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PLATE HEAT EXCHANGER

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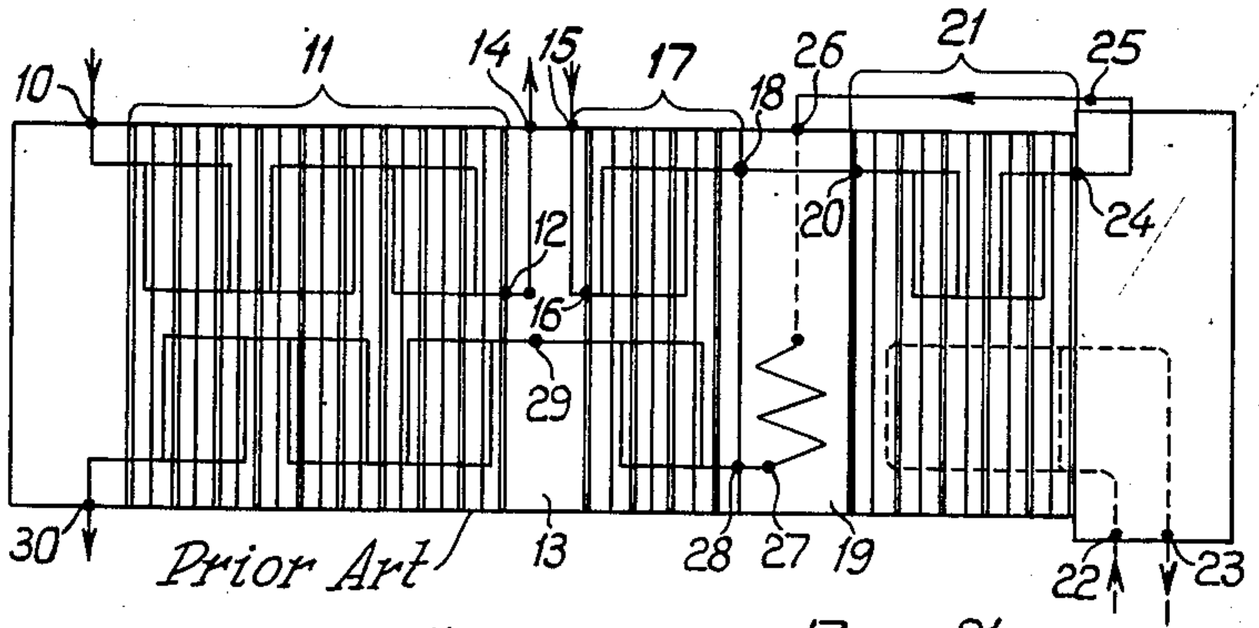

