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(54) IN-PROCESS ROLL-BOND PLATE AND METHOD FOR MANUFACTURING A ROLL-BOND HEAT EXCHANGER

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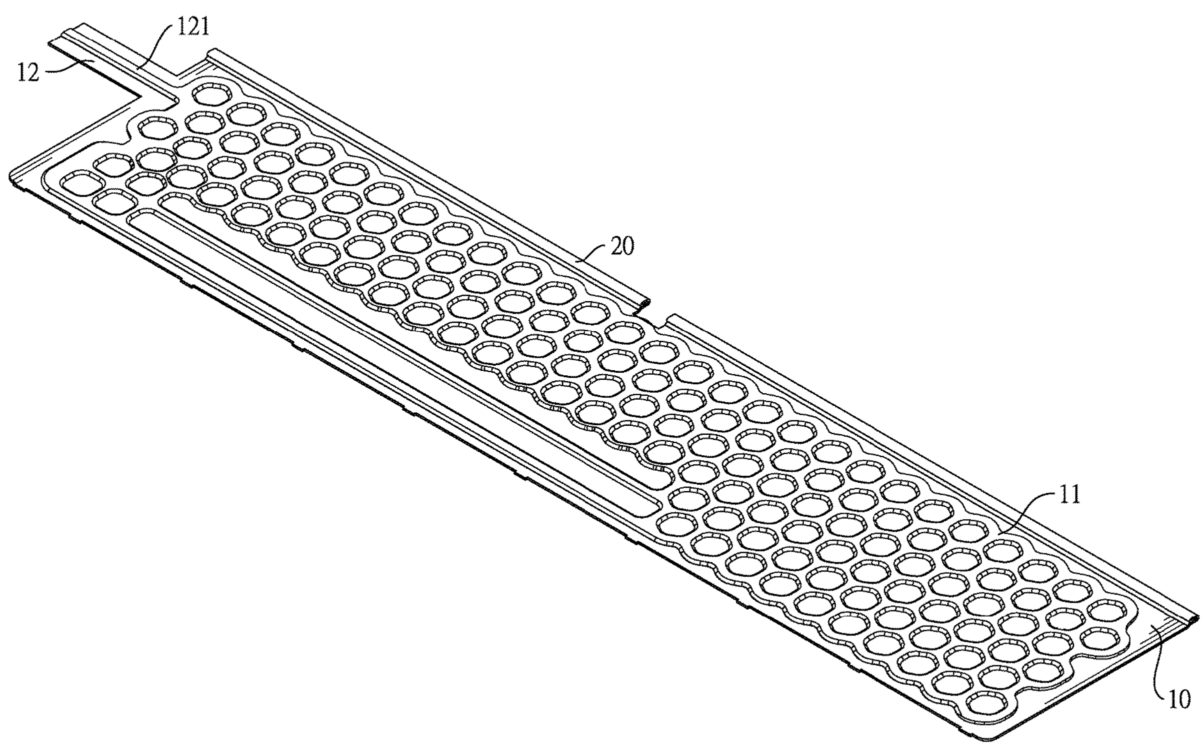
(57) **ABSTRACT**

A method for manufacturing a roll-bond heat exchanger has steps of: (1) A preparing step: preparing an in-process roll-bond plate that has a main plate with a bulged structure, and a degassing portion with a tube; (2) A degassing step: removing air from the bulged structure through the tube; (3) A filling step: filling refrigerant into the bulged structure; (4) A pressing step: pressing the bulged structure flat to form a pressed portion; (5) A cutting step: cutting the degassing portion to form a cut portion on the main plate; and (6) A sealing step: welding the cut portion. The main plate and the degassing portion are integrally formed as a single part and the degassing portion is able to be directly connected with the vacuum filling machine. Accordingly, processing steps and manpower for manufacturing the roll-bond heat exchanger are reduced.



