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(54) **Tank header plate connection.**

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EP 0 169 632 B2

Description

This invention relates to heat exchangers of the type having a header plate supporting the open ends of a plurality of tubes and a tank secured to the header plate.

The efforts by the automotive industry to reduce the weight of vehicles have brought about an increasing use of non-metallic materials in various parts of vehicles. Heat exchangers, more commonly termed radiators, are no exception. While metal materials are still employed in the cores for such heat exchangers because of their greater thermal conductivity over plastics, other heat exchanger components that do not require good thermal conductivity are being made of plastic. A primary example is the so-called tank which is fitted to the heat exchanger core, typically by securement to the header plates which define the ends of such cores.

Because the joint between the header plate and the tank is one of dissimilar materials, prior techniques of brazing or soldering the joint can no longer be employed. In lieu thereof, to effect the necessary seal, a gasket is disposed between the tank and the header plate and any of a variety of means are employed to hold the components in assembled relation with the gasket under compression to assure a seal at the operating pressures for which the heat exchanger was designed.

It is, of course, necessary that the means employed to effect the connection be strong and long lived to prevent leakage. At the same time, it is desirable that the means be such that disassembly of the component parts can be effected when required for servicing. It is also desirable that the means utilized lend themselves to use in mass production to minimize cost.

Attempts to achieve these objects have resulted in proposals wherein a header plate is provided with a peripheral groove in which the gasket to be compressed may be disposed. The tank is provided with a peripheral flange sized to be received in the groove and adapted to compress the gasket therein. The outer wall of the groove is then deformed in part to overlie the flange on the tank and hold the same in a position compressing the gasket. This approach is exemplified by US-A-4 331 201 which discloses the features according to the precharacterising part of claim 1.

Unfortunately, because this approach involves deformation of a metal wall which necessarily may be sufficiently thin as to be easily deformed, the same may not always be as strong as might be desired. Pressure within the system during operation will act against the deformed material and tend to deform it back toward its original configuration. When such occurs, the compressive forces exerted on the gasket are lessened and leakage may occur.

According to the present invention there is provided a heat exchanger comprising : a metal header plate supporting the open ends of a plurality of tubes ; a gasket receiving area extending about the periphery of said header plate and having a bottom wall surrounded by an upstanding deformable side wall terminating in an edge ; a compressible gasket in said gasket receiving area ; a plastics tank having an opening surrounded by an outwardly extending flange, said flange being sized and configured to be fitted within said gasket receiving area with one side of the flange abutting said gasket and another side of the flange within said area and spaced from said side wall edge, said tank compressing said gasket so that said gasket effects a seal between said tank and said header plate ; and a plurality of tabs in said side wall overlying said another side to hold said tank in compressing relation to said gasket, each said tab being formed by deformation and piercing of said side wall after said flange has been fitted within said gasket receiving area to have a nominally planar, free edge displaced from said side wall and in contact with said another side of said flange, characterised in that each said tab is located below the side wall edge and tapers from said free edge toward said side wall edge to merge into said side wall on all sides of said tab except that defining the free edge prior to or at said side wall edge and that said side wall in the area of said tabs and above said free edge is deformed towards said tank to at least overlie said flange to assure abutment of said free edges with said another side.

The chosen configuration of the tabs provides excellent force distribution to the side wall of the gasket receiving area or groove so as to provide excellent resistance to deformation back toward the original shape. At the same time, the tabs are easily formed according to mass production techniques and, where necessary, may be intentionally deformed back to their original configuration to allow disassembly of the components.

Preferably, each tab is generally part eggshaped, or part spherical.

The tabs may be formed in the side wall by punching or piercing. No restraint is placed on the portion of the side wall wherein the tabs are formed such that such portion may be slightly bent toward the tank. Thereafter the side wall is rolled or bent from the vertical to partially overlie the flange such that the free edges of the tabs are parallel to the upper surface of the flange.

