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PLATE TYPE HEAT EXCHANGER

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Fig. 1

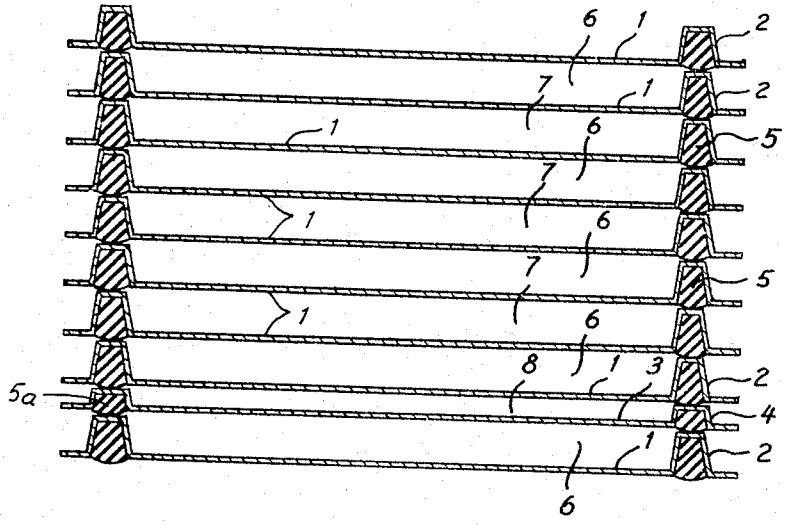
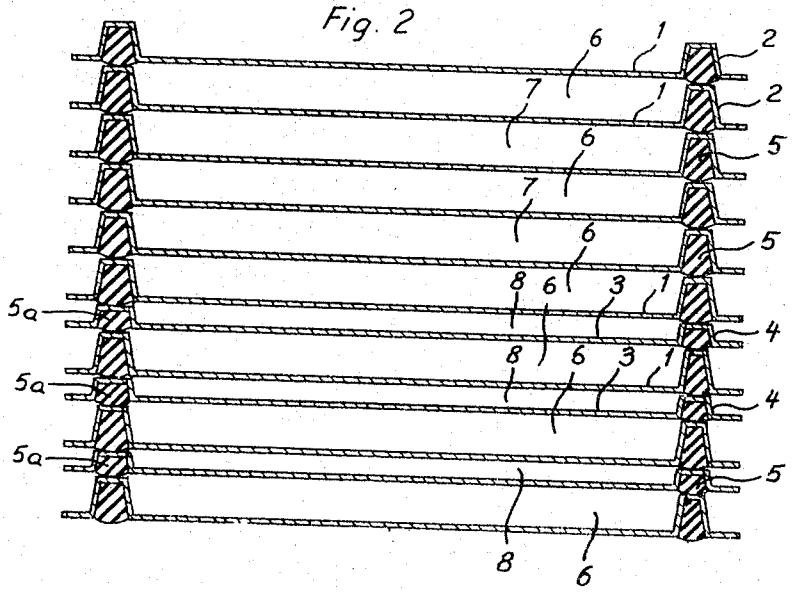


Fig. 2



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PLATE TYPE HEAT EXCHANGER

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The present invention relates to a method for adjusting the temperature, acquired by heat exchange, of at least one of the media flowing through a plate heat exchanger of the type in which plates identical in size and outer configuration are clamped in one and the same frame, the plates being spaced from each other by marginal gaskets.

Plate heat exchangers have several advantageous features which make it desirable to use such exchangers in industrial plants. For example, they are easy to adapt to the heat exchange capacity desired in a particular case by using a corresponding number of plates, and they are easy to dismantle for cleaning. In a plate heat exchanger, it is usually desired to attain a certain temperature, at least for one of the heat-exchanging media. In practice, both media are supplied to the heat exchanger at certain different temperatures, the plate heat exchanger having a certain number of plates. It often occurs that the temperature of one of the media discharged from the heat exchanger is higher or lower than the desired temperature. If the number of plates is increased so that such medium passes through an additional plate interspace, the temperature of the medium can become too high. In other words, a plate heat exchanger has the drawback that the temperature of the medium or media leaving the heat exchanger can only be adjusted stepwise.

According to the present invention, it is possible to attain a desired preset temperature of one of the media by causing it to flow through a plurality of plate interspaces in layers of at least two different thicknesses.

Through Swedish patent specification 159,491, it is known to let a medium flow in layers of different thicknesses through a plate heat exchanger of the type previously described. The problem dealt with in that case, however, is quite different, as it relates to heat treatment of cream and milk in the same plate frame, in which the cream and the milk constitute two different media and steam flows, while condensing, through plate interspaces with different distances between the plates but without the steam temperature being significantly varied. In other words, the steam temperature is not subjected to any adjustment.

The desired adjustment according to the invention can be obtained as well by causing the medium to flow through interspaces connected in series as by causing the medium to flow through interspaces connected in parallel. According to a further embodiment of the invention, the medium can be caused to flow first through a group of interspaces connected in parallel and thereafter through another group of interspaces likewise connected in parallel, the latter group being connected in series to the former.

The invention also relates to a plate heat exchanger for carrying out the present method. In the new heat exchanger, the plates are clamped in one and the same frame, marginal sealing gaskets are interposed between adjacent plates, which are identical both in size and outer shape, and the distances between the plates forming the plate interspaces for at least one of the media are of at least two different sizes.