Fig. 1

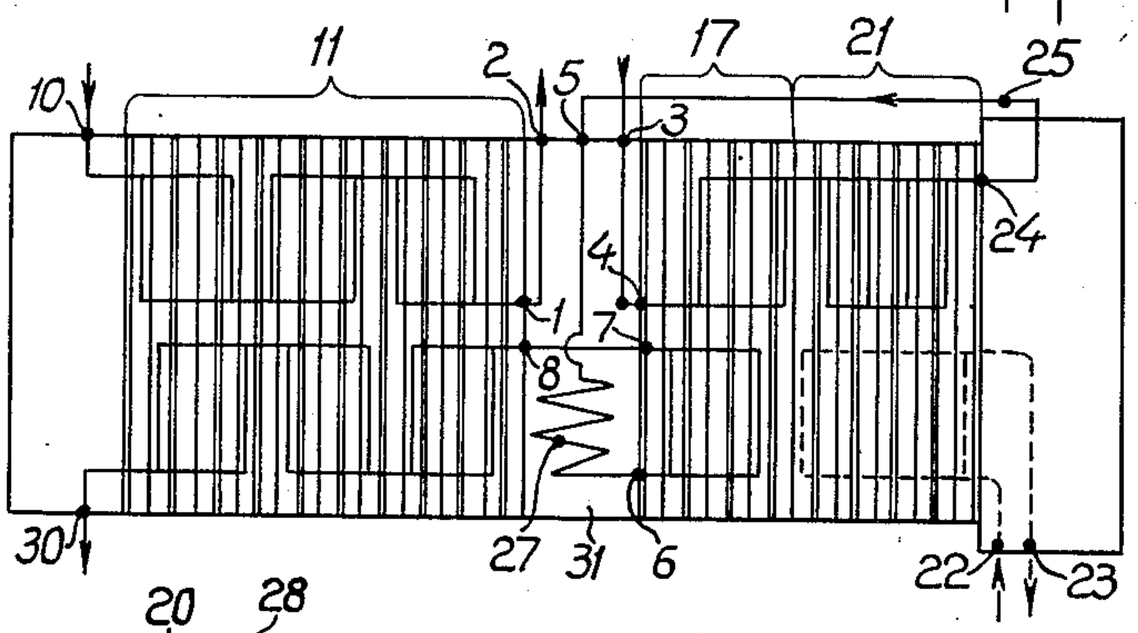

Fig. 2

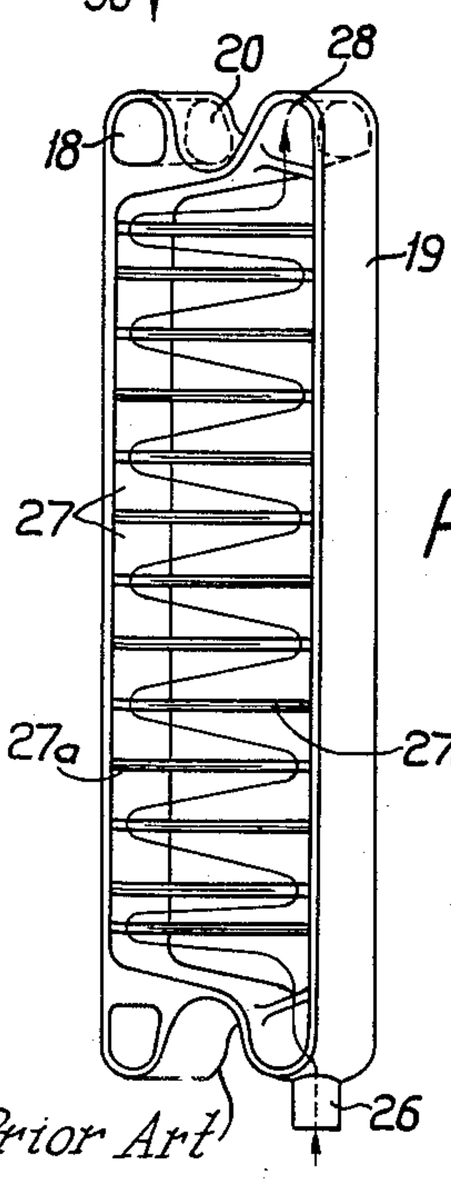

Fig. 3

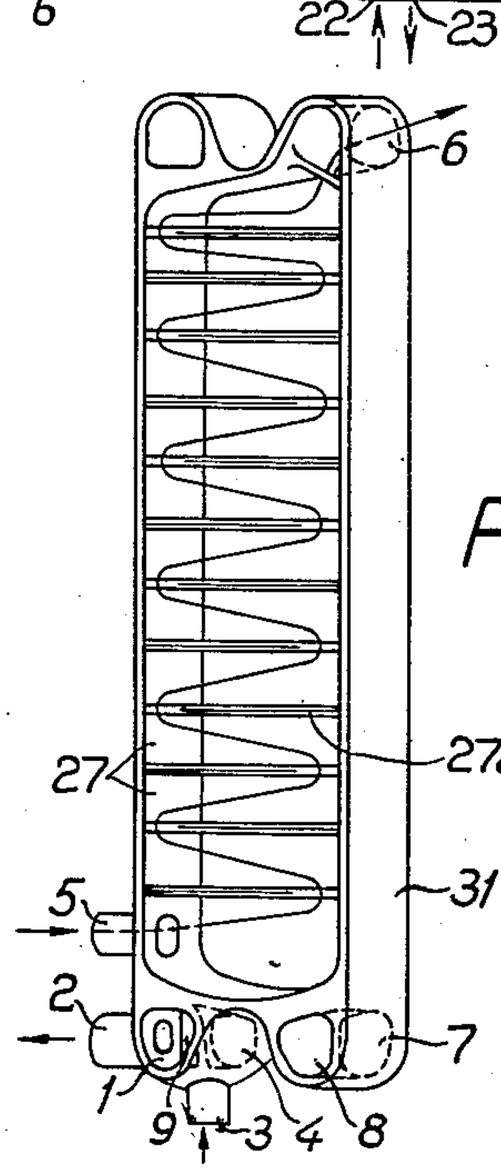

Fig. 4

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PLATE HEAT EXCHANGER

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6 Claims. (Cl. 257—245)

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This invention relates to heat exchangers, and more particularly to an improved plate heat exchanger of the type having a regenerative section and a holder cell.