The invention will be better understood from the following description or a preferred embodiment thereof, given by way of example only reference being had to the accompanying drawings, wherein :

Fig. 1 is a perspective view of a tank assembled to a header plate by a connection made according to the invention ;

Fig. 2 is a fragmentary, enlarged elevation of the

assembly ;

Fig. 3 is a further enlarged, sectional view taken approximately along the line 3-3 in Fig. 2 ; and

Fig. 4 is a fragmentary enlarged view of the header plate with a tab formed therein but with the tank removed for clarity.

Description of the Preferred Embodiment

An exemplary embodiment of the invention is illustrated in the drawing and with reference to Figs. 1 and 3 thereof, is seen to include a radiator tank 10, typically formed of plastic, and a header plate 12 formed of metal. Conventionally, the header plate 12 receives the open ends 14 of a plurality of tubes 16 (only one of which is shown). The tank 10 has an opening 18 which is surrounded by an outwardly directed flange 20 having upper and lower sides 22 and 24, respectively. One or more coolant ports 26 are provided for the tank 10. As best seen in Fig. 3, the header plate 12, at its periphery, includes a groove, generally designated 28. The groove 28 is defined by an upstanding, outer side wall 30, a bottom wall 32 and an inner wall 34 generally parallel to the outer wall 30 which merges with the main body of the header plate 12 by means of a round 36. As can be seen, the groove 28 and flange 20 are sized and configured so that the latter may be received in the former.

A compressible gasket 40 is disposed in the groove 28 in abutment with the bottom wall 32 thereof and the tank 10 oriented so that the flange 20 may be introduced into the groove 28. Upon introduction of the flange 20 into the groove, the surface 24 is brought into abutment with the gasket 40 and continued urging of the tank 10 toward the header plate 12 will result in the gasket 40 being compressed to the desired degree. In the usual case, somewhat more than the desired compression force will be placed on the components to allow a series of tabs 42 to be deformed from the wall 30 to overlie the surface 22 of the flange 20. When the tabs 42 have been formed, the compressive force may be released and the structure will assume the configuration illustrated in Fig. 3.

To assure good retentive strength and a resistance to deformation in response to pressure within the tank 10, the tabs 42 have the shape of one quadrant of a sphere or an egg. They include a curved lower free edge 44 which is nominally planar and overlies and abuts the surface 22 of the flange 20. The tabs 42 gradually taper from their edges 44 toward the outer side wall 30 to line 46. Generally, the edge 48 of the sidewall 30 is reached such that a space 50 exists between the edge 48 and the tab 42.

The tabs may be formed in one single operation with an appropriate shaped tool which effectively pierces the outer wall 30 to define a free edge 44 while deforming a portion of the wall 30 to define the body of the tab 42. This forming process is readily adaptable to mass production techniques.

To simplify the assembly operation, and to minimize the tooling required, the upper portion 52 of the side wall 30 wherein the tabs 42 are formed is not restrained oppositely of the advancing punching or piercing tool during the punching or piercing operation. This in turn may result in the upper portion 52 of the side wall 30 being slightly bent toward the tank 10.

Because the tabs 42 are formed by deforming metal, metal flow during the forming operation may result in the free edges 44 of the tabs being increasingly spaced from the upper surface of the flange 20 in the direction away from the side wall 30 and toward the tank 10. Consequently, to bring the entire extent of each free edge 44 into contact with the upper surface of the flange 20, following the operation wherein the tabs 42 are formed. The invention contemplates that the upper portion 52 of the side wall may be further bent along a line 54 approximately at the level of the free edges 44 in the direction of the tank 10. As a consequence, the upper portion 52 of the side wall 30 will remain upstanding but will partially overlie the flange 20 and the free edges 44 will be parallel to and abut the upper surface of the flange 50. The bending operation can be performed by any suitable process as, for example, by rolling. In a preferred embodiment, the upper portion 52 is bent approximately 30° from the vertical toward the tank 10.

