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(54) **Condensing unit attachment feature**

(57) The present invention relates to a condenser (24) is attached to the base plate (12) by means of integral torque tabs (52, 54) that are twisted underneath the base plate (12) to draw the condenser (24) downwardly against the upper surface (16) of the base plate (12). In a pre-

ferred embodiment, the torque tabs (52, 54) are located on the lower ends (45) of the condenser end plates (40, 42). The tabs (52, 54) are preferably designed to be machine twisted to provide enough holding force to maintain the condenser (24) and base plate (54) in a rigid condition.

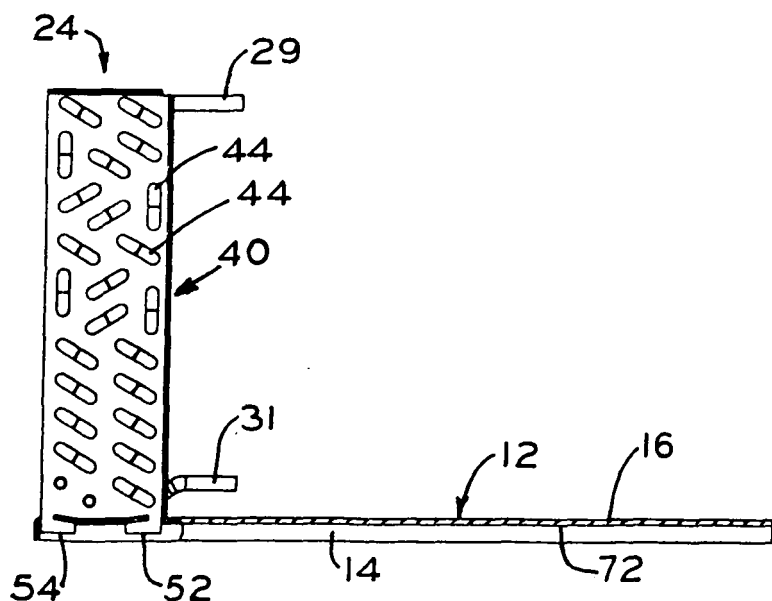


FIG. 6

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Description

[0001] This application claims the benefit of U.S. Provisional Patent Application Serial No. 61/178,089, entitled CONDENSING UNIT CONDENSER ATTACHMENT FEATURE, filed on May 14, 2009, the disclosure of which is expressly incorporated by reference herein.

[0002] The present invention relates to condensing units, and in particular to an attachment technique for fixing the condenser or other components to the condensing unit base plate.

[0003] Condensing units are self-contained units typically comprising a hermetic compressor, condenser and cooling fan all mounted to a base plate and having refrigerant lines adapted for connection to a remotely located expansion valve and evaporator. In the past, the condenser has been attached to the base plate by means of removable fasteners, such as bolts or threaded studs that extend through openings in the base plate and are secured by means of nuts and washers fastened from underneath the base plate. This not only increases the parts count for the condensing unit but increases assembly time due to the necessity of attaching the various fasteners.

[0004] In the present invention, the condenser or other component is attached to the base plate by means of integral torque tabs that are twisted underneath the base plate to draw the condenser or other component downwardly against the upper surface of the base plate. In a preferred embodiment, the torque tabs are located on the lower ends of the condenser or other component end plates. The tabs are preferably designed to be machine twisted to provide enough holding force to maintain the condenser or other component and base plate in a rigid condition.

[0005] In one form thereof, the present disclosure provides a condensing unit, including a base plate having a plurality of components mounted on an upper surface thereof, the components including a compressor and a condenser. At least one of the components includes a plurality of tabs extending through a corresponding plurality of slots in the base plate. The tabs include distal portions that are twisted underneath the base plate, and the tab distal portions include respective camming surfaces that tightly engage an undersurface of the base plate to tightly fix the at least one component to the upper surface of said base plate. In a preferred embodiment, the condensing unit includes a base plate having a condenser mounted on an upper surface thereof, the condenser including a plurality of tabs extending through a corresponding plurality of slots in the base plate.

[0006] In another form thereof, the present disclosure provides a condensing unit including a base plate having an undersurface and a condenser mounted on an upper surface thereof, the condenser including one or more attachment elements extending through one or more corresponding attachment receiving means in the base plate. The one or more attachment elements include

means for engaging the base plate such that, upon deformation, the one or more attachment means tighten against the undersurface of the base plate.

