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HEAT EXCHANGERS OF THE PLATE TYPE

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Fig. 1.

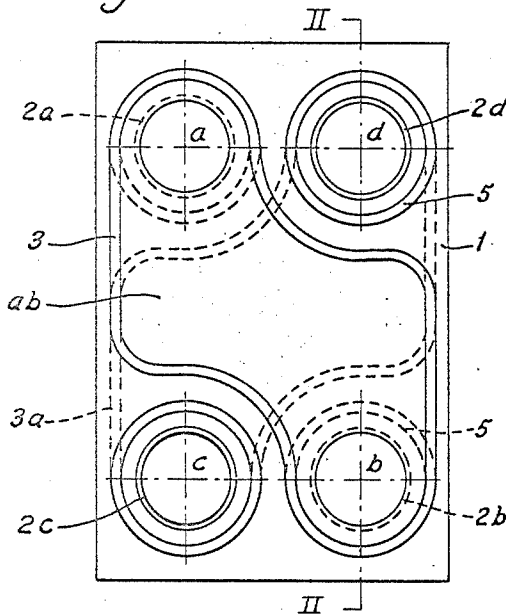


Fig. 2.

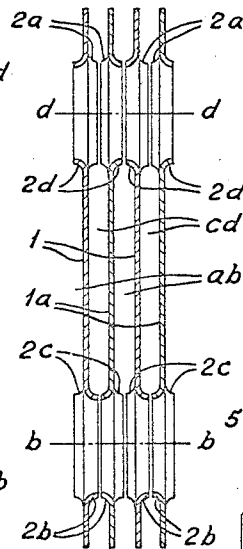


Fig. 3.

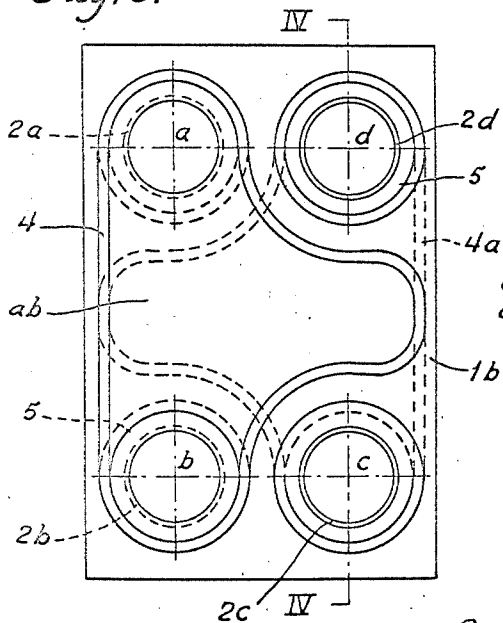


Fig. 4.

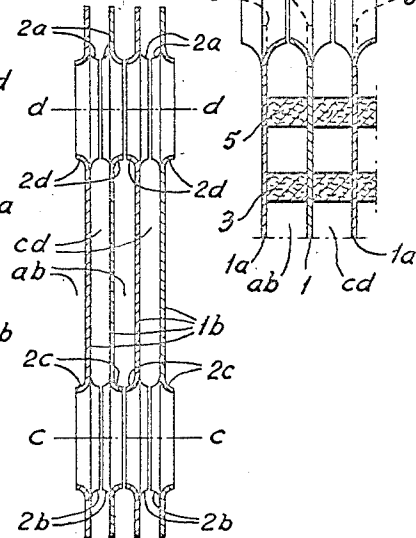
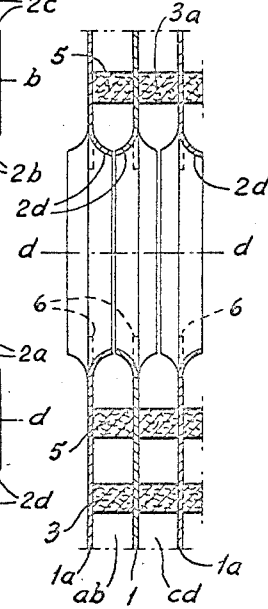


Fig. 5.