In the thermal treatment of milk and other liquids in plate heat exchangers, it is common practice to cause the heated liquid, after pasteurization, to give off heat in the plate apparatus to the in-flowing cold liquid to be treated. For this purpose, the apparatus is provided with a regenerative section in which the liquid, passing at pasteurizing temperature in counter-current relation to the cold liquid, gives off heat to the latter.

The centrifugal treatment of milk in dairies is effected at a temperature between the initial temperature and the pasteurizing temperature. The milk must therefore be withdrawn from the regenerative section at a point where it has the proper separating temperature and then, after the centrifugal treatment, returned to the regenerative section at the same point of the temperature curve and further heated to pasteurizing temperature. In order to enable withdrawing and returning of the liquid, a so-called coupling plate is used, which is interposed at the liquid withdrawal and return point of the set of plates constituting the regenerative section. This section is thus divided into two sub-sections, each having its set of plates. A heating or pasteurizing section in the plate apparatus is formed by a third set of plates.

The principal object of the present invention is to simplify the plate apparatus with a view to making it cheaper. This is accomplished by moving the holder cell to the location where the coupling plate is arranged in conventional apparatus and providing it with means by which it can be connected to the inlet and outlet pipes of a centrifuge. In accordance with the invention, the holder cell is thus placed between the two sub-sections of the regenerative section, instead of beyond the regenerative section as has heretofore been common practice.

For a better understanding of the invention, reference may be had to the accompanying drawings, in which:

Fig. 1 is a diagrammatical view of a plate heat exchange apparatus of the conventional type;

Fig. 2 is a similar view of a plate heat exchange apparatus made according to the invention;

Fig. 3 is a perspective view of the holder cell of the conventional apparatus illustrated in Fig. 1; and

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Fig. 4 is a perspective view of a holder cell made according to the invention.

According to Fig. 1, the liquid to be treated enters the plate apparatus at inlet 10, flows through the heating side of a set of plates 11, and then at 12 into a coupling plate 13, the object of which is to enable withdrawal of the liquid from the apparatus. Thus, the liquid leaves the coupling plate through an outlet 14, passes through a centrifuge (not shown) and is reintroduced into the coupling plate through an inlet 15. At passage 16 the liquid flows from the coupling plate 13 into a set of plates 17. It then passes along the heating side of plates 17 until it leaves the set at passage 18. The sets of plates 11 and 17 together form the so-called regenerative section of the plate apparatus. In this section, heat is transmitted to the inflowing liquid by bringing about a heat exchange with the liquid returning from a pasteurizing zone of the apparatus. When the centrifugal treatment consists in separating milk into cream and skim milk, only the skim milk is introduced at 15, the cream being heat-treated separately in one or more sets of plates or in other apparatus provided for this purpose. At the side of the set of plates 17, there is a holder cell 19 in the plate apparatus. The liquid from passage 18 flows through the holder cell in a simple throughflow channel and, at 20, enters the set of plates 21 in which it is heated to pasteurizing temperature, steam or hot water being used as a heating medium in this set. The steam is fed in at inlet 22 and withdrawn at outlet 23, possibly in the form of a condensate, after it has given off heat to the liquid in the set of plates 21. At outlet 24, the liquid reaches pasteurizing temperature, and it then proceeds through a channel 25 (which is often in the form of a pipe line located outside the apparatus) to the holder cell 19, the point of entrance to the cell being at inlet 26. In the cell 19, the liquid generally passes through a zig-zag channel, symbolized by the zig-zag line 27, and discharges at outlet 28 to the cooling side of the set of plates 17. Through a channel 29 in the coupling plate 13 it then flows into the set of plates 11 and, after having passed along the cooling side of this set, leaves the apparatus at outlet 30.

The holder cell 19 is illustrated in Fig. 3. On its way to the heating section 21, the liquid flows through the channel 18—20 in the upper left-hand corner. The liquid has not then assumed pasteurizing temperature. From the pipe 25 it enters the holder cell at inlet 26 and flows through the zig-zag channel 27, formed by stag-

gered baffles 27*a*, to the upper right-hand corner of the holder cell where it passes over into the set of plates 17 at outlet 28.

