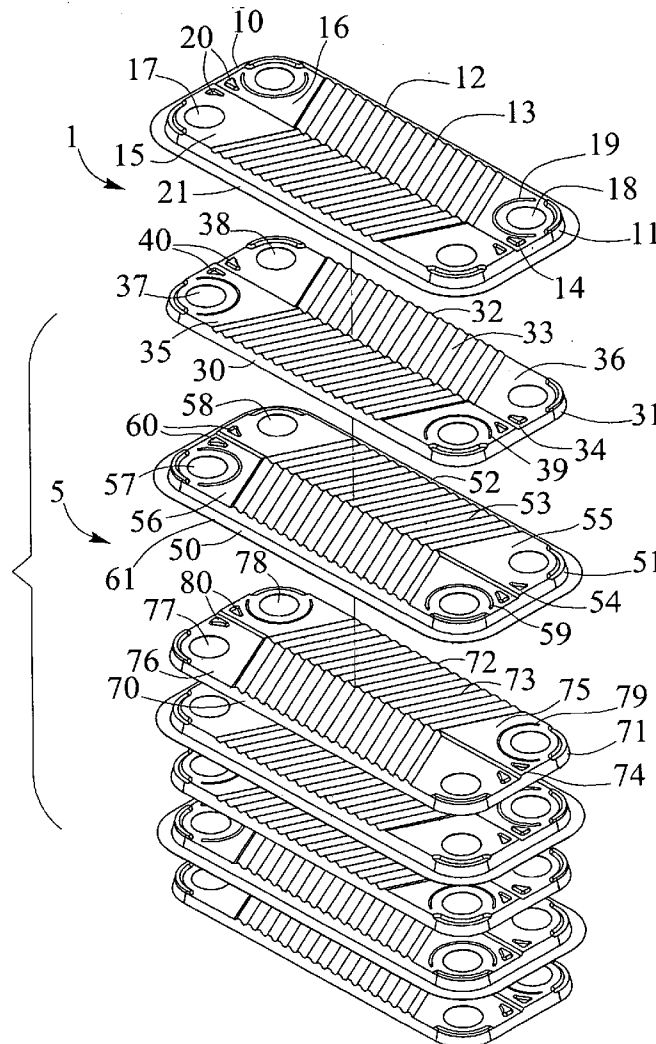




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(19) **United States**(12) **Patent Application Publication****HAN et al.**(10) **Pub. No.: US 2016/0040943 A1**(43) **Pub. Date: Feb. 11, 2016**(54) **HEAT EXCHANGER**(71) Applicant: **KAORI HEAT TREATMENT CO., LTD.**, Taoyuan Hsien (TW)(72) Inventors: **Hsien Sou HAN**, Taoyuan Hsien (TW);
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Chenchou HSIEH, Taoyuan Hsien (TW)(21) Appl. No.: **14/453,661**(22) Filed: **Aug. 7, 2014****Publication Classification**(51) **Int. Cl.**
F28F 9/26 (2006.01)(52) **U.S. Cl.**CPC **F28F 9/26** (2013.01)(57) **ABSTRACT**

A heat exchanger includes a housing and a plate having four corner areas secured together, and four outer peripheral sides spaced from each other, and a flowing channel formed between corrugated structures of the housing and the plate, the housing and the plate each include a recess for forming a higher side platform and a lower side surface, and a casing and a board are disposed below the plate and have four corner areas secured together and four outer peripheral sides spaced from each other, and having a passageway formed between corrugated structures of the casing and the board, the casing and the board each include a depression for forming a higher side platform and a lower side surface and located below the lower side surfaces and the higher side platforms of the housing and the plate respectively.



