roof and located above the lower edges of the condensing zone side panels.

3. The evaporator as claimed in claim **2** in which the

lower edges of the condensing zone side panels are sealed to the condenser floor and their upper edges spaced below the casing roof while the jacket side panels are sealed to the casing roof and their lower edges spaced above the condenser floor and below the upper edges of the condenser side panels.

4. The evaporator as claimed in claim **1** in which the jacket side panels are thin plates and rest on the bottom of the jacket and a gap is left between the roof of the casing and the top edges of the jacket side panels.

5. The evaporator as claimed in claim **1** in which the jacket side panels are thin plates and are suspended from the casing roof and have lower edges spaced above the floor of said condensing zone to define said openings therein, the condenser side panels being sealed to the condenser floor and spaced from the casing roof.

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