According to the invention, the holder cell takes the place of the coupling plate 13, and for this purpose the holder cell is provided with a number of connections and channels, illustrated in Fig. 4 and diagrammatically indicated in Fig. 2. The modified holder cell is designated generally by reference numeral 31. According to Figs. 2 and 4, the in-flowing liquid passes from the inlet 10 along the heating side of the set of plates 11 to an orifice 1 or inlet of the holder cell 31, whence it proceeds through a duct or outlet means 2 into a centrifuge (not shown). The liquid from the centrifuge returns to the holder cell 31 through a duct or inlet means 3 and proceeds to an orifice 4 at the rear of the holder cell 31 into the set of plates 17. It is to be noted that the orifice 4 is separated from the orifice 1 by a wall 9 which prevents the liquid from flowing directly from one orifice to the other. From the orifice 4, the liquid is conducted along the heating side of the set of plates 17 to the heating section 21 and then through channel 25 to an inlet connection 5 of the holder cell 31. After having passed through the zig-zag channel 27 in the holder cell, the liquid flows through an orifice 6 in the upper right-hand corner of the holder cell to the cooling side of the set of plates 17. In this case, the set 17 is placed to the right of the holder cell and not to the left as in Fig. 1. From the set 17, the liquid flows through a channel or passage 7—8 in the lower right-hand corner of the holder cell to the cooling side of the set of plates 11, and leaves the apparatus at outlet 30.

It will be apparent that the holding cell or cell body 31 of my invention has two passages 1—2 and 3—4 communicating, respectively, with the heating sides of the regenerative sub-sections 11 and 17, and also has a throughflow channel 7—8 connecting the cooling sides of the two regenerative sub-sections, and these passages and the channel 7—8 are separated from each other and from the main cell space 27, which is provided with a separate inlet 5 and with a separate outlet 6 leading to the cooling side of the sub-section 17. The ducts 2 and 3 constitute means forming, respectively, an outlet from passage 1—2 and an inlet to passage 3—4, so that the liquid being heated can be withdrawn from the regenerative section at the desired temperature for centrifuging and returned to this section. As shown in Fig. 4, the inlet to the main space 27 of the holding cell is located at the lower portion of the cell body, at one side, but above the passages 1—2 and 3—4 and the channel 7—8.

I claim:

1. In a plate heat exchange apparatus having a main heating section and also having a regenerative heater divided into two sub-sections, each section and sub-section having a heating side and a cooling side, the combination of a holding cell located between the two regenerative sub-section and having walls forming a main cell space communicating with the heating side of the main heating section for receiving heated liquid therefrom, the cell having an outlet from said space leading to the cooling side of one sub-section and also having a channel connecting the cooling sides of the two sub-sections, the cell also having two passages separated from each other and from said main space and channel and communicating, respectively, with the heating sides of the two sub-sections, means forming an outlet from one of said cell passages for feeding liquid to a centrifuge, and means forming an inlet to the other passage for receiving liquid from the centrifuge.

2. In a plate heat exchange apparatus having a regenerative section divided into two sub-sections each having a heating and a cooling side, the combination of a holding cell located between the sub-sections and having walls forming a main cell space, the cell having an inlet to said space and also having an outlet from said space leading to the cooling side of one of the sub-sections, the cell also having a channel separated from said inlet and outlet and connecting the cooling sides of the two sub-sections, the cell also having two passages separated from each other and from said inlet, outlet and channel and communicating, respectively, with the heating sides of the two sub-sections, means forming an outlet from one of said cell passages for feeding liquid from the regenerative section, and means forming an inlet to the other cell passage for returning liquid to the regenerative section.

3. A holding cell for plate heat exchange apparatus, which comprises a cell body having walls forming a main holding space and having an inlet to said space and an outlet therefrom, the cell also having a throughflow channel for a heating liquid and separated from said inlet and outlet, the cell also having two passages for liquid to be heated and separated from each other and from said inlet, outlet and channel, means forming an outlet from one of said passages, and means forming an inlet to the other passage.

4. In a plate heat exchange apparatus, the combination of a regenerative section divided into two sub-sections each having a heating side and a cooling side, a coupling plate located between the two regenerative sub-sections and having walls forming a holding cell space, said holding space having a liquid inlet and also a liquid outlet leading to one side of one of the sub-sections, the coupling plate also having passages separated from each other and from said holding space and communicating with the other side of said last sub-section and the corresponding side of the other sub-section, respectively, means forming an outlet from one of the passages for feeding liquid to a centrifuge, and means forming an inlet to the other passage for receiving liquid from the centrifuge.

5. A combination according to claim 4, in which said outlet means are connected through one of the coupling plate passages to the heating side of one of the regenerative sub-sections, and said inlet means are connected through the other coupling plate passage to the heating side of the other regenerative sub-section.

6. A combination according to claim 4, in which said inlet of the holding space is located at the lower portion of the coupling plate but above said passages.

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