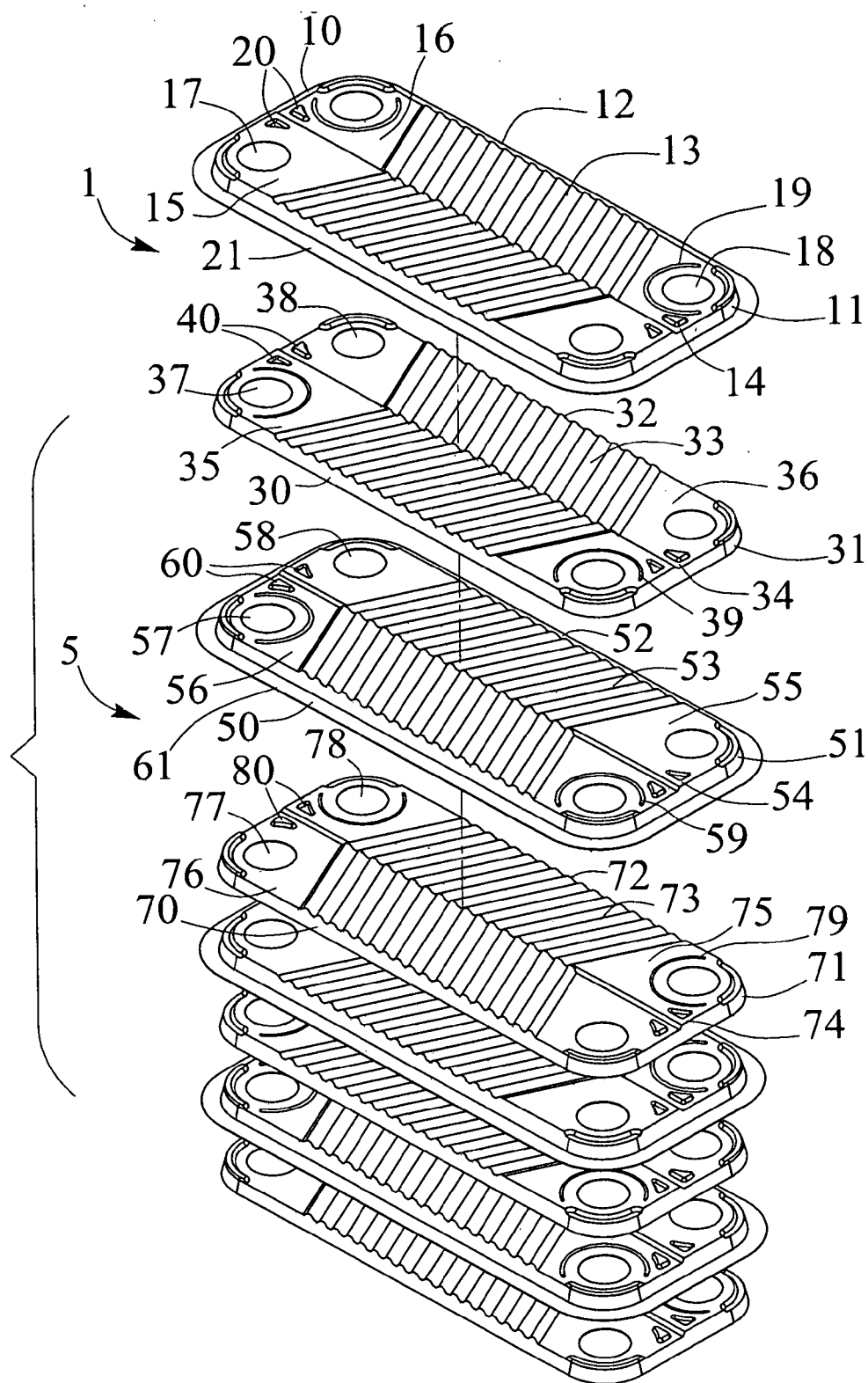


FIG. 1

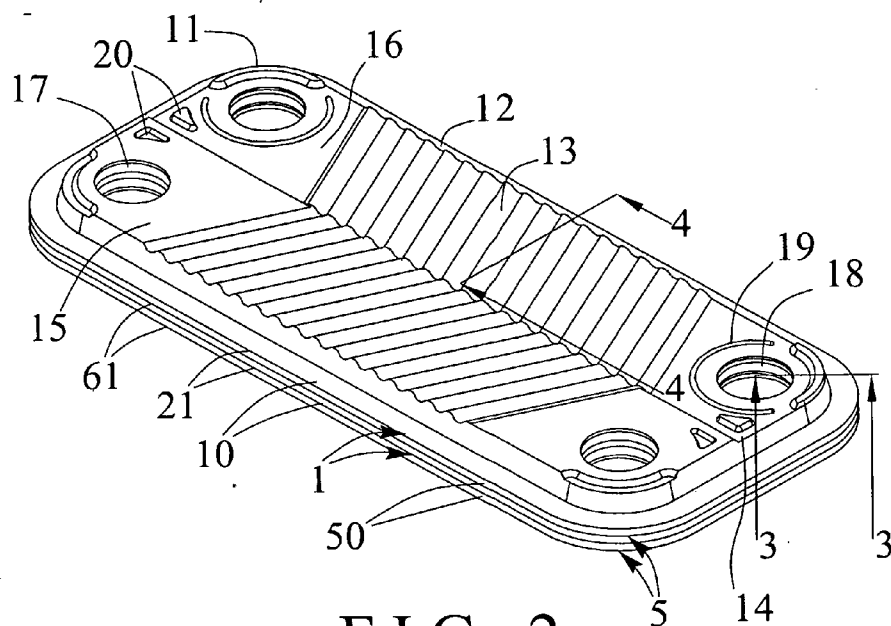


FIG. 2

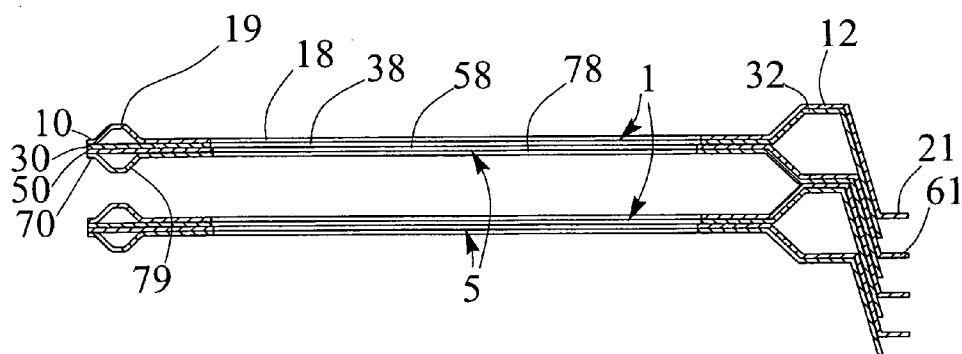


FIG. 3

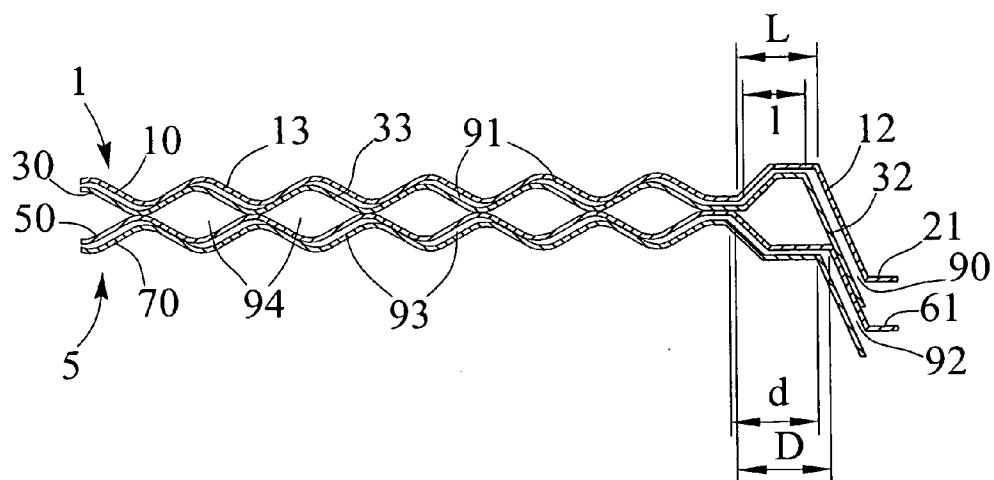


FIG. 4

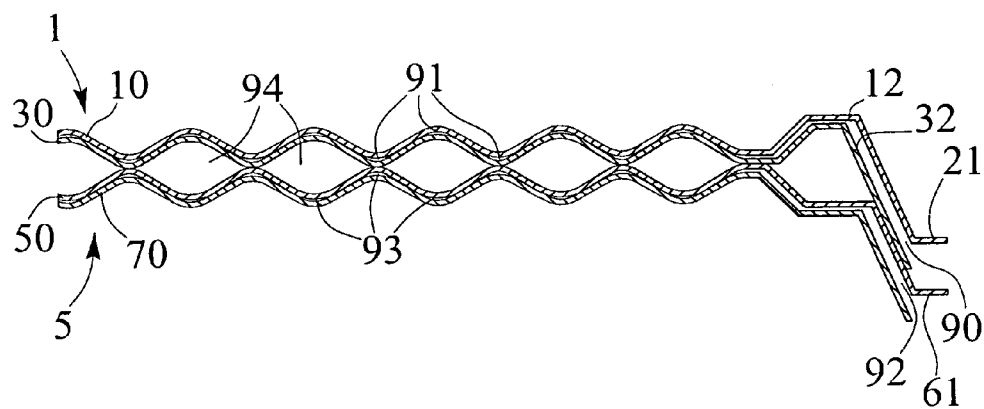


FIG. 5

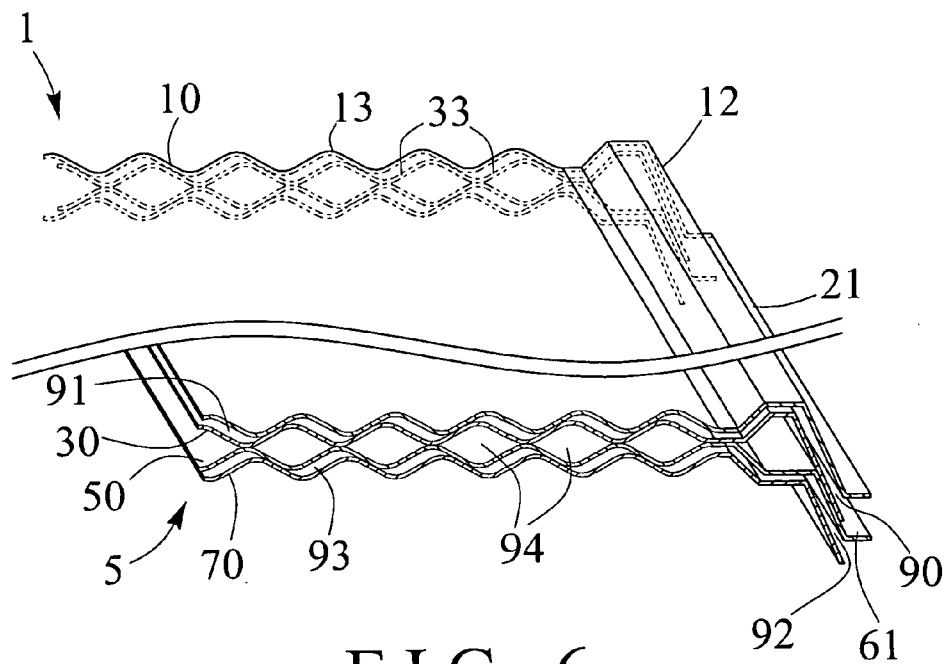


FIG. 6

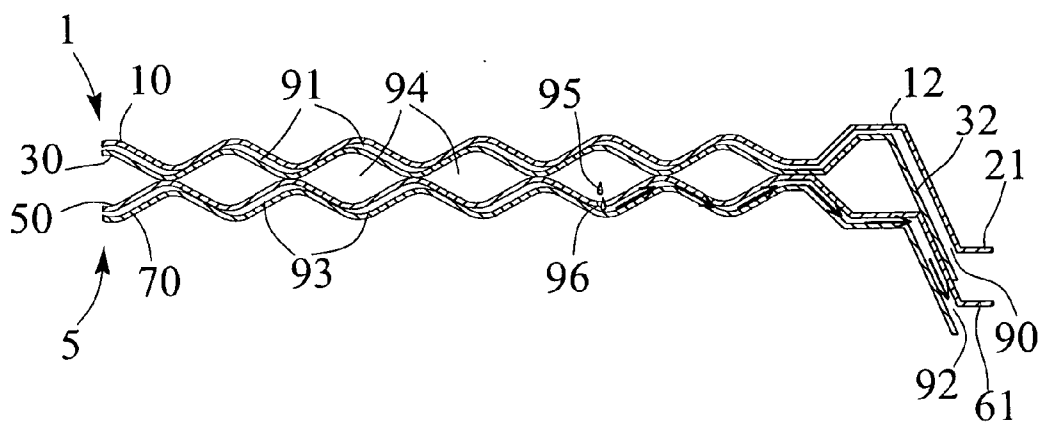


FIG. 8

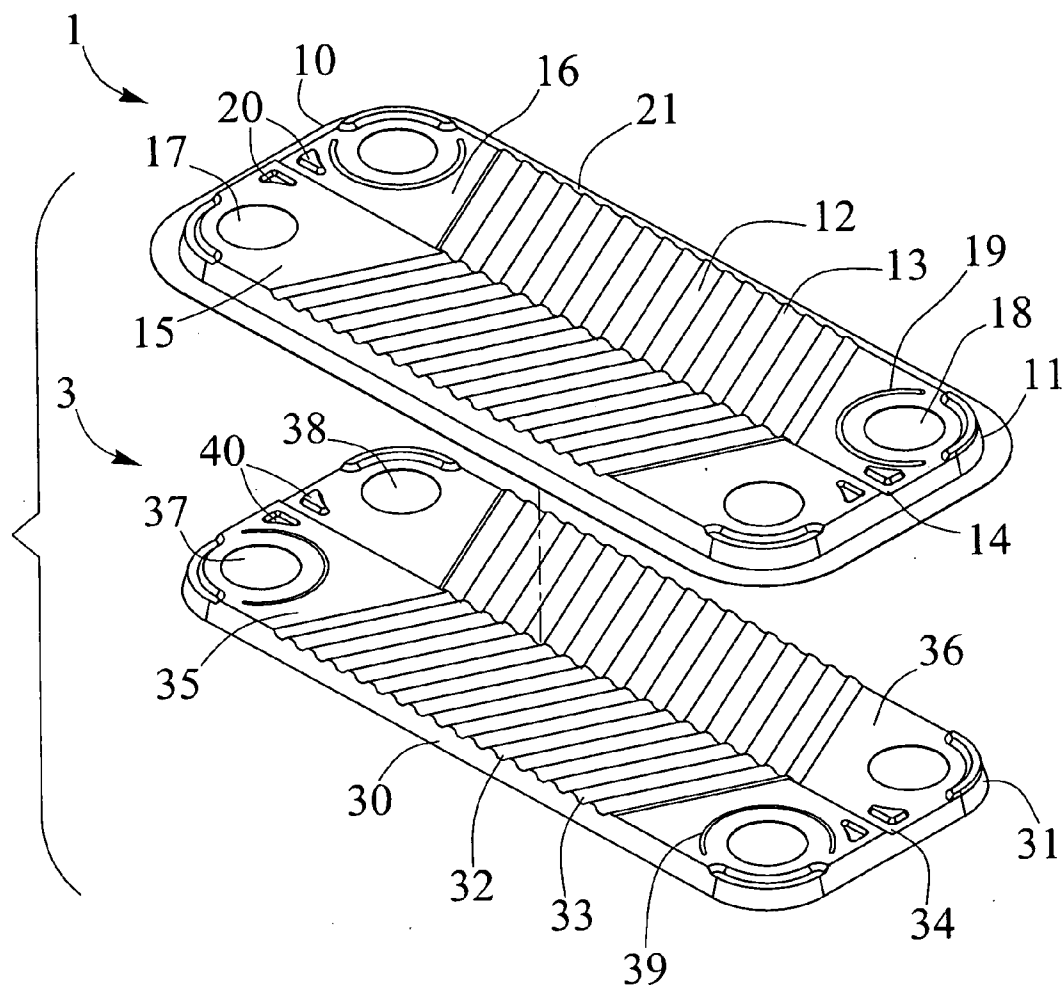


FIG. 7

HEAT EXCHANGER

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a heat exchanger, and more particularly to a heat exchanger having an improved structure or configuration for suitably detecting the leaking problem of the heat exchanging plates or boards or housings and for preventing the fluids in different flowing paths of the heat exchanging plates or boards or housings from being mixed or brazed together and for preventing explosions from being occurred or generated.

[0003] 2. Description of the Prior Art

[0004] Typical heat exchangers comprise a receptacle including a chamber formed therein for receiving a heat media, such as water or fluid, and an inlet and an outlet provided therein for allowing the heat media or water or fluid to flow into and out of the chamber of the receptacle. The receptacle further includes a number of plates or boards or housings disposed therein, and superposed with each other, and each having a corrugated structure arranged to allow the heat media or water or fluid to flow through the corrugated plates or boards or housings, and to allow the heat media or water or fluid to be heat exchanged indirectly with the other heat media within the chamber of the receptacle.