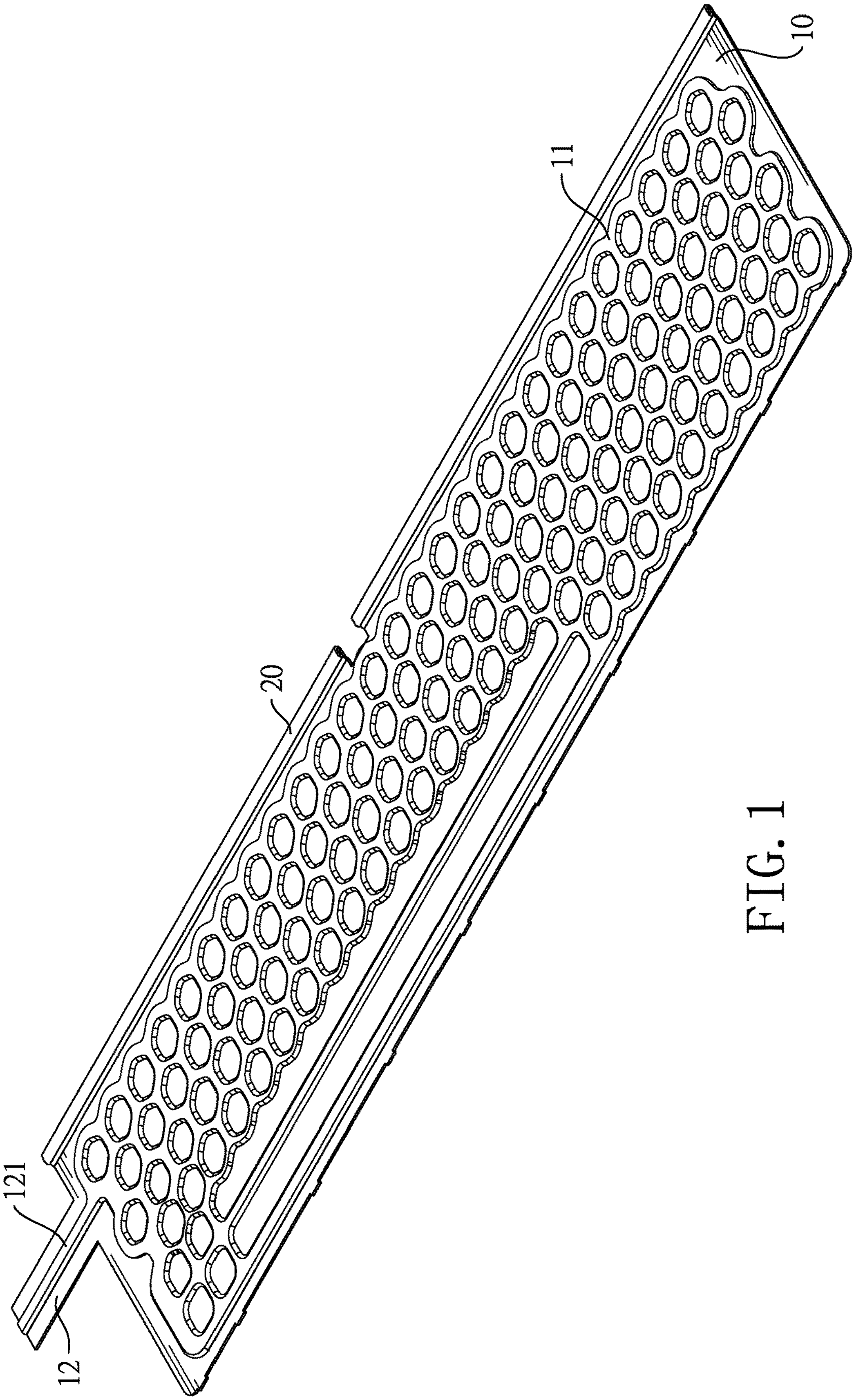


FIG. 1

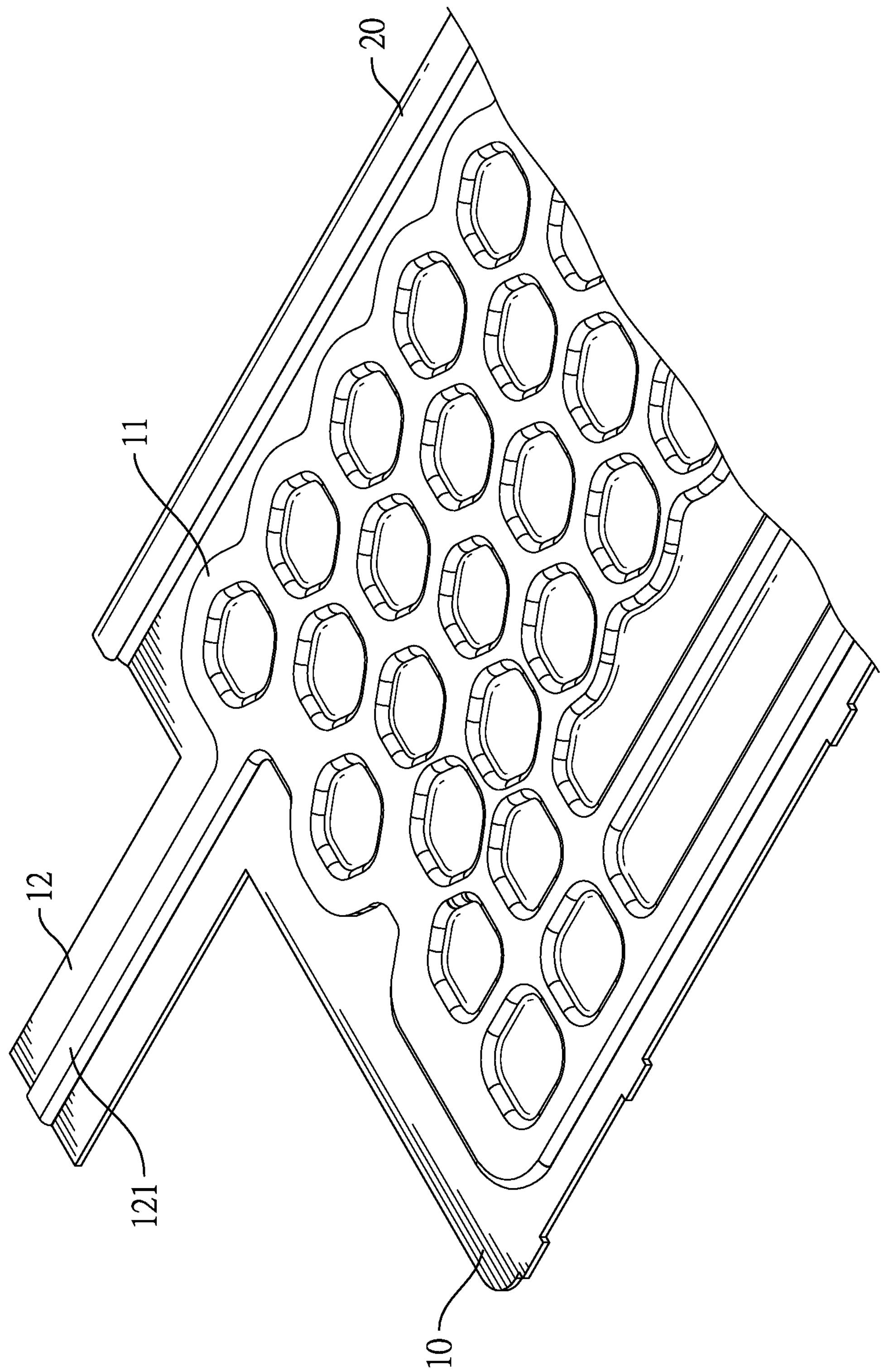


FIG. 2

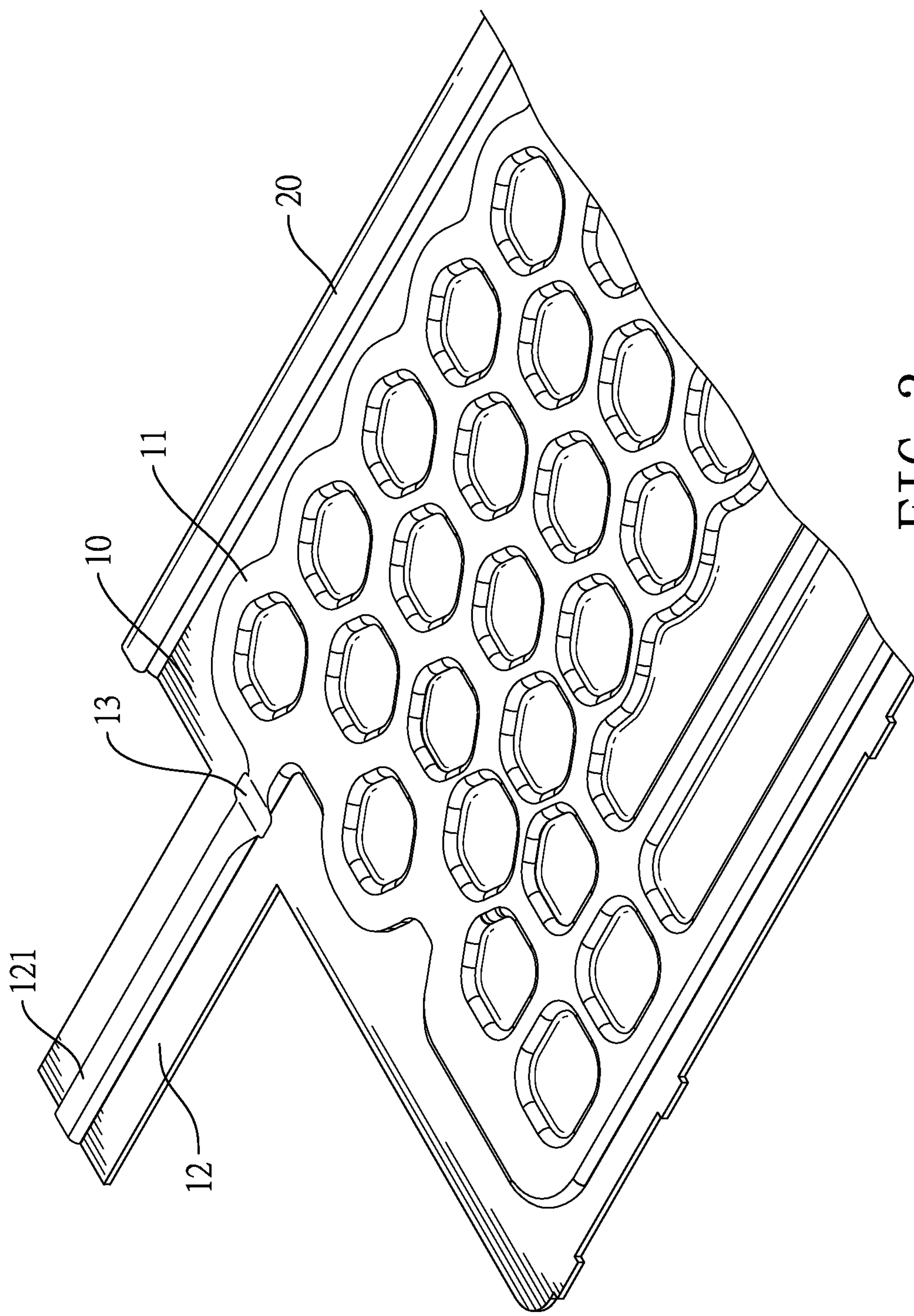


FIG. 3

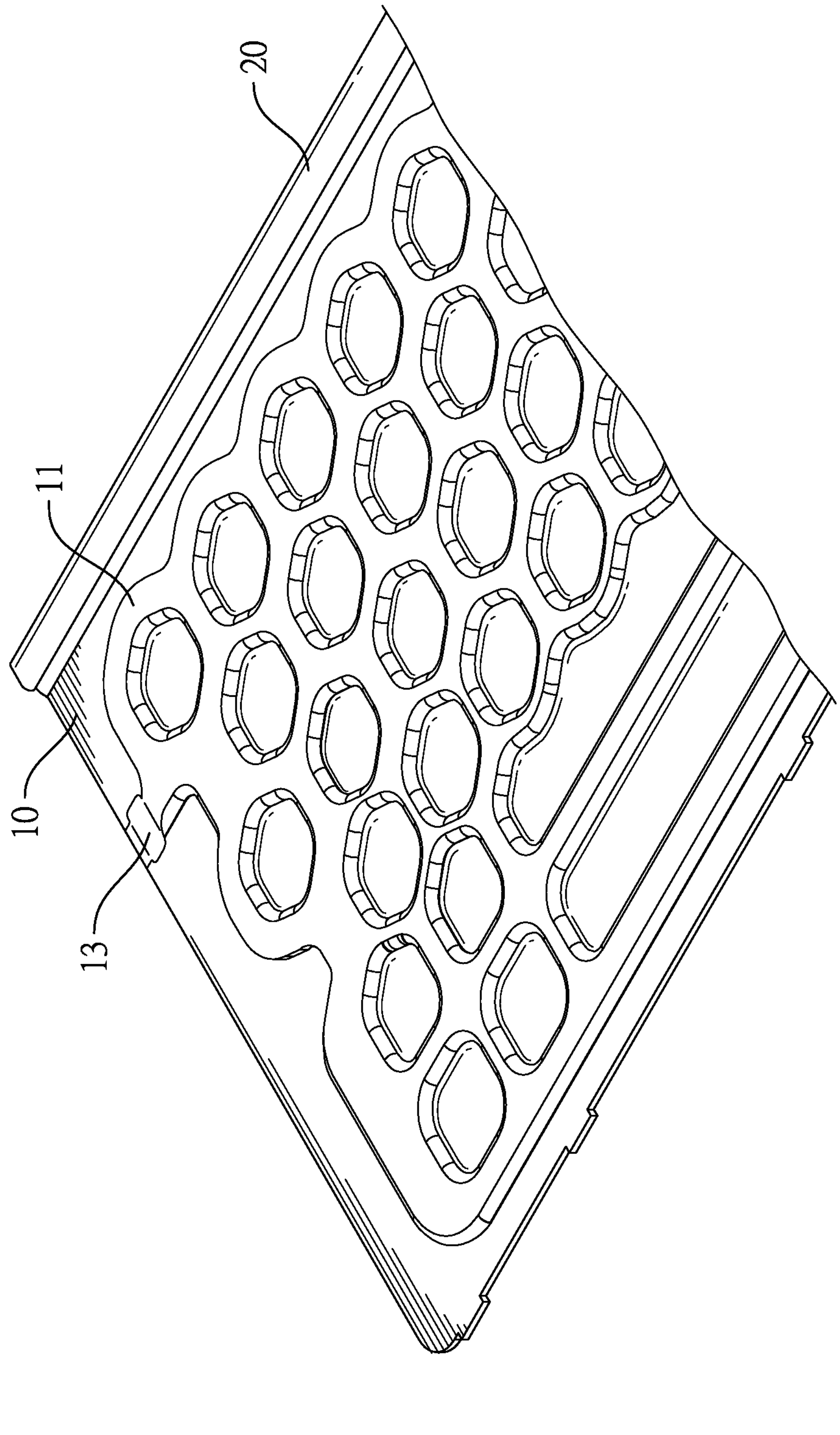


FIG. 4

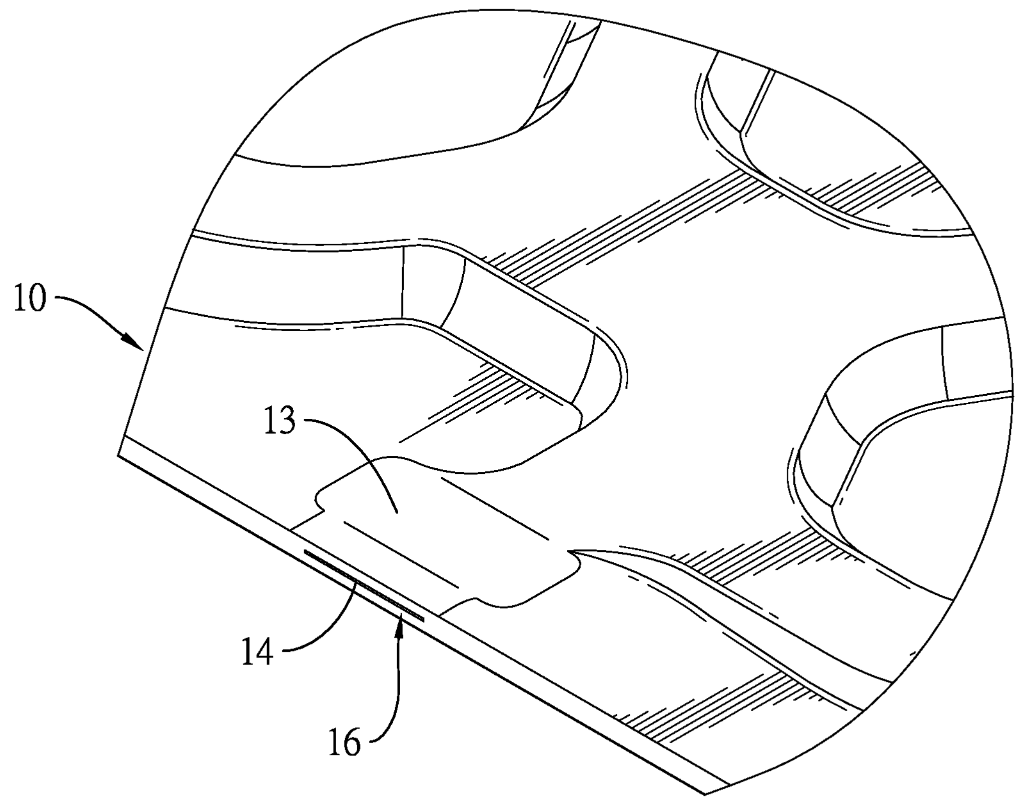


FIG. 5

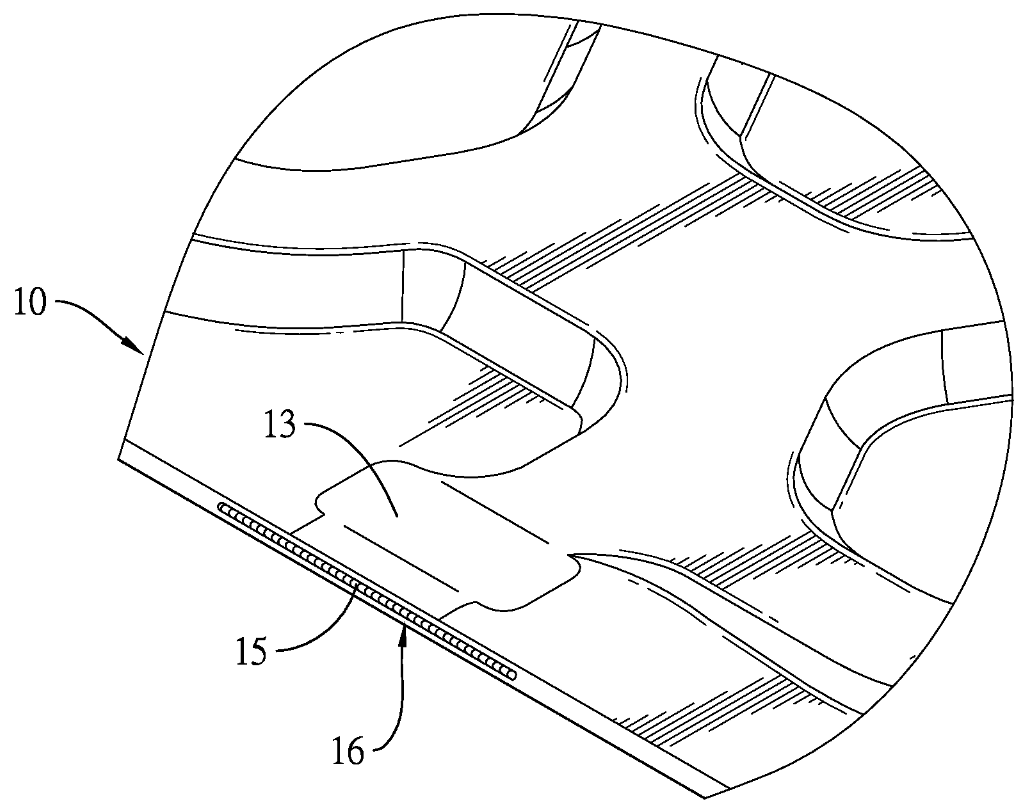


FIG. 6

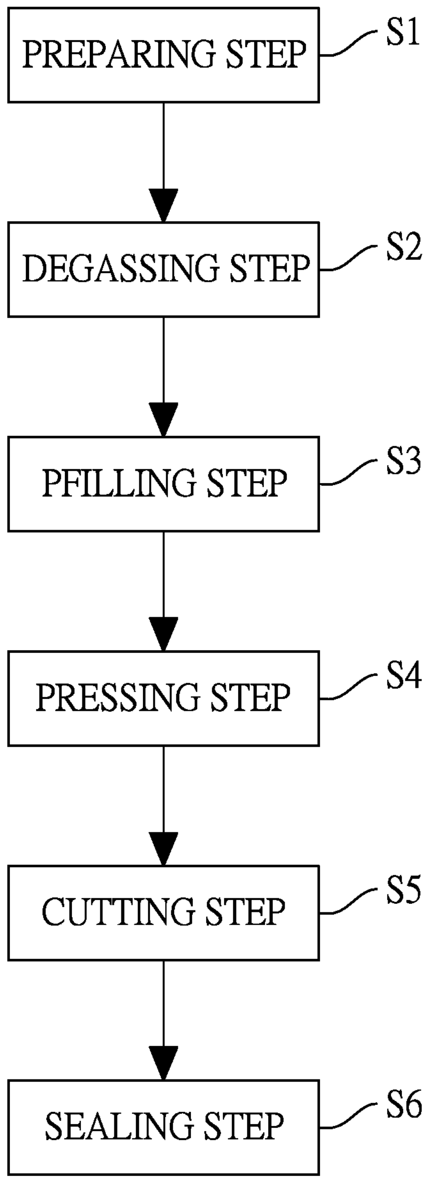

PREPARING STEP
S1
DEGASSING STEP
S2
PFILLING STEP
S3
PRESSING STEP
S4
CUTTING STEP
S5
SEALING STEP
S6

FIG. 7

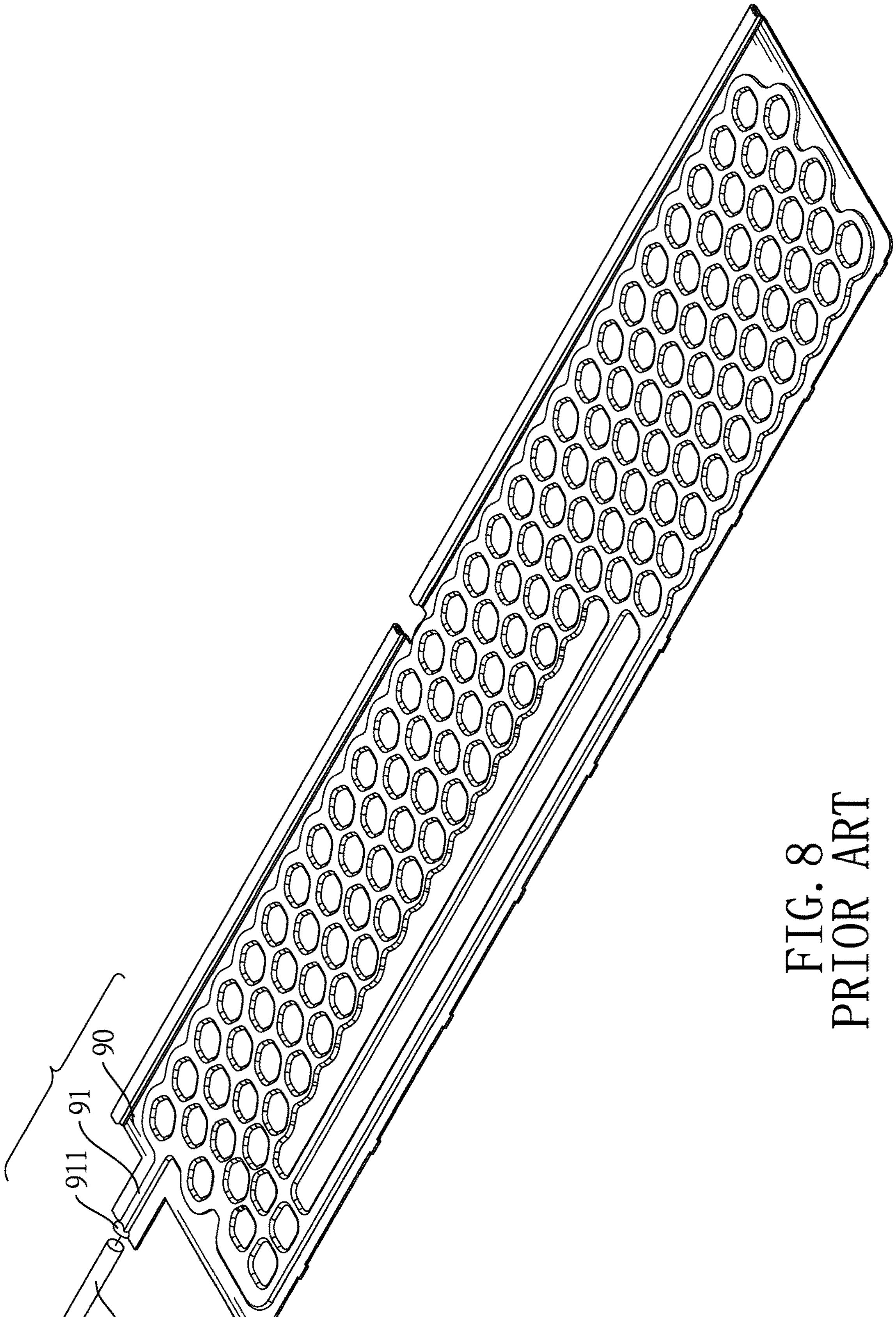


FIG. 8
PRIOR ART

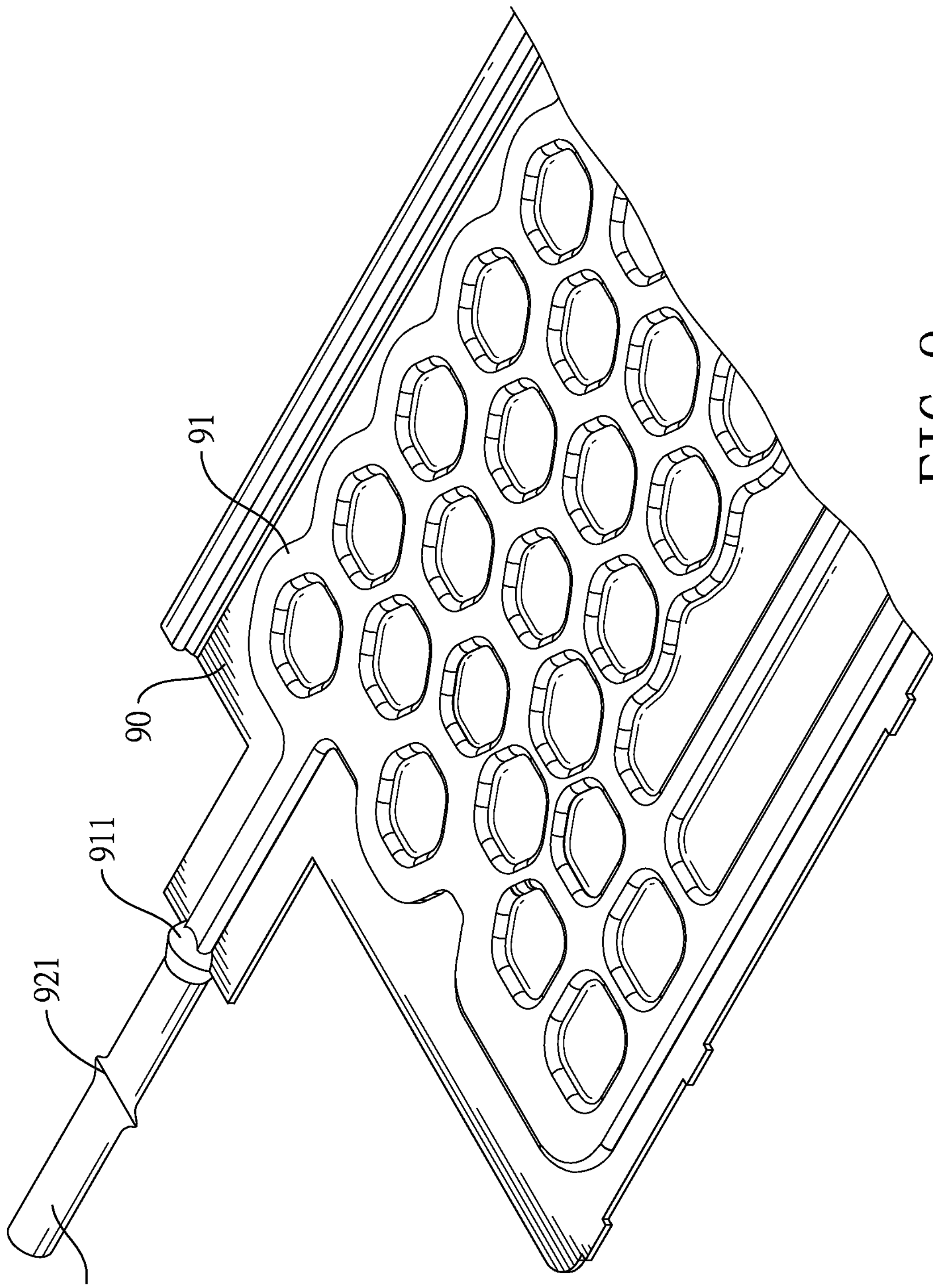


FIG. 9
PRIOR ART

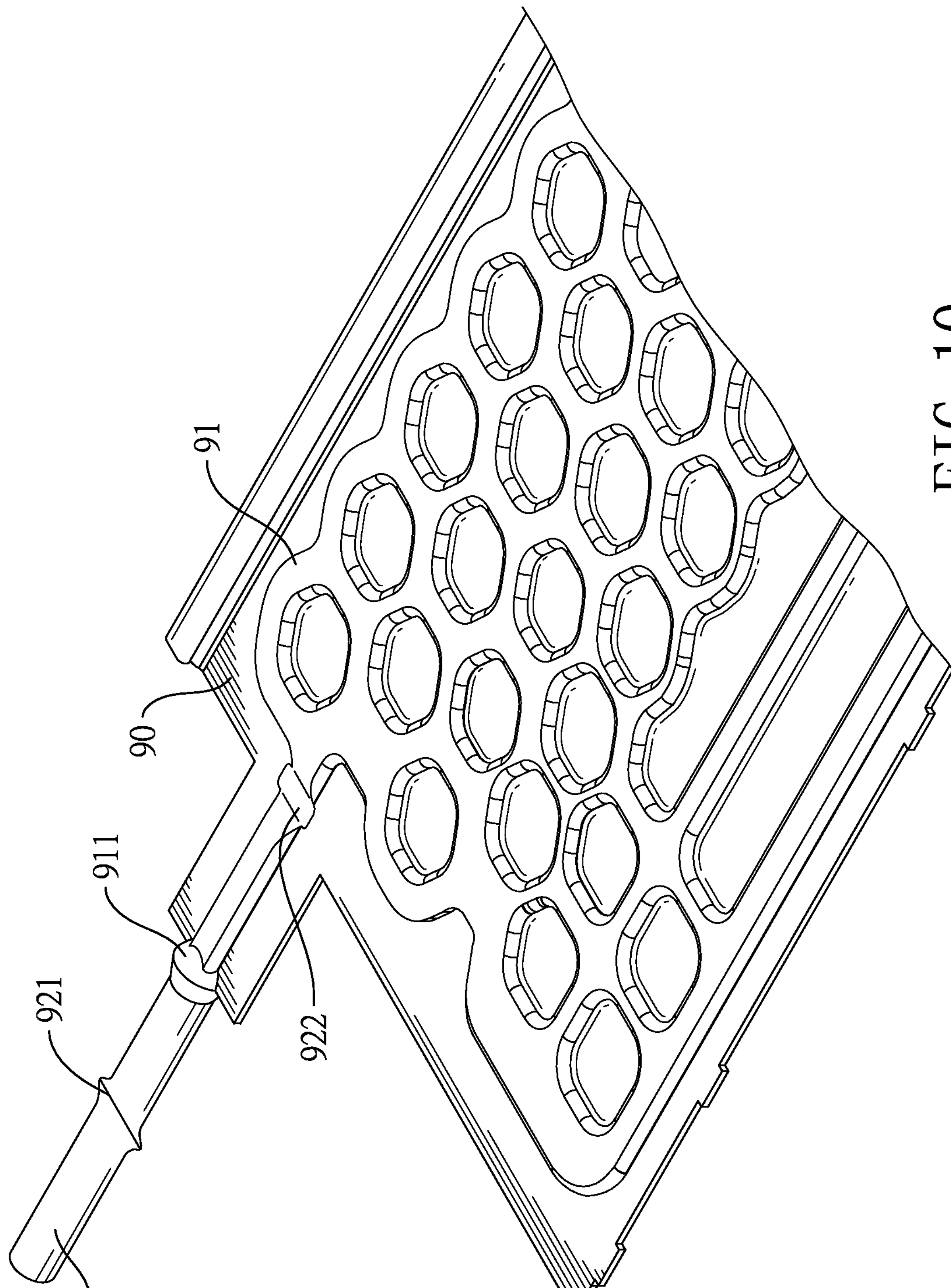


FIG. 10
PRIOR ART

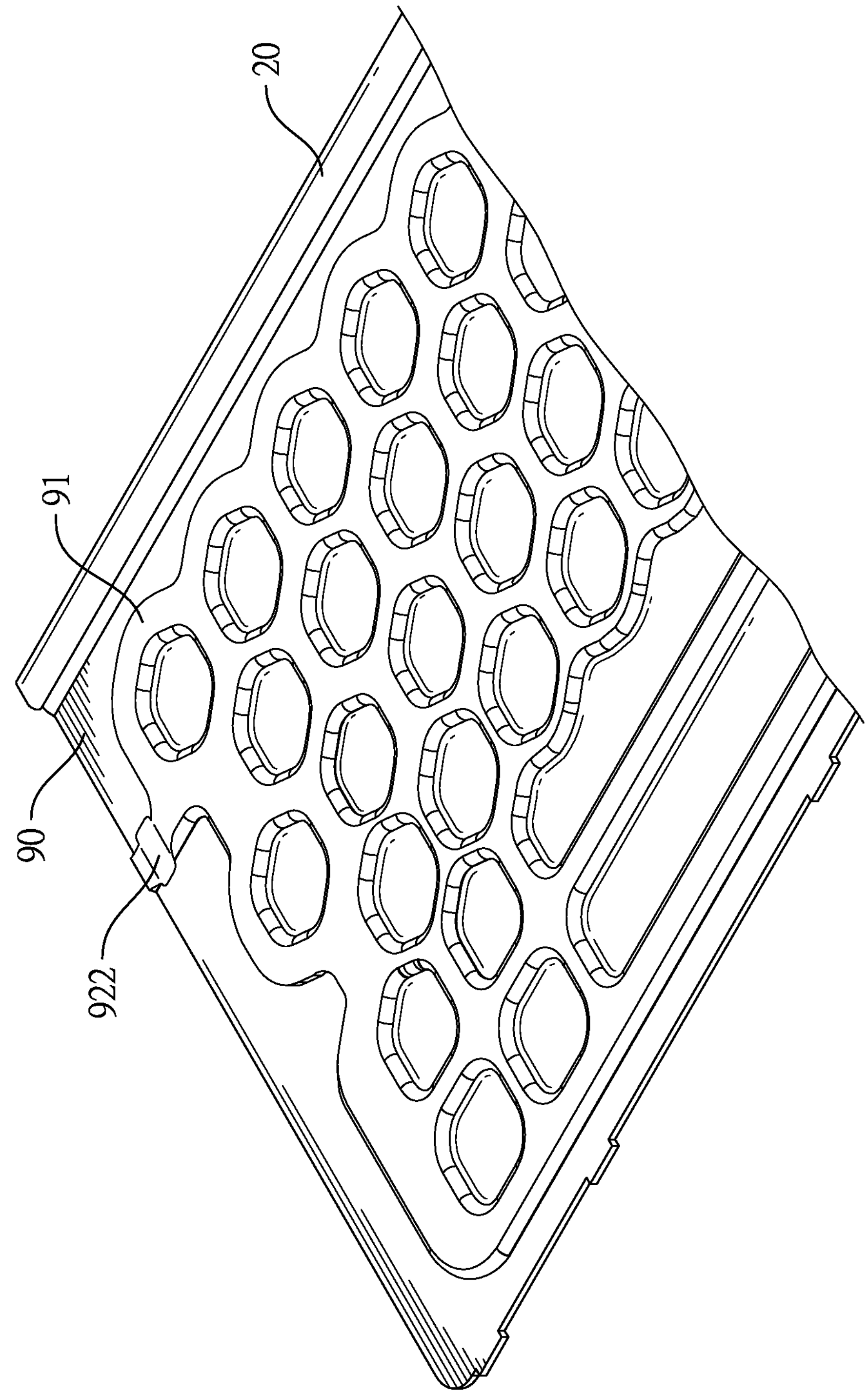


FIG. 11
PRIOR ART

IN-PROCESS ROLL-BOND PLATE AND METHOD FOR MANUFACTURING A ROLL-BOND HEAT EXCHANGER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims priority under 35 U.S.C. 119 from China Patent Application No. 201811534584.5 filed on Dec. 14, 2018, which is hereby specifically incorporated herein by this reference thereto.