It will be appreciated that when necessary, the tabs 42 may be deformed back to their original shape if, for any reason, it is necessary to remove the tank 10 from the remainder of the assembly. In this regard, it is desirable that the tabs 42 or the upper portion 54 of the side wall 30 do not extend inwardly to be in contact with a side wall 56 of the tank 10 so as to allow insertion of a tool to accomplish such deformation.

Finally, it will be appreciated that the geometry of the tabs 42 assures that forces tending to separate the tank 10 from the header plate 12 will be evenly distributed to the outer wall 30 to resist deformation of the same that could result in release of compressive force on the gasket 40 that could in turn result in leaks. The free edges 44 provide a substantial zone of contact with the flange surface 22 and such forces as are placed against the edges 44 are distributed to the remainder of the respective tab 42 which will be placed in compression without an appreciable bending moment applied thereto. Consequently, an extremely reliable and easily formed connection is provided by the invention.

Claims

1. A heat exchanger comprising: a metal header plate (12) supporting the open ends of a plurality of tubes (16); a gasket receiving area (28) extend-

ing about the periphery of said header plate and having a bottom wall (32) surrounded by an upstanding deformable side wall (30) terminating in an edge (48); a compressible gasket (40) in said gasket receiving area; a plastics tank (10) having an opening surrounded by an outwardly extending flange (20), said flange being sized and configured to be fitted within said gasket receiving area with one side (24) of the flange abutting said gasket and another side (22) of the flange within said area and spaced from said side wall edge (48), said tank compressing said gasket so that said gasket effects a seal between said tank and said header plate; and a plurality of tabs (42) in said side wall overlying said another side (22) to hold said tank in compressing relation to said gasket, each said tab being formed by deformation and piercing of said side wall after said flange has been fitted within said gasket receiving area to have a nominally planar free edge (44) displaced from said side wall and in contact with said another side (22) of said flange, **characterised in that** each said tab (42) is located below the side wall edge (48) and tapers from said free edge (44) toward said side wall edge (48) to merge into said side wall (30) on all sides of said tab except that defining the free edge prior to or at said side wall edge (48), and said side wall (30) in the area of said tabs (42) and above said free edge (44) is deformed towards said tank (10) to at least overlie said flange (20) to assure abutment of said free edges (44) with said another side (22).

2. A heat exchanger according to claim 1 characterised in that each said tab (42) is generally part egg-shaped or part spherical.

3. A heat exchanger according to claim 1 or claim 2 characterised in that said deformed side wall area is deformed approximately 30 degrees towards said tank (10).

Patentansprüche

1. Wärmetauscher, enthaltend: eine metallische Verteilerplatte (12), die die offenen Enden mehrerer Rohre (16) hält; einen Dichtungsaufnahmebereich (28), der sich um den Umfang der Verteilerplatte erstreckt und eine Bodenwand (32) hat, die von einer nach oben stehenden verformbaren Seitenwand (30) umgeben ist, die in einem Rand (48) endet; eine zusammendrückbare Dichtung (40) in dem Dichtungsaufnahmebereich; einen Kunststofftank (10) mit einer Öffnung, die von einem nach außen vorstehenden Flansch (20) umgeben ist, wobei der Flansch eine solche Größe und Gestalt hat, daß er in den Dichtungsaufnahmebereich paßt, wobei eine Seite (24) des Flansches an der Dichtung anstößt und eine andere Seite (22) des Flansches in dem Bereich liegt und von dem Seitenwandrand (48) beabstandet ist, und der Tank die Dichtung so zusammendrückt, daß die Dichtung einen Abschluß zwischen dem Tank und der Verteilerplatte bewirkt, und weiterhin enthaltend mehrere Nasen (42) in der Seitenwand, die über der genannten anderen Seite (22) liegen, um den genannten Tank in der die Dichtung zusammendrückenden Lage zu halten, wobei jede Nase nach Einpassen des Flansches in den Dichtungsaufnahmebereich durch Verformung und Ausstanzung der Seitenwand ausgebildet ist, um einen nominell ebenen, freien Rand (44) aufzuweisen, der gegenüber der Seitenwand versetzt ist und mit der genannten anderen Seite (22) des Flansches in Berührung ist, dadurch gekennzeichnet, daß jede Nase (42) unterhalb des Seitenwandrandes (48) angeordnet ist und sich von dem genannten freien Rand (44) zum Seitenwandrand (48) hin konisch verjüngt, um an allen Nasenseiten, mit Ausnahme der den freien Rand definierenden Seite, in die Seitenwand (30) vor oder an dem Seitenwandrand (48) überzugehen, und die Seitenwand (30) im Bereich der Nasen (42) und oberhalb des freien Randes (44) zum Tank (10) hin verformt ist, um wenigstens über dem Flansch (20) zu liegen, um ein Anstoßen der freien Ränder (44) an der genannten anderen Seite (22) sicherzustellen.

