

Dec. 23, 1958

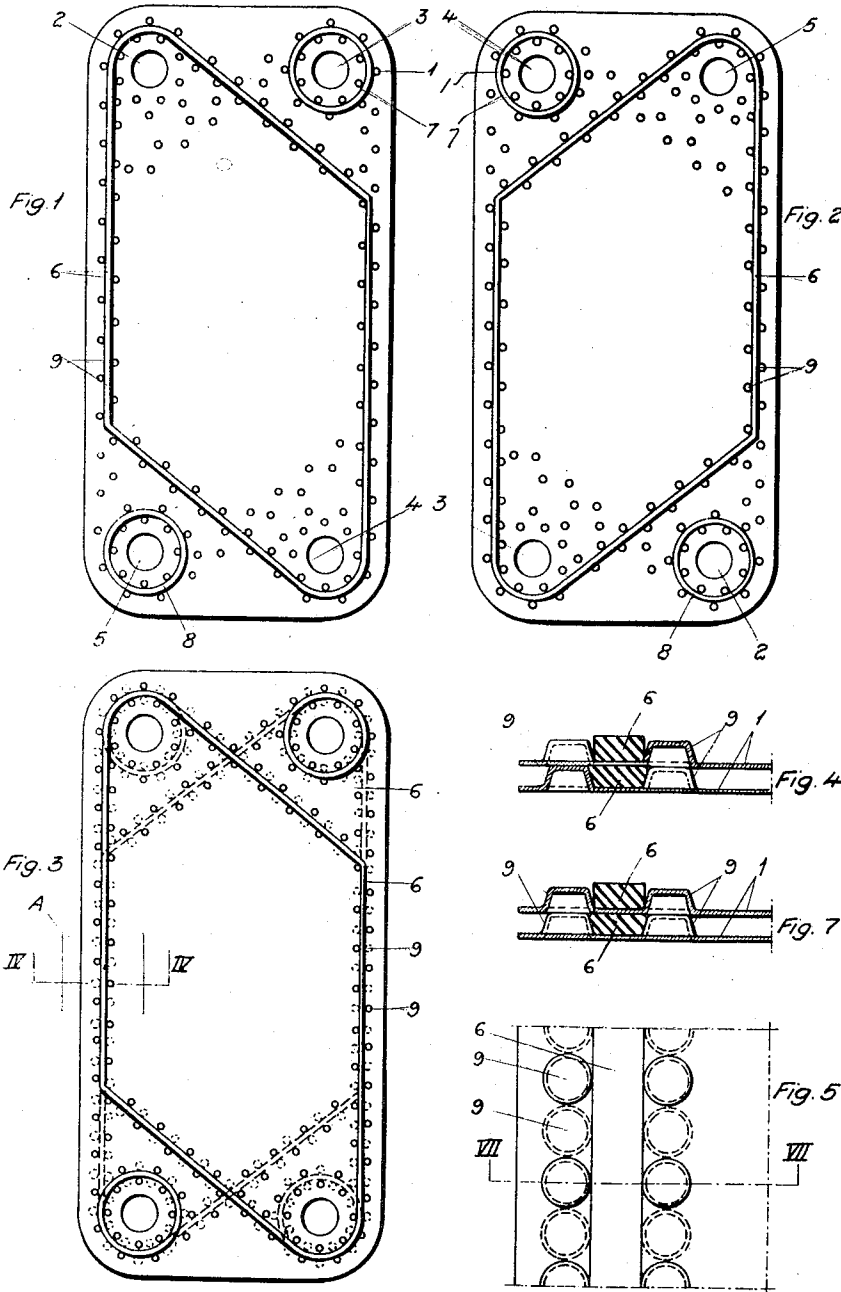
G. C. EGENWALL ET AL

2,865,613

PLATE TYPE HEAT-EXCHANGER

Filed Feb. 14, 1955

2 Sheets-Sheet 1



Gustaf Conrad Egenwall
and
Sverre Knut Jenssen
INVENTORS.

BY

Albert M. Parker
ATTORNEY.