[0007] In yet another form thereof, the present disclosure provides a method of attaching a condenser of a condensing unit to a base plate of the condensing unit, the method including the step of positioning the condenser to abut a base plate, the condenser having a plurality of tabs, each tab having an internal distal upper edge, and the base plate having an undersurface. The method further includes the step of aligning each tab with a corresponding slot on the base plate. The method further includes the steps of inserting each tab through the corresponding slot on the base plate such that each tab extends through the corresponding slot, and then twisting each tab to thereby draw the internal distal upper edge of each tab tightly against the undersurface of the base plate such that the condenser is locked to the base plate.

[0008] The above-mentioned and other features and advantages of this invention, and the manner of attaining them, will become more apparent and the invention itself will be better understood by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

[0009] Fig. 1 is a plan view of a condensing unit incorporating the attachment mechanism of the present invention;

[0010] Fig. 2 is a side elevational view of the condensing unit;

[0011] Fig. 3 is a perspective view of the condenser;

[0012] Fig. 4 shows a side elevational perspective view of the assembled condenser and base plate wherein the tabs are in their pre-twisted state;

[0013] Fig. 5 shows a distal plan view of the assembled condenser and base plate wherein the tabs are in their pre-twisted state;

[0014] Fig. 6 shows a side elevational view of the assembled condenser and base plate wherein the tabs are in their pre-twisted state;

[0015] Fig. 7 shows a side elevational view of one of the end plates of the condenser;

[0016] Fig. 8 shows an internal side view of one of the end plates showing an internal surface with open, unbent flanges;

[0017] Fig. 9 is a perspective view of the base plate;

[0018] Fig. 10 is a perspective internal side view of one of the base plates;

[0019] Fig. 11 is an internal side view of one of the end plates showing an internal surface with bent flanges;

[0020] Fig. 12 shows views of one of the end plates of the condenser showing the tabs in detail;

[0021] Fig. 13 shows a perspective view of the condenser and base plate wherein the tabs have been twisted to their locked position; and

[0022] Fig. 14 is a fragmentary elevational side end view of one of the plates and the base plate, showing the tabs twisted to their locked position;

[0023] Fig. 15 is a fragmentary elevational distal plan

view from underneath the base plate showing a tab twisted to its locked position;

[0024] Fig. 16 is an enlarged elevational view of the base plate and end plate wherein the tabs are in their pre-twisted state; and

[0025] Fig. 17 is an enlarged perspective view of the end plate and base plate with the tabs in their pre-twisted state.

[0026] Corresponding reference characters indicate corresponding parts throughout the several views. The exemplification set out herein illustrates one exemplary embodiment of the invention, in one form, and such exemplification is not to be construed as limiting the scope of the invention in any manner.

[0027] With reference to Figs. 1 and 2, an exemplary condensing unit 10 is shown. It comprises a metal base plate 12 having flanges 14 and an upper surface 16 to which are mounted a hermetic compressor 18, receiver 20 and a condenser unit 22, the latter comprising a condenser 24 and a fan assembly 26. Fan assembly 26 comprises a plastic housing or shroud 36 which houses motor driven fan 38. The discharge line 28 from compressor 18 is connected to inlet 29 of the condenser 24 and outlet 31 thereof is connected by means of tube 30 to receiver 20. Inlet and outlet ports 32 and 34, respectively, are adapted to be connected to the evaporator unit (not shown) of the refrigeration system.

[0028] Referring now to Fig. 3, condenser 24 comprises a pair of end plates 40 and 42, a serpentine coil 44 carrying a refrigerant connected to the inlet 29 and outlet 31 and in good thermal connection with a plurality of cooling fins 46 in a manner well known in the art. Coil 44 includes internal portions 47 and external portions 49.