The invention is described more in detail below with reference to the attached drawing, in which FIG. 1 schematically shows a cross section through one embodiment,

and FIG. 2 is a similar cross section through another embodiment of the invention.

The plate heat exchanger according to FIG. 1 comprises nine plates **1** which, by means of marginal gasket grooves **2** impressed in the plates and other spacing members on the plates (and not shown in the drawing), have large spacings between the plates. The exchanger also comprises a plate **3** which, by means of shallower gasket grooves **4** and shallower spacing members (not shown), has a small spacing from an adjacent plate **1**. Rubber gaskets **5** are fitted in the grooves **2**, and a thinner gasket **5***a* is fitted in groove **4**. It is assumed that a heat-emitting medium is flowing through plate interspaces **6** which are connected in parallel to each other and that a medium to be heated flows, preferably in counter-current to the heating medium, through plate interspaces **7** and **8** which are likewise connected in parallel. The latter medium flows in a thinner layer in the interspace **8** than in the interspaces **7**. This means that the fraction of the medium which flows through the interspace **8** is heated to a higher temperature than the fraction of the medium which flows through the interspaces **7**. However, at the outlet (not shown) of the heat exchanger, the different fractions of the medium mix together, whereby the mixture attains a temperature which, by a suitable combination of plates with deep and shallow spacing members, will be close to the desired temperature. As shown in FIG. 1, there is a combination of three interspaces **7** with large spacings and an interspace **8** with a small spacing between the plates. It is evident that in order to attain the desired temperature, it is possible to provide a suitable combination of a variable number of interspaces of the type **7** and a variable number of interspaces of the type **8**, and that the combination of the number of interspaces shown in FIG. 1 is given only by way of example. The medium to be adjusted in temperature is usually constituted by a liquid, although it may be a gas, provided that its temperature during the heat-exchange process does not lie close to the vaporization point or the condensation point.

Only two kinds of plates are shown in FIG. 1. In principle, three or more different kinds of plates (i.e., plates with spacing members of different heights) may be used. This allows for a more accurate control of the temperature of the medium. For practical reasons, however, it is desirable to manufacture the plates in as few types as possible, preferably only two types.

In the description of the embodiment shown in FIG. 1, it has been assumed that each heat-exchanging medium flows through its respective group of interspaces connected in parallel. It is also possible, however, to let the one medium flow through the interspaces **6** in series and to let the other medium flow through the interspaces **7** and **8** likewise in series, the media preferably flowing in countercurrent to each other. In either case, it is possible to attain a more accurate temperature control than if the medium or the media must pass between plates spaced alike for one and the same medium.

By way of example, it can be assumed that if the interspace **8** (see FIG. 1) had the same thickness as the interspaces **7**, a medium passing through these interspaces will be heated to increase its temperature by 12° C. If it is now desired that the medium should be heated to increase its temperature by 14° C., such a heating can be obtained as a result of replacing one or more of the interspaces of the type **7** (with a large plate spacing) by one or more interspaces of the type **8** (with a small plate spacing) in which the medium is heated to such a high temperature that the medium from the interspaces **8**, after having been mixed with the medium from the interspaces **7**, will have the desired temperature increase of 14° C. If, on the other hand, only interspaces of the

type 8 had been chosen, all of the medium woud have been heated too high, e.g., 24° C. In this connection it is assumed that the interspaces 8 give a temperature increase which is twice that of the interspaces 7, owing to the fact that about half of the quantity of the medium passes through an interspace of the type 8 per unit of time as compared with an interspace of the type 7.

Thus, if the heat transfer characteristics of both types of interspaces are known, it is possible to combine interspaces of the types 7 and 8 so as to attain the desired temperature.

Referring to FIG. 2, a group of interspaces 7 connected in parallel to each other is assumed to be connected in series to another group of interspaces 8 connected in parallel to each other. It is possible, however, to attain another desired temperature adjustment by connection in series of the interspaces within each of the groups 7 and 8.

In FIGS. 1 and 2, only variations of the thickness of the plate interspaces passed by one of the media have been shown. The scope of the invention, however also extends to the variation of the thickness of the plate interspaces passed by the other medium, in order to obtain a desired temperature adjustment for that latter medium as well.

I claim:

1. In a heat exchange effected by flowing a first medium in a plurality of first parallel layers and flowing a second medium in a plurality of second layers parallel to and alternating with said first layers, said layers being substantially coextensive in area and each layer being separated from but in heat exchange relation to each adjacent layer over substantially its entire area, and directing the layers of each medium to a separate outlet for such medium, the method of controlling the outlet temperature of said first medium which comprises maintaining said second layers and a plurality of said first layers substantially alike and constant in thickness, and maintaining at least one of said first layers at a substantially different constant thickness, said first layers being directed to flow in parallel to said outlet for the first medium.

2. In a plate heat exchanger, a plurality of heat exchange plates identical in size and outer configuration, said plates having ports and being disposed in parallel spaced relation to form a first series of interspaces for throughflow of a first medium and a second series of interspaces for throughflow of a second medium, said second interspaces alternating with said first interspaces, gaskets in said second series of interspaces for confining flow of the second medium through said second series and some of said ports to a common outlet, and additional gaskets in said first series of interspaces for confining flow of the first medium through said first series and others of said ports to another common outlet, said additional gaskets including gasket means of different thicknesses located, respectively, in different interspaces of said first series, thereby maintaining the interspaces of said first series with at least two different thicknesses, said first series of interspaces being connected in parallel.

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