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a heat exchanger, especially to an in-process roll-bond plate for further processing and a method for manufacturing a roll-bond heat exchanger.

2. Description of the Prior Art(s)

[0003] A conventional roll-bond heat exchanger is manufactured by printing a pre-designed channel pattern on a first aluminum sheet, combining the first aluminum sheet and a second aluminum sheet without channel pattern together into a single roll-bond plate through a roll bonding process, and bulging the roll-bond plate by high pressure nitrogen to form a channel having a required diameter along the channel pattern. The channel may be filled with refrigerant. The conventional roll-bond heat exchanger is flat in appearance, has high heat transfer efficiency, and is often used as an evaporator.

[0004] FIGS. **8** to **11** show processes of filling the conventional roll-bond heat exchanger with the refrigerant.

[0005] With reference to FIG. **8**, an opening of a duct **91** protruding from a side edge of the roll-bond plate **90** is enlarged to an expanded opening **911**, a proximal end of an aluminum tube **92** having smaller diameter than the expanded opening **911** is inserted into the expanded opening **911**, and then the proximal end of the aluminum tube **92** and the roll-bond plate **90** are welded together.

[0006] With further reference to FIG. **9**, a connecting pipe of a vacuum filling machine is connected to a distal end of the aluminum tube **92** to degas the roll-bond plate **90** and fill the roll-bond plate **90** with the refrigerant. By performing a first pressing step with a pressing device, a first pressed portion **921** is formed on the aluminum tube **92** to press the aluminum tube **92** flat and to seal the aluminum tube **92**.