[0029] Exterior surface 41 of end plate 42 is shown in Fig. 3. Fig. 12 illustrates interior surface 43 of end plate 42 in detail. End plate 42 is made of a stamped and bent piece of sheet metal, for example 18 Ga. galvanized steel, having flanges 48 and a plurality of openings 50 through which serpentine coils 44 extend as shown in Fig. 3. As further shown in Fig. 3, flanges 48 of end plate 42 are bendable to extend outwardly from exterior surface 41, and away from the plurality of cooling fins 46, such that a portion of flanges 48 remains adjacent to exterior surface 41. The pair of end plates 40 and 42 may further include attachment means extending from lower end 45 of each end plate 40 and 42, respectively, that includes tabs or similar structures to attach condenser 24 to base plate 12 by receipt through attachment receiving means in base plate 12, such as correspondingly shaped structural openings or slots 74 (Fig. 9).

[0030] As shown in Fig. 12, at lower end 45 of end plate 42 are a pair of tabs 52 and 54 that join the main body 56 of end plate 42 through connecting areas 58 and 60 formed by notches 62 that are oriented at an angle α of, for example, 10 degrees relative to side edges 64 such that internal distal upper edges 66 of notches 62 are disposed at the same angle α relative to lower edges 68. Each internal distal upper edge 66 acts as a camming

surface for each tab 52 and 54 when tabs 52 and 54 are received into slots 74 of base plate 12 and deformed or bent to lock condenser 24 to base plate 12. Each tab 52 and 54 additionally includes a side edge 65. Each tab 52 and 54 further includes an internal lateral edge 59 and an internal proximal edge 61 that, together with internal distal upper edge 66, defines notch 62. Left hand end plate 40 is identically constructed except that it is a mirror image.

[0031] Figs. 7 and 8 illustrate interior surface 43 of end plate 42 including a plurality of openings 50, lower end 45, the pair of tabs 52 and 54, and flanges 48. Flanges 48 are shown positioned in first, outwardly bent position (Fig. 7) and a second, unbent open position (Fig. 8). Figs. 10 and 11 show interior surface 43 of end plate 40 with a plurality of openings 50, a pair of side edges 64, main body 56, a pair of tabs 52 and 54, a lower end 45, and flanges 48 positioned in first, outwardly bent position.

[0032] Referring back to Fig. 3, serpentine coil 44 includes segments that are folded back and forth and extend through apertures 50 of end plates 40 and 42, where the segments of serpentine coil 44 have internal portions 47 that are positioned between the pair of end plates 40 and 42. Further, the segments of coil 44 include external portions 49 that are positioned outside external surfaces 41 of end plates 40 and 42, respectively.

[0033] Fig. 4 shows condenser 24 being placed on upper surface 16 of base plate 12 with tabs 52 and 54 extending through slots 74 (Fig. 9) of base plate 12 as shown in the lower left hand view of the assembled condenser and base plate as viewed from underneath with the lower surface of the base plate being visible. Tabs 54 and 52 and slots 74 in base plate 12 are aligned so that condenser 42 can simply be dropped in place on base plate 12 and the tabs 52 and 54 will be inserted into and extend through slots 74 as shown in the lower left hand views of Figs. 4 and 6, and in the distal plan view of Fig. 5.

[0034] Tabs 52 and 54 are then twisted by means of a suitable machine and due to the orientation of notches 62 and internal distal upper edges 66 (Fig. 16), such twisting action will cause distal portions of tabs 52 and 54, defined by side edge 65 and lower edge 68 of each tab 52 and 54, to bend about bending axis x-x (Fig. 17) so that internal distal upper edges 66 of tabs 52 and 54 will be tightly drawn against the underneath surface 72 of base plate 12 and very firmly lock condenser 24 in place.

[0035] As shown in Fig. 17, internal distal upper edge 66 includes a sloped, non-orthogonal plane relative to base plate 12 to allow for a complete geometric tolerance range of tabs 52 and 54 of end plate 42 when tabs 52 and 54 are inserted into slots 74 in base plate 12. Contact point A is positioned between base plate 12 and a surface of internal distal upper edge 66. Bending will occur along axis x-x that passes through contact point A and lies on plane AA. Plane AA is the plane with a minimum resistance against bending force P that is applied by the twisting machine (not shown). As shown in Fig. 16 and, in

particular, Fig. 17, the inclined surfaces of internal distal upper edges 66 as tabs 52 and 54 are bent rearwardly exert a type of camming action against the lower surface of base plate 12 that pulls end plates 40 and 42 against the upper surface of base plate 12 to lock condenser 24 against base plate 12. Figs. 13 and 15 illustrate distal plan views of condenser 24 attached to base plate 12 showing internal distal upper edges 66 bent and twisted into a locked position, where Fig. 15 shows a rearward bend and Fig. 13 shows an alternative frontward (or forward) bend. Fig. 14 shows external surface 41 of end plate 40 from an elevational side view showing tabs 52 and 54 similarly bent and twisted into a locked position.