Dec. 23, 1958

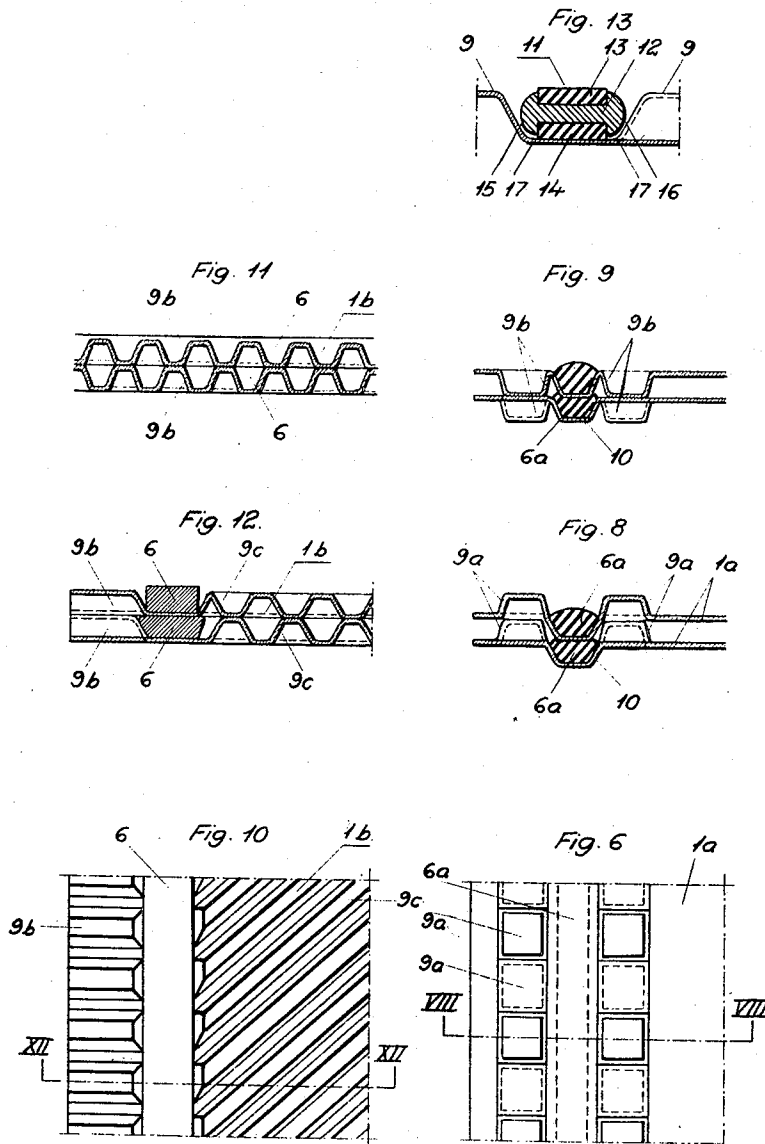
G. C. EGENWALL ET AL

2,865,613

PLATE TYPE HEAT-EXCHANGER

Filed Feb. 14, 1955

2 Sheets-Sheet 2



Gustaf Conrad Egenwall
and INVENTORS

Sverre Knut Jenssen
BY

Albert M. Parker
ATTORNEY.

1

2,865,613

PLATE TYPE HEAT-EXCHANGER

Gustaf Conrad Egenwall, Stockholm, and Sverre Knut Jenssen, Saltsjobaden, Sweden, assignors to Aktiebolaget Rosenblads Patent, Stockholm, Sweden, a corporation of Sweden

Application February 14, 1955, Serial No. 487,896

Claims priority, application Sweden February 25, 1954

2 Claims. (Cl. 257—245)

The present invention relates to heat exchangers of the type comprising a plurality of pressed sheet-metal heat transmission plates which together with interposed strip-sealings or packings extending in a loop form a stack or pile.

It is previously known in connection with heat exchangers of this general type to provide impressions in one flat surface of the plate within the areas thereof encircled by the sealing strips, whereby the opposite flat surface of the plate will show projections or protrusions forming spacing elements or spacers between adjacent plates. The plates are superimposed with the spacers of any one plate extending in the same direction as the spacers of the adjacent plate or plates.

The invention has for its primary object to arrange spacers of this type in a manner so as to prevent the sealing strips positively from being forced out of their proper operative position in sealing engagement with the plates. To this purpose the spacers form, on one hand, positive obstacles against such displacement, and on the other hand, they will also provide space-maintaining elements between adjacent plate-portions situated outside the areas of these plates encircled by the sealing strip, whereby said elements prevent these portions of the plates in the stack from getting spread apart at any place due to pressure exerted by the sealing strip, and thus prevent the sealing strip from being released.

It is also an object of the invention to combine the arrangement stated in the preceding paragraph with sealing strips which are particularly applicable thereto and which might be of previously known types.

The invention is mainly characterized by the feature that each one of the heat transmission plates is provided with such spacers which are disposed in rows and in spaced relation in the longitudinal direction of the sealing strip one such row extending on each side of and adjacent to said sealing strip, in such a manner that said spacers engage an adjacent plate between those impressions therein which correspond to the spacers similarly arranged on the said adjacent plate.

The invention will now be explained more in detail, reference being had to the accompanying drawings illustrating, by way of example, a few practical embodiments thereof, and in which:

Fig. 1 is a plan-view of a heat transmission plate and the associated endless strip-sealing in accordance with the present invention.

