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TWO UNIT PLATE HEAT EXCHANGER WITH END SUPPORTS

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Fig.1

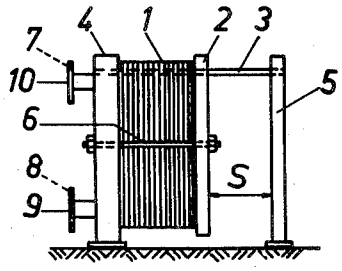
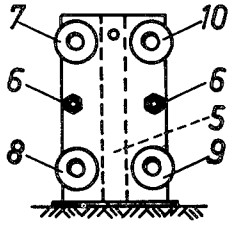


Fig.2



PRIOR ART

Fig.3

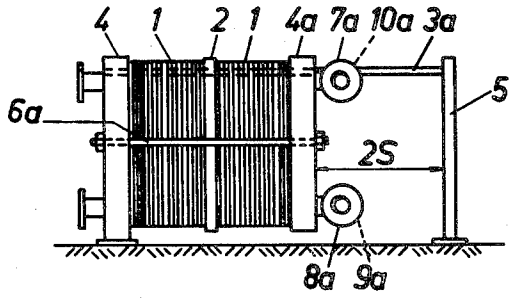
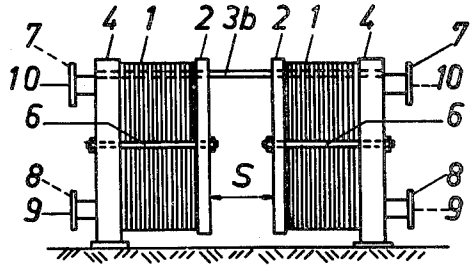


Fig.4



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TWO UNIT PLATE HEAT EXCHANGER WITH END SUPPORTS

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The present invention relates to plate heat exchangers with stacks of substantially vertical heat transmission plates, clamped together so as to be disassembled in a horizontal direction. More especially the invention relates to heat exchangers of the kind in which each of two such stacks in one and the same apparatus unit (twin apparatus) forms one of two separate heat exchanging sections, such two sections being arranged to work independently of each other. The main purpose of such a twin apparatus is to make it possible to operate two separate heat exchanging processes with less apparatus costs and less apparatus space requirements than is possible by using separate units (single apparatus), one for each process. Twin apparatus as heretofore produced have made it possible to only a limited extent to satisfy this main purpose, and merely at the expense of the possibility of shutting off the two sections independently of each other, for instance, for inspection, cleaning and replacement of the heat transmission plates. This disadvantage is very serious, as will be clear more in detail from the following description.

It is an object of the invention to combine an improved effect, as regards said main purpose, with an accompanying elimination of said disadvantage. The invention is based on the known arrangement wherein each one of the two heat exchanging sections consists of a stack of plates, clamped together between an end plate at one end of the stack, said plate being provided with the inlet and outlets for heat exchanging media of the heat exchanging section in question, and at the other end of the stack a cover plate. The invention is characterized by the fact (a) that two such end plates are arranged to carry supporting means on which there is arranged, between said end plates, the two stacks of plates and two cover plates separating said stacks, namely one cover plate for each stack, (b) that between each endplate and the adjacent cover plate there is arranged a disengagable connection to clamp together the stack of plates therebetween and (c) that the distance between the cover plates of the respective stacks of plates clamped together is large enough to permit each stack between its end plate and the other stack clamped together to be disassembled for inspection, cleaning and removal of its individual heat transmission plates.

The invention will now be described more in detail with reference to the annexed drawing in which

FIG. 1 illustrates a side view of a single prior art apparatus with heat exchanging section of the type of which the invention relates,

FIG. 2 illustrates the same single apparatus as seen from the left side in FIG. 1,

FIG. 3 illustrates a side view of a known modification of twin aparatus with two heat exchanging sections according to FIG. 1, and

FIG. 4 illustrates a side view of a twin apparatus according to the invention, such apparatus having two heat exchanging sections, each of such sections being made according to FIG. 1.

The figures are schematic and are intended to serve only as examples. Identical details in the several figures are indicated by the same reference numerals.

In the several figures the stacks of plates are indicated

only by close vertical lines, but it should be understood that, as known per se, they consist of heat transmission plates which are clamped together in interspaced relation so as to define between them passages for the heat exchanging media within border packings of elastic material. Thus, from FIGS. 1 and 2 a person skilled in the art will easily recognize a single apparatus, in which the stack **1** of plates and its cover plate **2** are suspended from a suspension bar **3** between an end plate **4** and a pillar **5**, which together constitute a support for the suspension bar **3**, whereby the stack of plates will be clamped together by means of a disengageable bolt connection **6**, and the end plate is provided with four nozzles **7**, **8**, **9** and **10** serving as inlets and outlets respectively for two heat exchanging media. Thus one medium, passed through every second interspace between the plates, may, for instance, be supplied through a nozzle **7** and withdrawn through a nozzle **8**, while the other medium, passed through the remaining interspaces between the plates, will be supplied through a nozzle **9** and withdrawn through a nozzle **10**. The distance S between the cover plate **2** and the pillar **5** is also understood to be so dimensioned that on unscrewing the bolt connection **6**, said distance will permit the cover plate and the individual heat transmission plates of the stack to be slid apart on the suspension bar to a sufficient degree for facilitating inspection, cleaning and, if desired, removal of individual plates.