[0036] While this invention has been described as having a preferred design, the present invention can be further modified within the spirit and scope of this disclosure. This application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure as come within known or customary practice in the art to which this invention pertains and which fall within the limits of the appended claims.

Claims

1. A condensing unit (22), comprising:

a base plate (12) having a plurality of components mounted on an upper surface (16) thereof, said components including a compressor (18) and a condenser (24);

at least one of said components including a plurality of tabs (52, 54) extending through a corresponding plurality of slots (74) in said base plate (12);

said tabs (52, 54) including distal portions (65, 68) that are twisted underneath said base plate (12), said tab distal portions (65, 68) including respective camming surfaces (66) that tightly engage an undersurface (72) of said base plate (12) to tightly fix said at least one component to the upper surface (16) of said base plate.

2. The condensing unit (22) of claim 1, wherein said at least one of said components is a condenser (24) that comprises a pair of end plates (40, 42) having a plurality of apertures (50), a pair of side edges (64), and a lower end (45), said plurality of tabs (52, 54) extending from said lower end (45) of each of said end plates (40, 42).

3. The condensing unit (22) of claim 2, wherein said condenser (24) further comprises:

a coil (44) extending through said plurality of apertures (50) of said pair of end plates (40, 42).

4. The condensing unit (22) of claim 1, wherein each said camming surface (66) comprises an internal distal upper edge (66), and each tab (52, 54) further includes an internal proximal edge (61) and an internal lateral edge (59), said internal proximal edge (61), said internal lateral edge (59), and said internal distal upper edge (66) defining a notch (62).

5. The condensing unit (22) of claim 4, wherein said internal distal upper edge (66) and said internal lateral edge (59) are oriented non-orthogonally relative to said base plate undersurface (72) at a given angle (α).

6. The condensing unit (22) of claim 5, wherein said given angle (α) is 10 degrees.

7. The condensing unit (22) of claim 1, wherein at least one of said tabs (52, 54) further includes a side edge (65) and a lower edge (68), wherein at least one of said distal portions (65, 68) is defined by said lower edge (68) and said side edge (65).