[0005] For example, U.S. Pat. No. 2,617,634 to Jendrassik, U.S. Pat. No. 3,444,926 to Stalberg, U.S. Pat. No. 4,246,926 to Morello, U.S. Pat. No. 4,580,625 to Yamanaka et al., and U.S. Pat. No. 5,971,065 to Bertilson et al. disclose several of the typical plate heat exchangers each comprising a receptacle including a number of plates or boards or housings disposed therein, and superposed with each other, and each of the plates or boards including an inlet opening and an outlet opening provided therein and each formed by an inner peripheral flange for allowing the heat media or water or fluid to flow into and out of the receptacle through the openings.

[0006] However, the plates or boards or housings are normally well secured or welded together and may not be easily opened, such that the leaking problem of the heat exchanging plates or boards or housings may not be easily detected and realized, and two or more of the fluids or heat media may have a good chance to be mixed or brazed together, and explosions may be occurred or generated inadvertently some times.

[0007] The present invention has arisen to mitigate and/or obviate the afore-described disadvantages of the conventional heat exchanging plates or boards or housings for the heat exchangers.

SUMMARY OF THE INVENTION

[0008] The primary objective of the present invention is to provide a heat exchanger including an improved structure or configuration for suitably detecting the leaking problem of the heat exchanging plates or boards or housings and for preventing the fluids in different flowing paths of the heat exchanging plates or boards or housings from being mixed or brazed together and for preventing explosions from being occurred or generated.

[0009] In accordance with one aspect of the invention, there is provided a heat exchanger comprising a first heat exchanging unit including a housing and a plate having four corner areas secured together, and having four outer peripheral sides spaced from each other for forming a slot between the outer peripheral sides of the housing and the plate, the housing and

the plate each including a corrugated structure and having a flowing channel formed between the corrugated structures of the housing and the plate and communicating with the slot that is formed between the outer peripheral sides of the housing and the plate, the housing and the plate each including a recess formed therein for forming a first higher side platform and a first lower side surface, and the housing and the plate each including two orifices formed in the first higher side platform, and each including two apertures formed in the first lower side surface, and a second heat exchanging unit including a casing and a board disposed below the plate of the first heat exchanging unit and having four corner areas secured together and secured to the corner areas of the housing and the plate, and having four outer peripheral sides separated from each other for forming a slit between the outer peripheral sides of the casing and the board, the casing and the board each including a corrugated structure and having a passage-way formed between the corrugated structures of the casing and the board and communicating with the slit that is formed between the outer peripheral sides of the casing and the board, the casing and the board each including a depression formed therein for forming a second higher platform and a second lower side surface, the second higher side platforms of the casing and the board being located below the first lower side surfaces of the housing and the plate, and the second lower side surfaces being located below the first higher side platforms of the housing and the plate, and the casing and the board each including two holes formed in the second higher side platform and aligned with the orifices of the housing and the plate respectively, and the casing and the board each including two openings formed in the second lower side surface and aligned with and communicating with the apertures of the housing and the plate respectively.

[0010] The first higher side platforms of the housing and the plate are superposed with each other, and the first lower side surfaces of the housing and the plate are superposed with each other. The second higher side platforms of the casing and the board are also superposed with each other, and superposed with the first lower side surfaces of the housing and the plate, and the second lower side surfaces of the casing and the board are also superposed with each other.

[0011] The housing preferably includes an outer peripheral skirt extended laterally and outwardly therefrom. The casing preferably includes an outer peripheral skirt extended laterally and outwardly therefrom. The orifices of the housing and the plate are preferably located in two of the corner areas of the housing and the plate, and the apertures of the housing and the plate are preferably located in the other two corner areas of the housing and the plate. The holes of the casing and the board are preferably located in two of the corner areas of the casing and the board, and the openings of the casing and the board are preferably located in the other two corner areas of the casing and the board.

[0012] The outer peripheral sides of the housing and the plate include a shape or structure or width different from each other for forming the slot between the outer peripheral sides of the housing and the plate. The outer peripheral sides of the casing and the board include a shape or structure or width different from each other for forming the slit between the outer peripheral sides of the casing and the board.

[0013] The corrugated structures of the casing and the board include a structure different from each other for forming the flowing passageway between the corrugated structures of the casing and the board. The corrugated structures of

the housing and the plate include a structure different from each other for forming the flowing channel between the corrugated structures of the housing and the plate.

[0014] The housing and the plate include an engaging element engaged with each other for anchoring the housing and the plate together. The casing and the board include an engaging element engaged with each other for anchoring the casing and the board together.

[0015] The housing includes two curved grooves formed around the apertures of the housing, and the plate includes two curved grooves formed around the orifices of the plate. The casing includes two curved grooves formed around the openings of the casing, and the board includes two curved grooves formed around the holes of the board.

[0016] Further objectives and advantages of the present invention will become apparent from a careful reading of the detailed description provided hereinbelow, with appropriate reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a partial exploded view illustrating four sets of superposed heat exchanging plates or boards or housings for a heat exchanger in accordance with the present invention;

[0018] FIG. 2 is a perspective view of the heat exchanger;

[0019] FIG. 3 is a partial cross sectional view of the heat exchanger taken along lines 3-3 of FIG. 2;

[0020] FIG. 4 is another partial cross sectional view of the heat exchanger taken along lines 4-4 of FIG. 2;

[0021] FIG. 5 is a further partial cross sectional view similar to FIG. 4, illustrating the other arrangement of the heat exchanger;

[0022] FIG. 6 is an enlarged partial perspective view illustrating a portion of the heat exchanger;

[0023] FIG. 7 is another partial exploded view of the heat exchanger; and

[0024] FIG. 8 is a still further partial cross sectional view similar to FIGS. 4 and 5, illustrating the operation of the heat exchanger.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0025] Referring to the drawings, and initially to FIGS. 1-7, a heat exchanger in accordance with the present invention comprises a number of heat exchanging plates or housings or boards disposed and superposed with each other, for example, as shown in FIGS. 1 and 2, a combination of two heat exchanging assemblies are shown and illustrated, and two or more heat exchanging assemblies may be disposed one above the other and superposed with each other for forming or defining the heat exchanger combination as shown in FIG. 1, however, only one of the heat exchanging assemblies will be discussed hereinafter.