2. Wärmetauscher nach Anspruch 1, dadurch gekennzeichnet, daß jede Nase (42) teileiförmig oder teilsphärisch ist.

3. Wärmetauscher nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der umgebogene Seitenwandbereich um ungefähr 30° zum Tank (10) hin verformt ist.

Revendications

1. Echangeur de chaleur comprenant : une plaque d'embase métallique (12) portant les extrémités ouvertes de plusieurs tubes (16) ; une aire (28) de réception de joint s'étendant suivant la périphérie de ladite plaque d'embase et possédant une paroi de fond (32) entourée par une paroi latérale déformable verticale (30) se terminant en un bord (48) ; un joint compressible (40) dans ladite aire de réception de joint ; une cuve (10) en matière plastique possédant une ouverture qui est entourée par un rebord s'étendant vers l'extérieur (20), ledit rebord étant dimensionné et configuré de façon à s'ajuster à l'intérieur de la-

dite aire de réception de joint, si bien qu'un premier côté (24) du rebord soit en appui sur ledit joint et qu'un autre côté (22) du rebord se trouve à l'intérieur de ladite aire et écarté dudit bord (48) de la paroi latérale, ladite cuve comprimant ledit joint si bien que le joint assure l'étanchéité entre ladite cuve et ladite plaque d'embase ; et plusieurs pattes (42) ménagées dans ladite paroi latérale de façon à se trouver au-dessus dudit autre côté (22) afin de maintenir ladite cuve en relation de compression vis-à-vis dudit joint, chaque dite patte étant formée par déformation et poinçonnage de ladite paroi latérale après l'introduction dudit rebord dans ladite aire de réception de joint de manière à comporter un bord libre (44) sensiblement plan écarté de ladite paroi latérale et en contact avec ledit autre côté (22) dudit rebord, caractérisé en ce que chaque dite patte (42) est placée au-dessous du bord (48) de la paroi latérale et s'incline dudit bord libre (44) vers ledit bord (48) de la paroi latérale, de façon à se fondre dans ladite paroi latérale (30) de tous les côtés de ladite patte sauf du côté qui définit le bord libre avant ledit bord (48) de la paroi latérale ou au niveau de celui-ci, et ladite paroi latérale (30) est, dans la zone desdites pattes (42) et au-dessus dudit bord libre (44), déformée en direction de ladite cuve (10) jusqu'à au moins surmonter ledit rebord (20) afin d'assurer un appui desdits bords libres (44) sur ledit autre côté (22).

2. Echangeur de chaleur selon la revendication 1, caractérisé en ce que ladite patte (42) est sensiblement de forme partiellement ovoïde ou partiellement sphérique.

3. Echangeur de chaleur selon la revendication 1 ou 2, caractérisé en ce que ladite aire de paroi latérale déformée est déformée sensiblement de 30° en direction de ladite cuve (10).

Fig. 1.

