

[54] **HEAT-EXCHANGER FOR DESALTING SEA WATER**

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[56]

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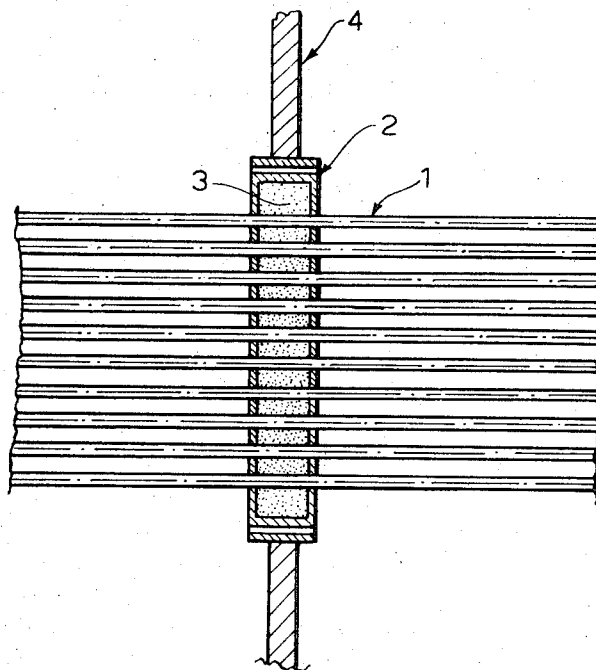
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ABSTRACT

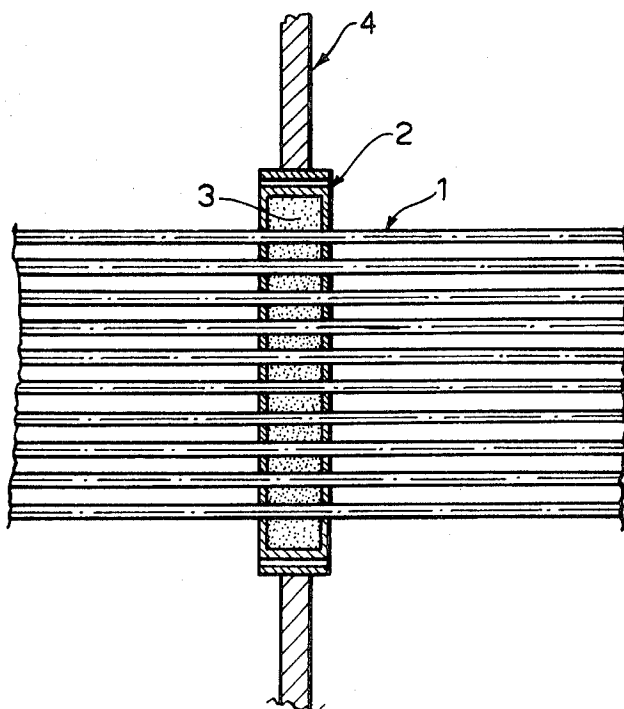
The heat-exchanger tubes of instantaneous evaporators for providing fresh water from saline formed into a unitary nest by transverse supports corresponding in position with the walls dividing off successive chambers of the evaporator and in shape with holes provided in those walls.

2 Claims, 1 Drawing Figure



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HEAT-EXCHANGER FOR DESALTING SEA WATER

The present invention relates to the removal of salt from sea-water and more particularly to an improvement relating to multiple expansion instantaneous evaporators.

In multiple expansion instantaneous evaporators, for a high evaporation efficiency, a plurality of instantaneous expansion chambers are provided which are connected in series and which operate at decreasing pressures.

Normally, such evaporators are obtained by subdividing the space enclosed by an outer shell by means of vertical baffles which extend in the transverse direction of the shell. The saline solution under evaporation is caused to flow through the chambers in the direction of diminishing pressure through passages of a particular shape, known as mouths, provided in the baffles.

The vapor formed condenses on nests of heat-exchanger tubes which longitudinally traverse the entire length of the evaporator and the condensate is collected so that it cannot come in contact with the saline solution.

In order to ensure best results and for economy in the process, the sea-water is pre-heated before being introduced into the chambers by causing it to pass as cooling liquid through heat-exchanger tubes.

For a high efficiency of the apparatus of this type in the removal of salt from sea-water, it is particularly important to maintain the pre-fixed temperature and pressure curves in the plurality of chambers as far as possible unaltered for the period of time involved.

Now, for passage of the tubes through the plurality of chambers, it is necessary to have numerous holes provided in the baffles which sub-divide the evaporator. Their presence however results in changes in the temperature and pressure levels in the chambers since substantial quantities of vapor pass from one chamber to another through the eccentric annular space between the dividing wall and the tube.

In particular, the passage of vapor between the various stages at different pressures occurs to a considerable extent the greater is the difference between the operative pressures of the stages and the greater the number of consecutive chambers operating at decreasing pressure.

In multiple chamber instantaneous evaporators, when it is found that, in the vapor generated at elevated pressure and condensed at lower pressure, there is a lessening of energy which produces a change in the thermal profiles of the evolving fluids and thus a drop in the efficiency of the apparatus.