[0026] For example, as shown in FIGS. 1 and 3-6, the heat exchanging assemblies each include two heat exchanging devices or sets or units 1, 5 also disposed one above the other and superposed with each other, the upper or first heat exchanging unit 1 includes an upper or covering housing 10 and a base or lower plate 30 also disposed one above the other and superposed with each other, and the lower or second heat exchanging unit 5 includes an upper or covering casing 50 and a base or lower board 70 also disposed one above the

other and superposed with each other, and superposed with and disposed below the plate 30 of the upper or first heat exchanging unit 1.

[0027] The housing 10 and the plate 30 of the upper or first heat exchanging unit 1 include a substantially rectangular structure or configuration or shape having four corner areas 11, 31 and four outer peripheral sides 12, 32, in which the corner areas 11, 31 of the housing 10 and the plate 30 are secured or welded together, best shown in FIG. 3, and the outer peripheral sides 12, 32 of the housing 10 and the plate 30 are slightly spaced or disengaged or separated from each other (FIGS. 4, 5) for forming or defining a gap or slit or slot 90 between the outer peripheral sides 12, 32 of the housing 10 and the plate 30. For example, the outer peripheral sides 12, 32 of the housing 10 and the plate 30 may include a shape or width or length (L, 1, FIG. 4) different from each other for forming or defining the slot 90 between the outer peripheral sides 12, 32 of the housing 10 and the plate 30.

[0028] As also shown in FIGS. 4, 5, the housing 10 and the plate 30 each include a corrugated configuration or shape or structure 13, 33 formed or provided thereon and substantially aligned with each other, but offset or spaced or separated from each other for forming or defining a flowing channel 91 between the corrugated structures 13, 33 of the housing 10 and the plate 30 and arranged for allowing the water or fluid or heat media to flow through the flowing channel 91 of the housing 10 and the plate 30 with an increased contacting area, and the corrugated structures 13, 33 of the housing 10 and the plate 30 may include a structure or shape different from each other for forming or defining the flowing channel 91 of different space or shape or the like.

[0029] The flowing channel 91 of the housing 10 and the plate 30 is communicating with the slot 90 that is formed and provided between the outer peripheral sides 12, 32 of the housing 10 and the plate 30 for allowing the water or fluid or heat media to selectively flow out through the slot 90 of the housing 10 and the plate 30. It is preferable, but not necessary that the flowing channel 91 of the housing 10 and the plate 30 is formed and provided through the length of the corrugated structures 13, 33 of the housing 10 and the plate 30, best shown in FIG. 6, and may be partially communicating with the slot 90 that is formed and provided between the outer peripheral sides 12, 32 of the housing 10 and the plate 30.

[0030] As shown in FIG. 7, the housing 10 and the plate 30 each include a notch or depression or recess 14, 34 formed therein, such as formed in one half of the housing 10 and the plate 30 respectively for forming or defining a higher left side surface or platform 15, 35 and a lower right side surface 16, 36, in which the higher side platform 15, 35 and the lower side surface 16, 36 are preferably parallel to each other and each occupy about one half of the housing 10 and the plate 30 respectively, and the housing 10 and the plate 30 each include two orifices 17, 37 formed in the higher side platform 15, 35 respectively and spaced or separated from each other and preferably located in two of the corner areas 11, 31 of the housing 10 and the plate 30, and each include two apertures 18, 38 formed in the lower side surface 16, 36 respectively and spaced or separated from each other, and located in the other two corner areas 11, 31 of the housing 10 and the plate 30.

[0031] The higher side platforms 15, 35 of the housing 10 and the plate 30 are superposed with each other, and the lower side surfaces 16, 36 of the housing 10 and the plate 30 are also superposed with each other, and the orifices 17, 37 and the

apertures **18, 38** of the housing **10** and the plate **30** are aligned with each other respectively for forming or defining the fluid flowing orifices **17, 37** and fluid flowing apertures **18, 38** in the housing **10** and the plate **30**. The housing **10** includes two curved grooves **19** formed and provided close to and around the apertures **18** of the housing **10**, and the plate **30** includes two curved grooves **39** formed and provided close to and around the orifices **17** of the plate **30**, and the curved grooves **19, 39** are provided for collecting the welders or particles or the like for preventing the welders or particles from flowing into the corrugated structures **13, 33** of the housing **10** and the plate **30** that are primarily provided for heat exchanging purposes. The housing **10** and the plate **30** may include one or more engaging or anchoring members or elements **20, 40**, such as recesses or depressions and/or projections or protrusions **20, 40** engaged with each other for anchoring or retaining or positioning the housing **10** and the plate **30** together, and the housing **10** may further include an outer peripheral skirt **21** extended radially and laterally and outwardly therefrom.