[0007] With further reference to FIG. **10**, by performing a second pressing step, a second pressed portion **922** is formed on the duct **91** of the roll-bond plate **90** to press the duct **91** flat.

[0008] With further reference to FIG. **11**, then the duct **91** is cut from a position between the first pressed portion **921** and the second pressed portion **922** and is flush with the side edge of the roll-bond plate **90**.

[0009] However, in the above-mentioned processes, it is needed to additionally enlarge the opening of the duct **91** and weld the aluminum tube **92** to the duct **91** of the roll-bond plate **90** and to perform the two pressing steps, which costs not only the aluminum tub **92** but also processing steps and manpower. Accordingly, it costs high manufacturing cost to manufacture the roll-bond heat exchanger by the conventional roll-bond plate **90** in the conventional processes.

[0010] To overcome the shortcomings, the present invention provides an in-process roll-bond plate and a method for manufacturing a roll-bond heat exchanger to mitigate or obviate the aforementioned problems.

SUMMARY OF THE INVENTION

[0011] The main objective of the present invention is to provide an in-process roll-bond plate and a method for manufacturing a roll-bond heat exchanger.

[0012] The in-process roll-bond plate has a main plate and a degassing portion. The main plate has a bulged structure formed on a side surface of the main plate. The degassing portion protrudes from the main plate and has a tube communicating with the bulged structure. The degassing portion and the main plate are integrally formed as a single part

[0013] The method for manufacturing the roll-bond heat exchanger has the following steps.

[0014] (1) A preparing step: preparing an in-process roll-bond plate as described above.

[0015] (2) A degassing step: connecting the tube of the degassing portion to a connecting tube of a vacuum filling machine to remove air from the bulged structure.

[0016] (3) A filling step: filling refrigerant into the bulged structure that has been degassed by using the vacuum filling machine.

[0017] (4) A pressing step: pressing the bulged structure flat to form a pressed portion by using a pressing device.

[0018] (5) A cutting step: cutting the degassing portion by using a cutting device to form a cut portion on the main plate.

[0019] (6) A sealing step: welding the cut portion by using a welding device.

[0020] Since the main plate and the degassing portion are integrally formed as a single part and the degassing portion is able to be directly connected with the vacuum filling machine, it is not needed to additionally weld an adapting tube to the main plate and enlarge the opening of the tube. Accordingly, processing steps and manpower for manufacturing the roll-bond heat exchanger are reduced. Moreover, the U-shaped structure of the insertion portion allows the roll-bond heat exchanger to be firmly and stably inserted on a base of a heat dissipating device.