8. A condensing unit (22), comprising:

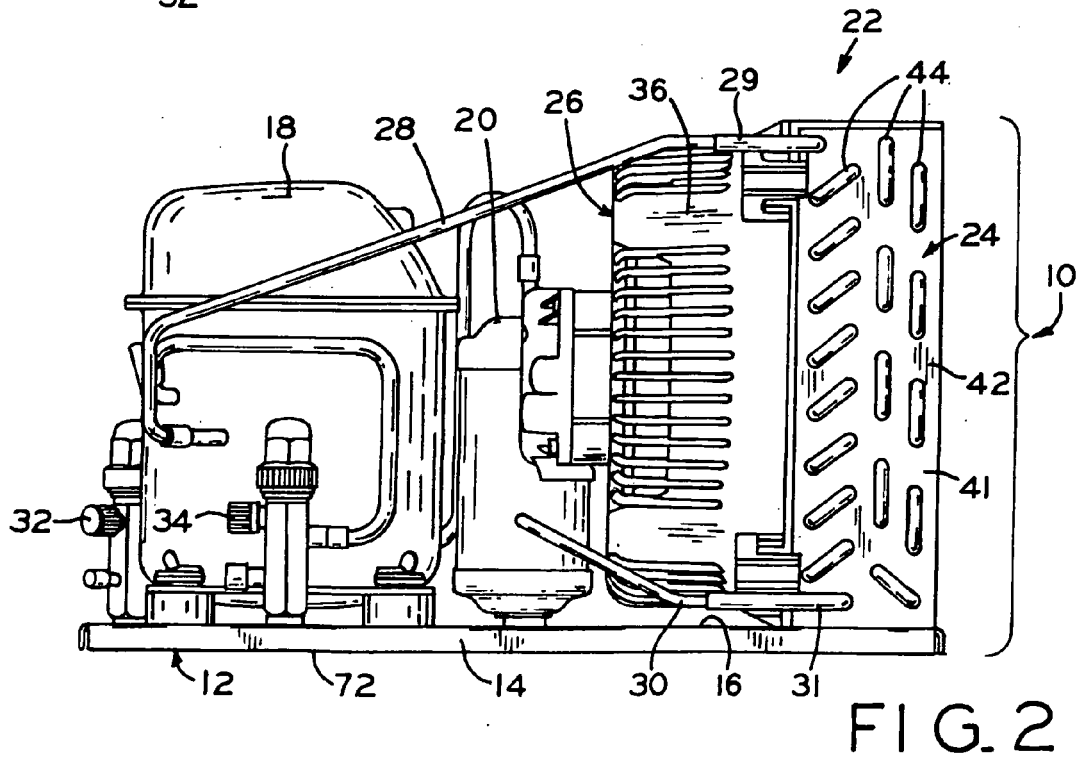
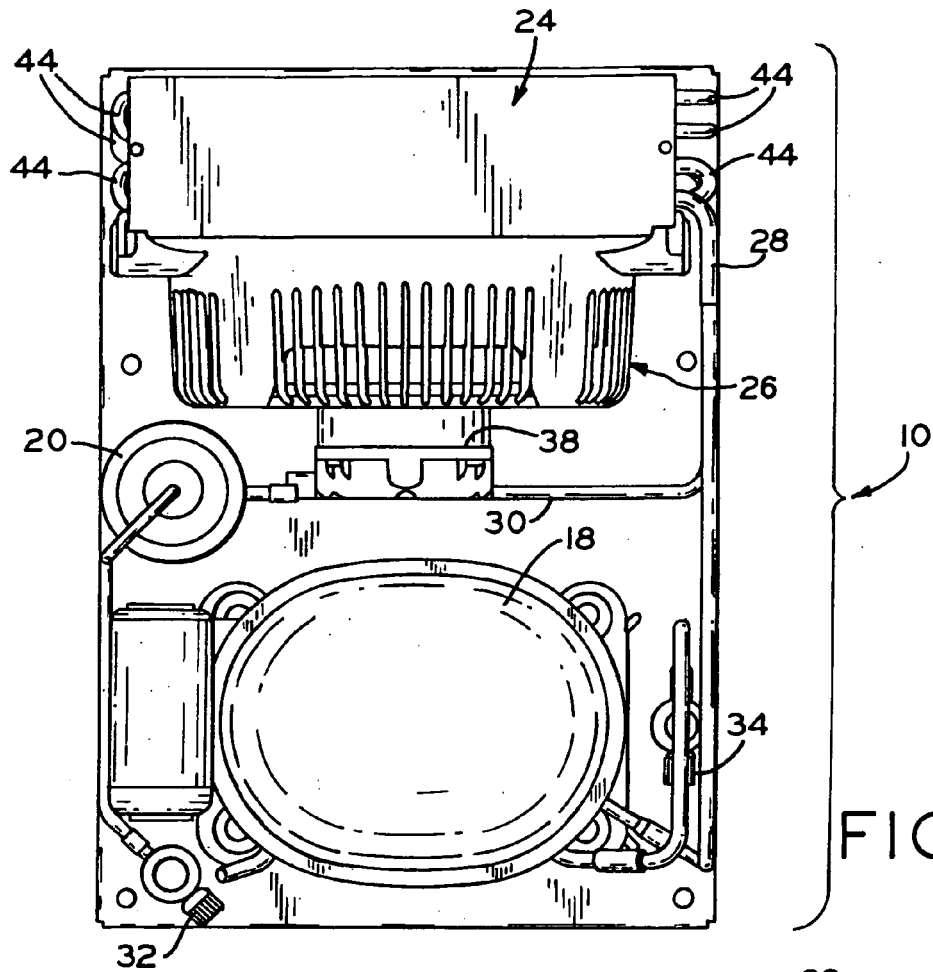
a base plate (12) having a condenser (24) mounted on an upper surface (16) thereof, said condenser (24) including a plurality of tabs (52, 54) extending through a corresponding plurality of slots (74) in said base plate (12); said tabs (52, 54) including distal portions (65, 68) that are twisted underneath said base plate (12), said tab distal portions (65, 68) including respective camming surfaces (66) that tightly engage an undersurface (72) of said base plate (12) to tightly fix said condenser (24) to the upper surface (16) of said base plate (12).