[0032] The upper or covering casing **50** and the base or lower board **70** of the lower or second heat exchanging unit **5** also include a substantially rectangular structure or configuration or shape having four corner areas **51, 71** and four outer peripheral sides **52, 72**, in which the corner areas **51, 71** of the casing **50** and the board **70** are secured or welded together, best shown in FIG. 3, and the outer peripheral sides **52, 72** of the casing **50** and the board **70** are slightly spaced or disengaged or separated from each other (FIGS. 4, 5) for forming or defining a gap or slot or slit **92** between the outer peripheral sides **52, 72** of the casing **50** and the board **70**. For example, the outer peripheral sides **52, 72** of the casing **50** and the board **70** may include a shape or structure or width or length (D, d, FIG. 4) different from each other for forming or defining the slit **92** between the outer peripheral sides **52, 72** of the casing **50** and the board **70**.

[0033] As also shown in FIGS. 4, 5, the casing **50** and the board **70** each include a corrugated configuration or shape or structure **53, 73** formed or provided thereon and substantially aligned with each other, but offset or spaced or separated from each other for forming or defining a flowing passageway **93** between the corrugated structures **53, 73** of the casing **50** and the board **70** and arranged for allowing the water or fluid or heat media to flow through the flowing passageway **93** of the casing **50** and the board **70** with an increased contacting area, and the corrugated structures **53, 73** of the casing **50** and the board **70** may include a structure or shape different from each other for forming or defining the passageway **93** of different space or shape or the like.

[0034] The flowing passageway **93** of the casing **50** and the board **70** is communicating with the slit **92** that is formed and provided between the outer peripheral sides **52, 72** of the casing **50** and the board **70** for allowing the water or fluid or heat media to selectively flow out through the slit **92** of the casing **50** and the board **70**. It is preferable, but not necessary that the flowing passageway **93** of the casing **50** and the board **70** is formed and provided through the length of the corrugated structures **53, 73** of the casing **50** and the board **70**, and may be partially communicating with the slit **92** that is formed and provided between the outer peripheral sides **52, 72** of the casing **50** and the board **70** for allowing the fluid to flow between the flowing passageway **93** and the slit **92** of the casing **50** and the board **70**.

[0035] As shown in FIG. 1, the casing **50** and the board **70** each include a notch or recess or depression **54, 74** formed therein, such as formed in one half of the casing **50** and the board **70** respectively for forming or defining a higher right side surface or platform **55, 75** and a lower left side surface **56, 76**, in which the higher side platform **55, 75** and the lower side surface **56, 76** are preferably parallel to each other and each occupy about one half of the casing **50** and the board **70** respectively, and the higher side platforms **55, 75** of the casing **50** and the board **70** are aligned with and located below the lower side surfaces **16, 36** of the housing **10** and the plate **30**, and the lower side surfaces **56, 76** are aligned with and located below the higher side platforms **15, 35** of the housing **10** and the plate **30**, and the casing **50** and the board **70** each include two holes **57, 77** formed in the higher side platform **55, 75** respectively and spaced or separated from each other and preferably located in two of the corner areas **51, 71** of the casing **50** and the board **70**, and the casing **50** and the board **70** each include two openings **58, 78** formed in the lower side surface **56, 76** respectively and spaced or separated from each other, and located in the other two corner areas **51, 71** of the casing **50** and the board **70**.

[0036] The higher side platforms **55, 75** of the casing **50** and the board **70** are superposed with each other, and the lower side surfaces **56, 76** of the casing **50** and the board **70** are also superposed with each other, and the holes **57, 77** of the casing **50** and the board **70** are aligned with the orifices **17, 37** of the housing **10** and the plate **30** respectively but offset or spaced or separated from the orifices **17, 37** of the housing **10** and the plate **30**, because of the formation of the recesses **14, 34** in the housing **10** and the plate **30** and the depressions **54, 74** in the casing **50** and the board **70** respectively, and the openings **58, 78** of the casing **50** and the board **70** are aligned with and communicating with the apertures **18, 38** of the housing **10** and the plate **30** respectively (FIG. 3). The casing **50** includes two curved grooves **59** formed and provided close to and around the openings **58** of the casing **50**, and the board **70** includes two curved grooves **79** formed and provided close to and around the holes **57** of the board **70**, and the curved grooves **59, 79** are provided for collecting the welders or particles or the like for preventing the welders or particles from flowing into the corrugated structures **53, 73** of the casing **50** and the board **70** that are primarily provided for heat exchanging purposes.

[0037] The casing **50** and the board **70** may include one or more engaging members or elements **60, 80**, such as recesses or depressions and/or projections or protrusions **60, 80** engaged with each other for anchoring or retaining or positioning the casing **50** and the board **70** together, and the casing **50** may further include an outer peripheral skirt **61** extended radially and laterally and outwardly therefrom for suitably separating the slot **90** between the outer peripheral sides **12, 32** of the housing **10** and the plate **30** and the slit **92** between the outer peripheral sides **52, 72** of the casing **50** and the board **70** from each other.

[0038] As shown in FIGS. 4-6 and 8, the corrugated structures **33, 53** of the plate **30** and the casing **50** of the heat exchanging units **1, 5** are offset or spaced or separated from each other for forming or defining a flowing chamber **94** between the corrugated structures **33, 53** of the plate **30** and the casing **50** and for receiving heat media **95** therein (FIG. 8). As also shown in FIG. 8, for example, when a broken hole or port **96** is formed in the corrugated structure **53** of the casing **50**, the heat media **95** contained in the flowing chamber **94**

that is formed and provided between the corrugated structures 33, 53 of the plate 30 and the casing 50 may flow through the broken port 96 of the casing 50 and may flow into the passageway 93 of the casing 50 and the board 70 and may then flow out through the slit 92 of the casing 50 and the board 70.