In order to obviate these drawbacks, it is important to achieve a high degree of leakproofness between one stage and the next and particularly around the eccentric annular spaces between the dividing walls and the tubes.

Normally, in the prior art, seals are used at each hole around heat-exchanger tubes. For example, bushes of plastic material may be used, of such a thickness as to fill the space left free in the holes of the tubes.

Another system of the prior art uses clip-closing gaskets made from a base metal and plastics material and provided with fins which rise to ensure tightness.

However, such systems are not very advantageous and have considerable disadvantages because, since by

virtue of the large number of heat-exchanger tubes involved, there are a very large number of holes in the baffles, the fitting of seals is inconvenient and expensive and it is also extremely difficult to replace seals inside the nest of tubes when, as normally happens, they have become worn out due to ageing.

In addition, such systems complicate the maintenance of such instantaneous evaporators when the entire nest of heat-exchanger tubes must be withdrawn.

In fact, since extraction of the entire nest of tubes necessitates every time repetition of the same operations for each tube and since each tube, in order to be released from the aforesaid leakproofing systems requires long and difficult operations, it is obvious how important it is to have a highly simplified leakproofing system in order to enjoy easy and rapid withdrawal of the nest of tubes.

The object of the present invention is an improvement relating to instantaneous multiple expansion evaporators, the said improvement making it easily, economically and particularly advantageously possible to achieve a high degree of leakproofness between the various chambers of the evaporators themselves, avoiding the above-described drawbacks.

According to the said improvements, the individual tubes are no longer each caused to traverse a corresponding hole provided for the purpose in the wall of the dividing baffle; instead, the entire nest of tubes is rendered rigid with a hollow cylinder which is then passed through a single hole provided in the separating baffle so that a high degree of tightness is achieved between the cylinder and the hole.

Each tube of the nest, is located in apertures pre-disposed in the circular walls of the cylinder and therefore rendered rigid with the cylinder itself.

In the preferred embodiment of the present invention, the tubes are rendered rigid with the cylinder by means of a plastics material which fills the cavity inside the cylinder. Of the plastics materials, particularly useful for the purpose are the polyolefines such as polyethylene and poly-propylene, polypropylene being preferred.

The diameter of such a cylinder is slightly greater than that of the nest of tubes and its height is a little greater than the thickness of the separating baffle.

There are numerous advantages which derive from the improvement which is the object of the present invention.

In particular, the tightness between one chamber and the next is considerably improved, so that in the interior there are more regular temperature and pressure levels and hence a greater efficiency in the multiple expansion instantaneous evaporators. Above all, this is influenced by the fact that the linear development of the zone of tightness of the cylinder is considerably less than the sum of the linear developments of the zones of tightness which be necessary for each tube of the nest if each tube were so applied directly to the baffle.

Furthermore, when during maintenance operations it is necessary to withdraw the nest of tubes from the evaporators, the improvement which is achieved by the invention makes it possible to carry out this operation far more rapidly and easily in that the nest of tubes is withdrawn en bloc by a single series of operations without its being necessary to repeat the same operations every time for each tube in the nest.

A greatly simplified form of implementing the improvement of the present invention as an alternative to the foregoing resides in welding the tubes into the holes in a single plate having edges smoothed so that when the said plate is subsequently fitted into the hole in the baffle, it is possible to achieve a high degree of leak-proofness.

In this latter case, in order to facilitate the welding operations which are carried out by means of processes normally used in welding of metallic surfaces, it is preferable to use elevated tube-bushings for the holes in the plate.

The attached drawing shows a longitudinal section through a preferred embodiment of the improvement according to the present invention.

A nest of tubes 1 passes between two subsequent chambers through the hole in the dividing baffle 4 through the agency of a cylinder 2 with which the tubes are rendered rigid by the plastics material 3 which fills the cavity in the cylinder.

The cylinder 2 is shaped so that a high degree of leak-proofness can be obtained in the proximity of the hole in the dividing baffle 4. In any case, complete tightness may be obtained by using a single annularly disposed seal or leakproofing system.

It will be appreciated that while two particularly advantageous forms of transverse support for the nest of tubes have been described above, namely hollow cylinders and simple perforated plates, other suitable members can readily be devised by those skilled in the art.

What we claim is:

1. In a heat-exchanger of the type having a plurality of heat exchanger conduits extending through at least one partition therein, a supporting and sealing arrangement for said conduits comprising a single aperture extending through said partition, a hollow member having an external configuration complementary to said aperture disposed in close fitting engagement in said aperture, said hollow member having a pair of spaced apart end walls parallel to said partition and a plurality of aligned apertures extending through said end walls, a plurality of conduits extending through said apertures in close fitting engagement and plastic sealing means filling said hollow member to seal the apertures through which said conduits extend.

2. In a heat-exchanger as set forth in claim 1 wherein said hollow member is a circular cylinder having a length only slightly greater than the thickness of said partition.

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