[0021] Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] FIG. **1** is a perspective view of an in-process roll-bond plate in accordance with the present invention;

[0023] FIG. **2** is an enlarged perspective view of the in-process roll-bond plate in FIG. **1**;

[0024] FIG. **3** is an enlarged perspective view of the in-process roll-bond plate in FIG. **1**, shown pressed;

[0025] FIG. **4** is an enlarged perspective view of the in-process roll-bond plate in FIG. **1**, shown cut;

[0026] FIG. **5** is an enlarged perspective view of the in-process roll-bond plate in FIG. **1**, showing before a cut part is welded;

[0027] FIG. **6** is an enlarged perspective view of the in-process roll-bond plate in FIG. **1**, showing after a cut part is welded;

[0028] FIG. **7** is a flow chart of a method for manufacturing a roll-bond heat exchanger in accordance with the present invention;

[0029] FIG. **8** is an exploded perspective view of a conventional in-process roll-bond plate in accordance with the prior art;

[0030] FIG. **9** is an enlarged perspective view of the conventional in-process roll-bond plate in FIG. **8**, showing a first pressed portion formed thereon;

[0031] FIG. **10** is an enlarged perspective view of the conventional in-process roll-bond plate in FIG. **8**, showing a second pressed portion formed thereon; and

[0032] FIG. **11** is an enlarged perspective view of a finished roll-bond heat exchanger manufactured by the conventional in-process roll-bond plate in FIG. **8**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0033] With reference to FIG. **1**, an in-process roll-bond plate in accordance with the present invention comprises a main plate **10**, a degassing portion **12**, and an insertion portion **20**.

[0034] With reference to FIGS. **1** and **2**, the main plate **10** has a bulged structure **11** formed on a side surface of the main plate **10**.

[0035] The degassing portion **12** protrudes from the main plate **10** and has a tube **121** communicating with the bulged structure **11**. The degassing portion **12** and the main plate **10** are integrally formed as a single part.

[0036] In the preferred embodiment, the bulged structure **11** is formed as a reticular channel. The tube **121** of the degassing portion **12** has a proximal end and a distal end. The proximal end of the tube **121** is connected to and communicates with the bulged structure **11** of the main plate **10**. The distal end of the tube **121** communicates with an exterior of the main plate **10** and is for being connected to a vacuum filling machine.

[0037] Preferably, a diameter of the tube **121** of the degassing portion **12** is, but is not limited to, 50 millimeter (mm).

[0038] The insertion portion **20** is U-shaped in cross-section and is formed on a side edge of the main plate **10**. In the preferred embodiment, the insertion portion **20** is used for combined with a base. The base may be a part of a conventional heat dissipating device and have multiple elongated insertion slots. The insertion portion **20** is inserted in a corresponding one of the insertion slots.

[0039] With reference to FIGS. **2** to **7**, a method for manufacturing a roll-bond heat exchanger comprises the following steps.

[0040] (1) A preparing step S**1**: with reference to FIG. **2**, preparing the in-process roll-bond plate as described above. The roll-bond plate is conveyed to a processing zone via a conveying device.

[0041] (2) A degassing step S**2**: connecting the tube **121** of the degassing portion **12** to a connecting tube of a vacuum filling machine to remove air from the bulged structure **11** by using the vacuum filling machine.

[0042] (3) A filling step S**3**: filling refrigerant into the bulged structure **11** that has been degassed by using the vacuum filling machine. The vacuum filling machine is able to create a vacuum inside the bulged structure **11** and then fills the refrigerant into the bulged structure **11** on one machine.

[0043] (4) A pressing step S**4**: with reference to FIG. **3**, pressing the bulged structure **11** flat to form a pressed portion that is disposed adjacent to the tube **121** by using a pressing device. By pressing the tube **121** flat, the bulged structure **11** is sealed.

[0044] (5) A cutting step S**5**: with further reference to FIG. **4**, cutting the degassing portion **12** by using a cutting device to form a cut portion **16** on the main plate **10** and the cut portion **16** being flush with the side edge of the main plate **10**. After performing the cutting step S**5**, a slit **14** is formed in the cut portion **16**.

[0045] (6) A sealing step S**6**: with further reference to FIGS. **5** and **6**, welding the cut portion **16** and forming a welded portion **15** on the cut portion **16** by using a welding device to seal the slit **14** in the cut portion **16**.

[0046] The tube **121** of the degassing portion **12** corresponds in size to the connecting tube of the vacuum filling machine. Thus, the tube **121** of the degassing portion **12** is able to be directly connected with the connecting tube of the vacuum filling machine, so as to allow the vacuum filling machine to degas the bulged structure **11** and to fill the refrigerant into the bulged structure **11** without enlarging an opening of the tube **121**.

[0047] In addition to remove burrs on the cut portion **16**, forming the welded portion **15** also further seals the bulged structure **11**, such that effect of sealing the bulged structure **11** can be improved.

[0048] Since the main plate **10** and the degassing portion **12** are integrally formed as a single part and the degassing portion **12** is able to be directly connected with the vacuum filling machine, it is not needed to additionally weld an adapting tube to the main plate **10** and enlarge the opening of the tube **121**. Accordingly, processing steps and manpower for manufacturing the roll-bond heat exchanger are reduced.

[0049] Moreover, the U-shaped structure of the insertion portion **20** allows the roll-bond heat exchanger to be firmly and stably inserted on the base of the heat dissipating device.

[0050] Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and features of the invention, the disclosure is illustrative only. Changes may be made in the details, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. An in-process roll-bond plate comprising:

a main plate having a bulged structure formed on a side surface of the main plate; and

a degassing portion protruding from the main plate and having a tube communicating with the bulged structure, wherein the degassing portion and the main plate are integrally formed as a single part.

2. The in-process roll-bond plate as claimed in claim **1** further comprising an insertion portion, and the insertion portion being U-shaped in cross-section and formed on a side edge of the main plate.

3. A method for manufacturing a roll-bond heat exchanger comprising:

a preparing step: preparing an in-process roll-bond plate, wherein the in-process roll-bond plate comprises a main plate having a bulged structure formed on a side surface of the main plate and a degassing portion protruding from the main plate and having a tube communicating with the bulged structure, wherein the degassing portion and the main plate are integrally formed as a single part

a degassing step: removing air from the bulged structure;

a filling step: filling refrigerant into the bulged structure that has been degassed;

a pressing step: pressing the bulged structure flat to form a pressed portion;

a cutting step: cutting the degassing portion to form a cut portion on the main plate; and

a sealing step: welding the cut portion.

4. The method for manufacturing the roll-bond heat exchanger as claimed in claim **3**, wherein in the pressing step, the pressed portion is disposed adjacent to the tube of the degassing portion.

5. The method for manufacturing the roll-bond heat exchanger as claimed in claim **3**, wherein in the cutting step, the cut portion is flush with the side edge of the main plate.

6. The method for manufacturing the roll-bond heat exchanger as claimed in claim **4**, wherein in the cutting step, the cut portion is flush with the side edge of the main plate.

* * * * *