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HEAT EXCHANGERS OF THE PLATE TYPE

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2 Claims. (Cl. 257-245)

The present invention relates to heat exchangers of the plate-type for two heat exchanging fluids and comprising heat transmission plates of thin sheet metal, assembled to packs or piles with interspaces between the plates, said interspaces being enclosed by edge packings and said fluids, within said interspaces being conducted along either side of the plates, namely one fluid through every second of said interspaces and the other fluid through the remaining interspaces, by means of separate passage holes for each fluid in the plates.

As a rule, the plates are provided with four such passage holes disposed quadrangularly in relation to one another, and each being in registering position in relation to such a hole in the adjacent plates, said holes forming together four parallel hole series, each extending through the pack of plates. In cooperation with packings in the interspaces between the plates and around the holes, two of the hole series conduct one fluid to and from every second of said interspaces, respectively, while the two remaining hole series conduct the other fluid to and from the remaining of said interspaces, respectively. In most cases the arrangement is such that each of the edges of the holes in said hole series forms a sharp threshold transverse to the direction of flow of the fluid. On one hand this causes that the inlets and outlets to and from the interspaces, respectively, will be extremely abrupt and produce pressure drops and, on the other hand, impurities in the fluid, such as fibers or the like, will easily stick to the threshold so as to obstruct the passage system particularly in said inlets and outlets.

The invention aims at eliminating these inconveniences and is primarily characterized in that the passage holes for one fluid, located in registering relationship to one another and belonging to adjacent plates forming interspaces for the other fluid, are flanged opposed to each other into a smooth orifice shape in such a manner that the free edges of respective flange portions at least approximately are interconnected with one edge surface abutting against the other.

The invention will be more particularly described below with reference to the accompanying drawing, which shows, by way of example, some embodiments of the invention. In the drawings:

Figure 1 is a plan view of a pile or pack of plates according to the invention;

Figure 2 shows a section of the pack of plates according to Figure 1, along line II-II of this figure but with the packings in this figure omitted;

Figure 3 is a plan view of a pack of plates having a modified plate construction according to the invention;

Figure 4 shows a section of pack of plates according to Figure 3 along line IV-IV of this figure, but with the packings in this figure omitted; and

Figure 5 shows a detail of the device according to the invention in section and a larger scale than in the other figures.

Identical details are designated with the same reference character in the various figures.

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According to Figures 1 and 2, two plates 1 and two plates 1a are alternately combined into a pack having interspaces *ab* for one fluid and *cd* for the other fluid. The interspace indicated to the left in Figure 2 is assumed to be formed of another plate 1a in front of the left plate 1. This plate 1a is not shown since this seems to be unnecessary for explaining the spirit of the invention. It is assumed that an arbitrary number of plates may be assembled in the manner as illustrated.

Each plate is provided with passage holes *a*, *b*, *c*, and *d*, respectively. Between the plates similarly designated passage holes are positioned opposite each other and constitute together and in cooperation with packings 5 around the holes four hole series *a-a*, *b-b*, *c-c*, and *d-d*, respectively, through the pack of plates. The hole series *a-a* and *b-b* communicate with the interspaces *ab*, each enclosed by an edge packing 3, and the hole series *c-c* and *d-d* communicate with the interspaces *cd*, each enclosed by an edge packing 3a in a manner conventional in such packs of plates.

According to the invention, see for example the hole series *d-d* in Figure 2, the holes *d* are provided with flanged collar portions 2d, said holes being positioned in registering relation to each other and conducting one of the fluids. The holes belonging to juxtaposed plates, for instance, the middle plates 1a and 1 forming an interspace *ab* for the other fluid, are flanged in opposed direction to each other so that the free edges of the respective flanged collar portions approximately abut. According to the same rule one and all holes of the various hole series are flanged in such a manner that the collar portions are opposed to each other pairwise between plates forming an interspace for the fluid which is not conducted through the relevant hole series. The matter may also be put like this: the flanged collar portions are throughout in opposed direction to each other within a packing 5 around the respective hole and should be able to replace these packings if the collar portions could be made to fit closely together. This is readily understood from Figure 5 which shows, on a larger scale, a section of a hole series *d-d* with packings. Furthermore, Figure 5 illustrates a type of flanging which involves particularly favourable flowing conditions through the hole series and between the same and the respective interspaces between the plates. It is also readily understood from this figure how the sharp and thin thresholds being formed if the openings in accordance with the dash-dotted indication are not flanged according to the invention.