Fig. 2 is a plan-view of a heat transmission plate identical to that of Fig. 1 but rotated 180° relative thereto about a central axis perpendicular to its plane.

Fig. 3 is a plan-view of the plate shown in Fig. 1 superimposed on a plate as that shown in Fig. 2 in the same manner as in an actual stack of plates.

Fig. 4 illustrates, on a larger scale, a cross-section taken on the line IV—IV of the border portion A of Fig. 3.

Fig. 5 is an enlarged plan-view of the portion A of Fig. 3 but with the spacing projections arranged in a somewhat modified manner.

2

Fig. 6 is an enlarged plan-view of the portion A of Fig. 3 but with the spacing projections arranged in a further modified manner.

Fig. 7 illustrates the arrangement according to Fig. 5 in cross-section taken on the line VII—VII in this figure.

Fig. 8 illustrates the arrangement according to Fig. 6 in cross-section taken on the line VIII—VIII in this figure.

Fig. 9 illustrates a section view of a modified arrangement according to Fig. 8.

Fig. 10 is an enlarged plan-view of a border portion of Fig. 3 but with the spacing projections further modified.

Fig. 11 illustrates the border portion of Fig. 10 in side view as seen from the left in this figure.

Fig. 12 illustrates the border portion of Fig. 10 in cross-section along the line XII—XII in this figure.

Fig. 13 is a cross-sectional view of a particular type of strip-sealing according to an embodiment of the present invention.

Referring now to the drawings more specifically, in Fig. 1 thereof numeral 1 designates a heat transmission plate having in its four corners openings 2, 3, 4 and 5 which form passages for the heat-exchanging fluid. A sealing strip 6 made of elastic material, such as rubber, extends over the upper flat surface of the plate so as to enclose the passage openings 2 and 4 whilst excluding the passage openings 3 and 5, the latter openings being encircled by separate sealing strips 7 and 8, respectively.

Fig. 2 illustrates a plate identical to that of Fig. 1 but being rotated 180° about an axis perpendicular to the plane of the plate relative to the position of the plate shown in Fig. 1. In addition, the sealing strips are so arranged, contrary to the showing of Fig. 1, that the sealing strip 6 encloses the passage openings 3 and 5 whereas the sealing strips 7 and 8 separately enclose the passage openings 4 and 2, respectively.

Spacing projections 9 on one flat surface of the plate 1 formed by corresponding impressions in the opposite flat surface of the plate are disposed in such a manner that either the sealing strips are disposed in accordance with Fig. 1 or in accordance with Fig. 2, all sealing strips will extend between rows of such projections and in close proximity thereto. These projections, in addition, are disposed in such a manner that, when two identical plates are superimposed as they would be in a stack of plates as illustrated in Fig. 3, with their corresponding flat surfaces facing the same direction and with one plate rotated 180° in its plane relative to the other plate, the spacing projections of one plate will engage the other plate in a staggered relation to the spacing projections corresponding to the impressions of said other plate.

In this position of the plates the spacing projections prevent lateral displacement of the sealing strips between the plates which will be still more apparent from a consideration also of Fig. 4. In a plate stack compressed by clamping end plates, those spacing projections which are disposed exteriorly of the sealing strip will act to prevent any pair of adjacent plates from getting spread apart at any such place due to lateral pressure exerted by the sealing strip, and thus prevent the sealing strip from being released or flexing laterally outwards.

In the embodiment illustrated in Figs. 1 to 4, the spacing projections adjacent one side of the sealing strip are so disposed as to be offset in the longitudinal direction of the sealing strip relative to similar projections forming a row of spaced projections adjacent the other side of the sealing strip. It would also be possible, of course, to arrange the projections of the two rows so as to be aligned in side-by-side relation, as shown in Figs. 5 and 7. They could also have a cross-sectional contour other than a circular one, such as the square contour 9a as

illustrated in Figs. 6 and 8, which, in addition, show a plate 1a of an alternative structural arrangement which, in accordance with prior practice, has formed therein an impressed channel 10 for an endless sealing strip 6a. It has been found that the mere provision of such a channel will not afford adequate security against the sealing strip getting "blown out" at high pressures. However, in combination with the spacing projections according to the present invention full safety against this danger will be ensured, as will be clearly apparent from Fig. 8. Fig. 9 illustrates a modification of the arrangement of Fig. 8, the modification consisting in the feature that the spacing projections have been impressed from the same flat surface of the plate as the channel 10. The lateral sealing-supporting efficiency is virtually the same as that of the arrangement illustrated in Fig. 8.