From this single apparatus the known type of twin apparatus according to FIG. 3 has been developed in the following way: On the extended suspension bar **3*a*** at the free side of the cover plate **2** in FIG. 1 there is suspended an additional stack of plates **1** with an end plate **4*a*** of substantially the same type as regards the inlets and outlets as that of the end plate **4**, whereby the two stacks of plates and their common cover plate **2** will be clamped together by an elongated bolt connection **6*a*** between the end plate **4** and the end plate **4*a***, which is provided with inlet and outlet nozzles **7*a***, **8*a***, **9*a*** and **10*a*** for this additional stack of plates corresponding to the nozzles **7**, **8**, **9** and **10** for the first stack of plates. The distance **2S** between the end plate **4*a*** and the pillar **5** is required to permit both stacks in unison to be slid apart on the suspension bar **3*a*** for inspection, cleaning and if desired, removal of individual plates.

A comparison between this twin apparatus and two single apparatus aligned with their respective pillars **5** facing each other (a two-apparatus system) gives the following result: The gain in space requirement cannot be considerable as the length of the twin apparatus will be about equal to the total lengths of two single apparatus. The gain from reduction of structural elements substantially resides in the fact that one pillar **5** and one cover plate **2** can be omitted. A structural disadvantage is that dissimilar endplates, one with and one without foot plate, have to be made and kept available for repairs. The most considerable disadvantage, however, is that the two stacks cannot be disassembled independently of each other, but the operation of both heat exchanging sections must be stopped as soon as any one of the stacks of plates has to be made accessible to inspection, cleaning or replacement of plates. As a result, the outer pipe line connections with end plate **4*a*** must also be disconnected and arranged so that after such a disconnection, said pipe lines do not prevent the motion of said end plate on the suspension bar. The end plate **4*a*** cannot therefore be provided with straight nozzles for inlets and outlets like the endplate **4** but must be provided with bent nozzles. Thus, also in this respect the endplate **4*a*** differs from the endplate **4**.

The twin apparatus according to the invention, as illustrated in FIG. 4, consists of a suspension bar **3*b***

on which two stacks of plates **1** and, separating said stacks, two cover plates, that is to say, one for each stack, are suspended between two end plates **4**, one for each stack, said end plates forming supports for the suspension bar. Each stack of plates is clamped together between its end plate and its cover plate by means of a bolt connection **6**, whereby the space between the cover plates is at least S, that is to say, large enough to permit each stack, one at the time, while utilizing that space, to separate or slide apart on the suspension bar to a sufficient degree for facilitating inspection, cleaning and removal of the individual plates.

If, instead, this twin apparatus according to the invention is compared with the same two-apparatus system as in the previous comparison, it will be found that the present apparatus may be regarded as developed from said system by substituting the suspension bar **3***b* for both suspension bars **3** of the two-apparatus system, whereby both pillars **5** are eliminated. Such gain from the reduction of the number of structural elements is of a value about equal to the advantage gained from eliminating one pillar and one coverplate in the previous comparison. Except for the longer suspension bar, no parts have to be made especially for the twin apparatus and kept in store because in all other respects the apparatus is built up of parts identical to those of the single apparatus.

However, the most important advantage of the present invention is that each heat exchanging section may be disassembled separately without the necessity of putting the other heat exchanging section out of operation, and also without the need of disconnecting any pipe connections. If the distance between the cover plates of the stacks together be limited so as not to exceed the minimum distance S to any considerable degree the reduction of space requirement also becomes considerable.

A limitation of the distance **2S** in FIG. 3 to such a degree, however, cannot be attained even if one should intend to disassemble only one stack at the time. As soon as the bolt connections **6***a* are unscrewed so as to relieve the pressure on the elastic packings between the plates, both stacks will expand horizontally so as to increase their length by about 30 to 40% with the interspaces between the plates still closed by the expanded packings. This means an equally large loss of efficient space for sliding the plates apart for inspection and cleaning purposes. In the apparatus according to the invention this loss is limited to the expansion of one stack of plates only.

With the aid of the illustrated examples a person skilled in the art should be able to make several modifications within the scope of the invention; for instance the number of plates in the different packs may be varied and all of the separate parts known per se in the plate heat exchanger art may be subjected to known modifications.

What I claim is:

1. A plate heat exchanger comprising at least two separate heat exchanging sections, each section including a group of generally vertically disposed heat exchanging plates assembled in a stack and disposed between an end plate at one end of the stack and a cover plate at the other end of the stack, the sections being disposed in alignment with the cover plates confronting and spaced a substantial distance from each other and with the end plates remote from each other, each end plate of each section having inlet means and outlet means for the heat exchanging fluids, and means for supporting the heat exchanger comprising means detachably connecting the end plates together in at least generally vertical parallel relationship, separate means on each of the heat exchanging sections for detachably securing the heat exchanging plates and cover plate of each section together and to their end plate, and means on each of the end plates serving to support the heat exchanger, the space between the cover plates of the two assembled plate stacks being great enough to permit either of the plate stacks to be disassembled between its end plate and the other assembled plate stack for the purpose of facilitating inspection, cleaning, and removal of the individual heat exchanging plates.

2. A plate heat exchanger as claimed in claim **1**, wherein the supporting means on the end plates are in the form of depending, floor engaging projections on the lower ends of the end plates.

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