In order to simplify the illustrations a not very frequently used method of arranging the packings has been shown, that is to say, the packings are pinched between completely plane plate surfaces with no special lateral guiding means. Under such circumstances it might seem fairly obvious to resort to a simpler measure than that of the invention, that is, having the packings extending along the edges 6 so that at least less obstructive thresholds are formed. However, in doing so it can not be avoided that these thresholds obtain sharp edges on either side of the packing in the direction of the holes. The packing arrangement now most widely used, however, is, as known by any person skilled in the art, to provide packing extending in grooves pressed in the plates with such free edges 6 of the plates extending around the grooves within the packings in the passage holes. In this case the invention can be applied as well as in the case illustrated. Hence, the invention represents a complete and general solution of the problem.

The device shown in Figures 3 and 4 differs in principle from that shown in Figures 1 and 2 merely in that the hole series for the same fluid are arranged along the same

side of the pack of plates. This will involve the advantage that the pack of plates may be assembled of one type of plates 1b only, which are identical concerning the location and flanging of the passage holes. Thus, each plate is provided with its flanged passage holes for the same fluid disposed at the same edge of the plate, and in the pack of plates every second such plate is turned 180°, in its own plane, in relation to adjacent plates. The more detailed description of the device according to Figures 1 and 2 is applicable as a description for the rest.

Both devices have especially the feature in common that in each plate passage holes for different fluids are flanged in opposite directions above the first and the second, respectively, of the surfaces of the plate.

With the guidance of the examples presented, a person skilled in the art can produce further modifications within the scope of the invention. A few examples of this is given here: the collar portions may be varied in shape and in height above the plate; in the latter case care should be taken that the combined height of collar portions directed opposed to each other in the pack of plates must not exceed the size of the interspace between the plates. The passage holes may each be varied in shape and may possibly be divided up into several units.

I claim:

1. A heat exchanger comprising an assembly of a plurality of heat transmission plates of thin sheet metal forming a readily disassembled stack of said plates with interspaces between adjacent plates, continuous edge packings enclosing portions of said interspaces, said portions serving as conduits for two heat exchanging fluids to be passed through the heat exchanger, every second of said portions serving as a conduit for one fluid and the remaining portions serving as conduits for the other fluid, each of said plates being provided with four passage holes through the plate, each passage hole of each plate being positioned in registering relationship with respect to a similar passage hole formed through the adjacent plate, two pairs of said registered passage holes being enclosed within the borders of each of said portions by the said edge packing therefor and the remaining two pairs of registered passage holes between said plates being

individually enclosed by packing rings overbridging said interspaces, the sheet metal bordering said individually enclosed pairs of passage holes being formed into flanges extending toward each other in the form of smoothly rounded orifices, the free end faces of said flanges coming substantially into contact within said enclosing packing rings and said orifices forming the sole passages for the flow of fluid between the interspaces bordered by the outer surfaces of the plates carrying said flanges.

2. In a plate heat exchanger comprising a plurality of heat transmission plates of thin sheet metal assembled together in side by side relationship with continuous edge packings surrounding the larger part of the face surfaces of said plates, said continuous edge packings being interposed between the plates so as to form a stack with the plates therein in spaced relation wherein the interspaces between the plates within said edge packings define passages for heat exchanging media through the heat exchanger, every second of those passages in pairs communicating with each other across an intermediate interspace between the plates through registering passage holes through one and the other respectively of said plates defining said intermediate interspace and through a packing ring overbridging that interspace around said passage holes, the improvement which comprises the sheet metal bordering each of said passage holes being formed into flanges in the form of smoothly rounded nozzles extending towards each other within the confines of said packing rings with their respective free end faces lying closely adjacent each other in face to face relationship.

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