[0039] When the heat media 95 flows into the passageway 93 of the casing 50 and the board 70 and is mixed with the fluid that is flowing through the passageway 93 of the casing 50 and the board 70, and is then flowing out through the slit 92 of the casing 50 and the board 70, the user or worker may know or realize that a leaking problem is happened or occurred within the heat exchanger which is now required to be repaired or fixed. It is to be noted that the housing 10 and the plate 30 of the upper or first heat exchanging unit 1 and the casing 50 and the board 70 of the lower or second heat exchanging unit 5 include a shape or configuration or structure identical to each other when the casing 50 and the board 70 of the lower or second heat exchanging unit 5 are rotated for one hundred and eighty (180) degrees relative to the housing 10 and the plate 30 of the upper or first heat exchanging unit 1.

[0040] Accordingly, the heat exchanger in accordance with the present invention includes an improved structure or configuration for suitably detecting the leaking problem of the heat exchanging plates or boards or housings and for preventing the fluids in different flowing paths of the heat exchanging plates or boards or housings from being mixed or brazed together and for preventing explosions from being occurred or generated.

[0041] Although this invention has been described with a certain degree of particularity, it is to be understood that the present disclosure has been made by way of example only and that numerous changes in the detailed construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

I claim:

1. A heat exchanger comprising:

a first heat exchanging unit including a housing and a plate having four corner areas secured together, and having four outer peripheral sides spaced from each other for forming a slot between said outer peripheral sides of said housing and said plate, said housing and said plate each including a corrugated structure and having a flowing channel formed between said corrugated structures of said housing and said plate and communicating with said slot that is formed between said outer peripheral sides of said housing and said plate, said housing and said plate each including a recess formed therein for forming a first higher side platform and a first lower side surface, and said housing and said plate each including two orifices formed in said first higher side platform, and each including two apertures formed in said first lower side surface, and

a second heat exchanging unit including a casing and a board disposed below said plate of said first heat exchanging unit and having four corner areas secured together and secured to said corner areas of said housing and said plate, and having four outer peripheral sides separated from each other for forming a slit between said outer peripheral sides of said casing and said board, said casing and said board each including a corrugated structure and having a passageway formed between said corrugated structures of said casing and said board and

communicating with said slit that is formed between said outer peripheral sides of said casing and said board, said casing and said board each including a depression formed therein for forming a second higher platform and a second lower side surface, said second higher side platforms of said casing and said board being located below said first lower side surfaces of said housing and said plate, and said second lower side surfaces being located below said first higher side platforms of said housing and said plate, and said casing and said board each including two holes formed in said second higher side platform and aligned with said orifices of said housing and said plate respectively, and said casing and said board each including two openings formed in said second lower side surface and aligned with and communicating with said apertures of said housing and said plate respectively.

2. The heat exchanger as claimed in claim 1, wherein said first higher side platforms of said housing and said plate are superposed with each other, and said first lower side surfaces of said housing and said plate are superposed with each other.

3. The heat exchanger as claimed in claim 1, wherein said second higher side platforms of said casing and said board are superposed with each other, and said second lower side surfaces of said casing and said board are superposed with each other.

4. The heat exchanger as claimed in claim 1, wherein said housing includes an outer peripheral skirt extended laterally and outwardly therefrom.

5. The heat exchanger as claimed in claim 1, wherein said casing includes an outer peripheral skirt extended laterally and outwardly therefrom.

6. The heat exchanger as claimed in claim 1, wherein said orifices of said housing and said plate are located in two of said corner areas of said housing and said plate, and said apertures of said housing and said plate are located in said other two corner areas of said housing and said plate.

7. The heat exchanger as claimed in claim 1, wherein said holes of said casing and said board are located in two of said corner areas of said casing and said board, and said openings of said casing and said board are located in said other two corner areas of said casing and said board.

8. The heat exchanger as claimed in claim 1, wherein said outer peripheral sides of said housing and said plate include a shape different from each other for forming said slot between said outer peripheral sides of said housing and said plate.

9. The heat exchanger as claimed in claim 1, wherein said outer peripheral sides of said casing and said board include a shape different from each other for forming said slit between said outer peripheral sides of said casing and said board.

10. The heat exchanger as claimed in claim 1, wherein said corrugated structures of said casing and said board include a structure different from each other for forming said passageway between said corrugated structures of said casing and said board.

11. The heat exchanger as claimed in claim 1, wherein said corrugated structures of said housing and said plate include a structure different from each other for forming said flowing channel between said corrugated structures of said housing and said plate.

12. The heat exchanger as claimed in claim 1, wherein said housing and said plate include an engaging element engaged with each other for anchoring said housing and said plate together.

13. The heat exchanger as claimed in claim **1**, wherein said casing and said board include an engaging element engaged with each other for anchoring said casing and said board together.

14. The heat exchanger as claimed in claim **1**, wherein said housing includes two curved grooves formed around said apertures of said housing, and said plate includes two curved grooves formed around said orifices of said plate.

15. The heat exchanger as claimed in claim **1**, wherein said casing includes two curved grooves formed around said openings of said casing, and said board includes two curved grooves formed around said holes of said board.

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