Fig. 10 illustrates a fragmentary border portion of a plate 1b in which the spacing projections 9b and 9c are in the form of ridges or ribs engaging the sealing strip at their end surfaces. The ridges 9b situated exteriorly of the sealing strip extend at right angles to the latter. The ridges 9c situated interiorly of the sealing strip extend at an oblique angle to the sealing strip in order to cause any two such plates having their respective ridges 9c crossing each other when superimposed as in a plate stack to support each other by the ridges or ribs of one of the plates while maintaining the flow passage unobstructed for the heat-exchanging fluid between the plates interiorly of the sealing strip, as will be apparent from Fig. 12. The ridges 9b could be arranged obliquely as well, for instance as continuations of the ridges 9c, and crossing each other in the operative position of any two plates in the pile so as to form supporting and spacing elements between such plates, also exteriorly of the sealing strip. Figs. 10 and 11 in combination, however, illustrate an example in which the ridges 9b of one plate are arranged centrally between, and in parallel relation to, identical ridges of the other plate.

In the embodiments illustrated in Figs. 1 to 9, for the sake of clarity, the spacing and strip-guiding projections of each row are shown as spaced at larger intervals than would often be suitable in actual practice in order safely to prevent a sealing strip deformable in all directions from flexing out along its non-guided portions. Fig. 10 however, also in this respect corresponds to a practical embodiment. In many cases, however, spaces of the order of magnitude indicated in the other figures could also be satisfactory in combination with a sealing strip which is reinforced so as to be able, at least at reasonable spaces between the guiding supports, to resist deformation by pressures acting along the planes of the plates. As an example of such a constructional form of a reinforced sealing strip of a type which is known per se except for a novel feature of importance in the actual connection, reference is now made to Figure 13. This sealing member or packing 11 comprises a strip 12 of metal or any suitable other material of a considerably higher mechanical strength than that of the sealing surfaces proper, and having a cross-sectional contour in the form of a lying I embracing on its both sides sealing insert strips 13 and 14, respectively, for instance of rubber or any suitable plastic material, such as Teflon or the like.

The novel feature of this construction resides in that the metal strip is formed along the central portions of the two lateral edges 15 and 16, respectively, of the sealing member in such a manner as to project sufficiently

in lateral direction beyond the remainder of the member to enable the sealing element, by said central portions, to engage the spacing projections without any possibility of sliding up the fillets 17 around the base of the projections inevitably involved in the pressing operation, which action would cause twisting of the sealing strip-member. If such a rigid sealing member is to be rearrangeable from a position as according to Figure 1 into the position illustrated in Figure 2, this operation could not be executed practically in connection with a re-establishment of the sealing member into its new shape but should be carried out simply after turning the sealing member 180° about an axis extending in the plane of the loop formed by said member. In order to cause the sealing member to be accommodated properly also in this reversed position, it is made symmetrical relative to the center plane of the sealing member. It would be throughout possible, of course, also to produce an integral one-piece soft sealing strip having such a symmetrical contour, and to treat the latter in the same manner as the former upon rearrangement of the same.

It is to be understood that the embodiments described hereinbefore in conjunction with the accompanying drawings have been chosen merely by way of example, and that many other modifications are possible without departing from the scope of the invention, both by further combining the embodiments exemplified, and by directly modifying these embodiments.

What we claim and desire to secure by Letters Patent is:

1. A heat exchanger comprising in combination a plurality of heat transmission plates integrally formed into their final shape out of thin plate material and arranged in spaced stacked relationship, string shaped circumferential border packings between each pair of adjacent heat transmission plates, said packings running along edge portions of said plates at a distance from the free edges thereof and being directly opposite each other when viewed in a direction perpendicular to the plates, said edge portions outside the packings having integrally formed spacers between adjacent edge portions of each pair of adjacent heat transmission plates, said spacers being arranged in a row in closely spaced relation to each other along and close to the outer side of the packing and consisting of protrusions on one side of the edge portion of one of the adjacent plates formed by corresponding impressions in the other side of said edge portion, all such spacers protruding in the same direction in the heat exchanger and abutting against the adjacent edge portion of an adjacent heat transmission plate between spacer forming impressions therein.

2. A heat exchanger as claimed in claim 1 wherein the spacers outside the packing are arranged to form the only support for the packing in its lateral outward direction.

References Cited in the file of this patent

UNITED STATES PATENTS

2,039,216	Feldmeier	Apr. 28, 1936
2,203,123	Astle	June 4, 1940
2,217,567	Seligman et al.	Oct. 8, 1940
2,281,754	Dalzell	May 5, 1942

FOREIGN PATENTS

537,477	Great Britain	June 24, 1941
---------	---------------	---------------

OTHER REFERENCES

Ser. No. 402,669, Nanz (A. P. C.), published May 25, 1943.