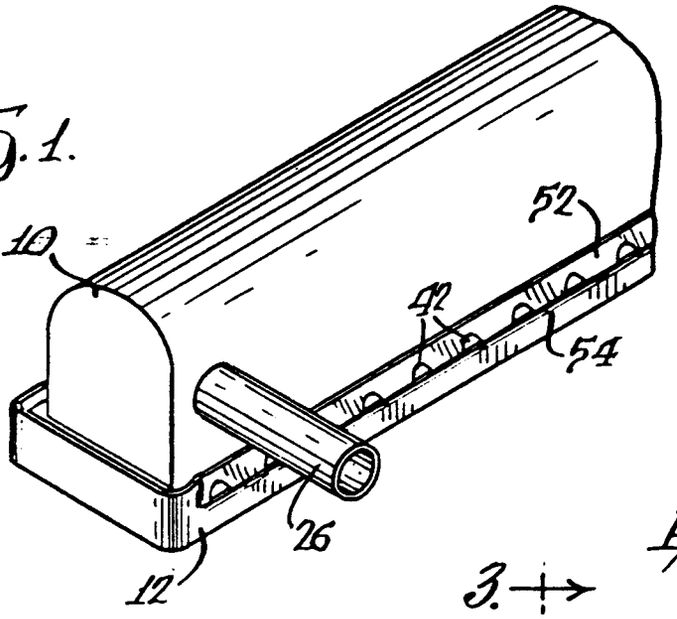

Fig. 2.

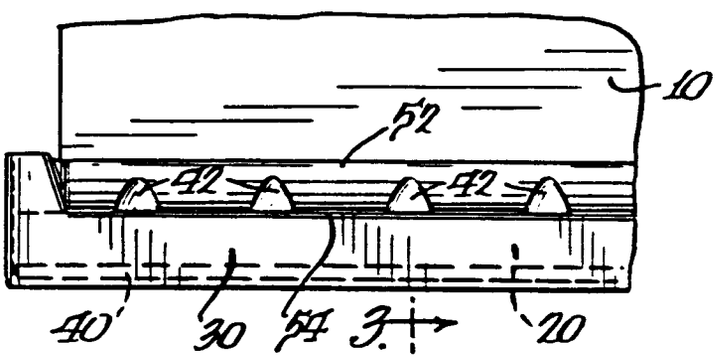

Fig. 3.

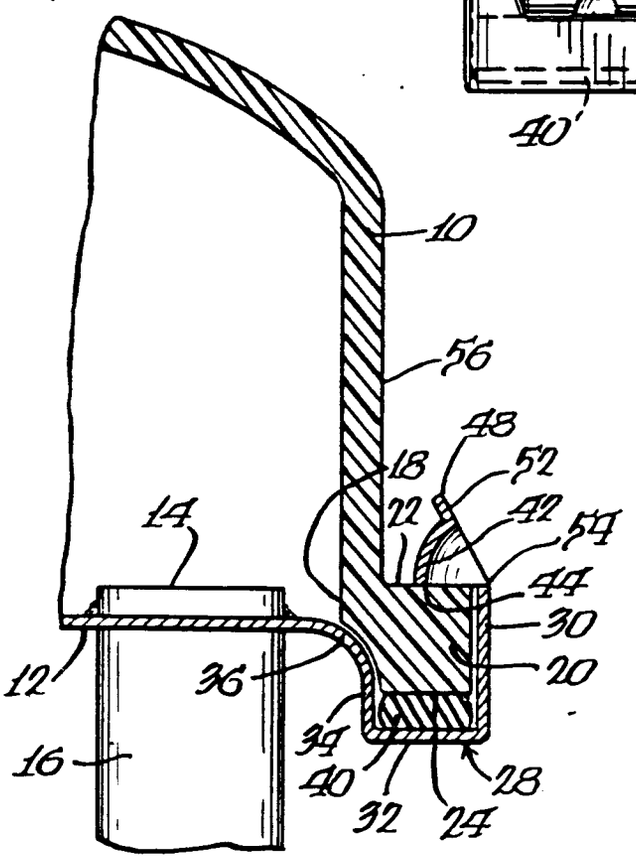

Fig. 4.