9. The condensing unit (22) of claim 8, wherein said condenser (24) further comprises a pair of end plates (40, 42) having a plurality of apertures (50), a pair of side edges (64), and a lower end (45), said plurality of tabs (52, 54) extending from said lower end (45) of each of said end plates (40, 42).

10. The condensing unit (22) of claim 9, wherein said condenser (24) further comprises a coil (44) extending through said plurality of apertures (50) of said pair of end plates (40, 42).

11. The condensing unit (22) of claim 8, wherein each of said camming surfaces (66) comprises an internal distal upper edge (66), and each tab (52, 54) further includes an internal proximal edge (61) and an internal lateral edge (59), said internal proximal edge (61), said internal lateral edge (59), and said internal distal upper edge (66) defining a notch (62).

12. The condensing unit (22) of claim 11, wherein said internal distal upper edge (66) and said internal lateral edge (59) are oriented non-orthogonally relative to said base plate undersurface (72) at a given angle (α).
13. The condensing unit (22) of claim 12, wherein said given angle (α) is 10 degrees.
14. The condensing unit (22) of claim 8, wherein at least one of said tabs (52, 54) further includes a side edge (65) and a lower edge (68), wherein at least one of said distal portions (65, 68) is defined by said lower edge (68) and said side edge (65).
15. A condensing unit (22) comprising:
- a base plate (12) having an undersurface (72) and a condenser (24) mounted on an upper surface (16) thereof, said condenser (24) including one or more attachment elements (52, 54) extending through one or more corresponding attachment receiving means (74) in said base plate (12); and
- said one or more attachment elements (52, 54) including means for engaging said base plate (12) such that, upon deformation, said one or more attachment means (52, 54) tighten against said undersurface (72) of said base plate (12).
16. The condensing unit (22) of claim 15, said condenser (24) further comprising a pair of end plates (40, 42) having a lower end (45), wherein said pair of attachment elements (52, 54) extends from said lower end (45) of each of said end plates (40, 42).
17. A method of attaching a condenser of a condensing unit (22) to a base plate (12) of the condensing unit (22), the method comprising the steps of:
- positioning the condenser (24) to abut a base plate (12), the condenser (24) having a plurality of tabs (52, 54), each tab (52, 54) having an internal distal upper edge (66), and the base plate (12) having an undersurface (72);
- aligning each tab (52, 54) with a corresponding slot (74) on the base plate (12);
- inserting each tab (52, 54) through the corresponding slot (74) on the base plate (12) such that each tab (52, 54) extends through the corresponding slot (74);
- then twisting each tab (52, 54) to thereby draw the internal distal upper edge (66) of each tab (52, 54) tightly against the undersurface (72) of the base plate (12) such that the condenser (24) is locked to the base plate (12).
18. The method of claim 17, wherein the step of twisting each tab (52, 54) comprises bending each tab (52, 54) about a bending axis (x-x).
19. The method of claim 18, wherein the step of twisting each tab (52, 54) comprises applying a bending force (P), wherein the bending axis (x-x) lies on a plane (AA) having a minimum amount of resistance towards the bending force (P).
20. The method of claim 17, wherein the step of twisting each tab (52, 54) comprises bending each tab (52, 54) about a bending axis (x-x) that intersects a contact point (A) at which the internal distal upper edge (66) contacts the base plate (12) and at which the internal distal upper edge (66) of each tab (52, 54) is positioned on the same horizontal plane (AA) as the undersurface (72) of the base plate (12).
21. The method of claim 17, wherein the internal distal upper edge (66) of each said tab (52, 54) is oriented non-orthogonally relative to the base plate undersurface (72), and the step of twisting exerts a camming action between the internal distal upper surface (66) and the base plate undersurface (72) to draw the condenser (24) tightly against an upper surface (16) of the base plate (12).
22. The method of claim 17, wherein the step of twisting each tab (52, 54) comprises machine twisting each tab (52, 54).



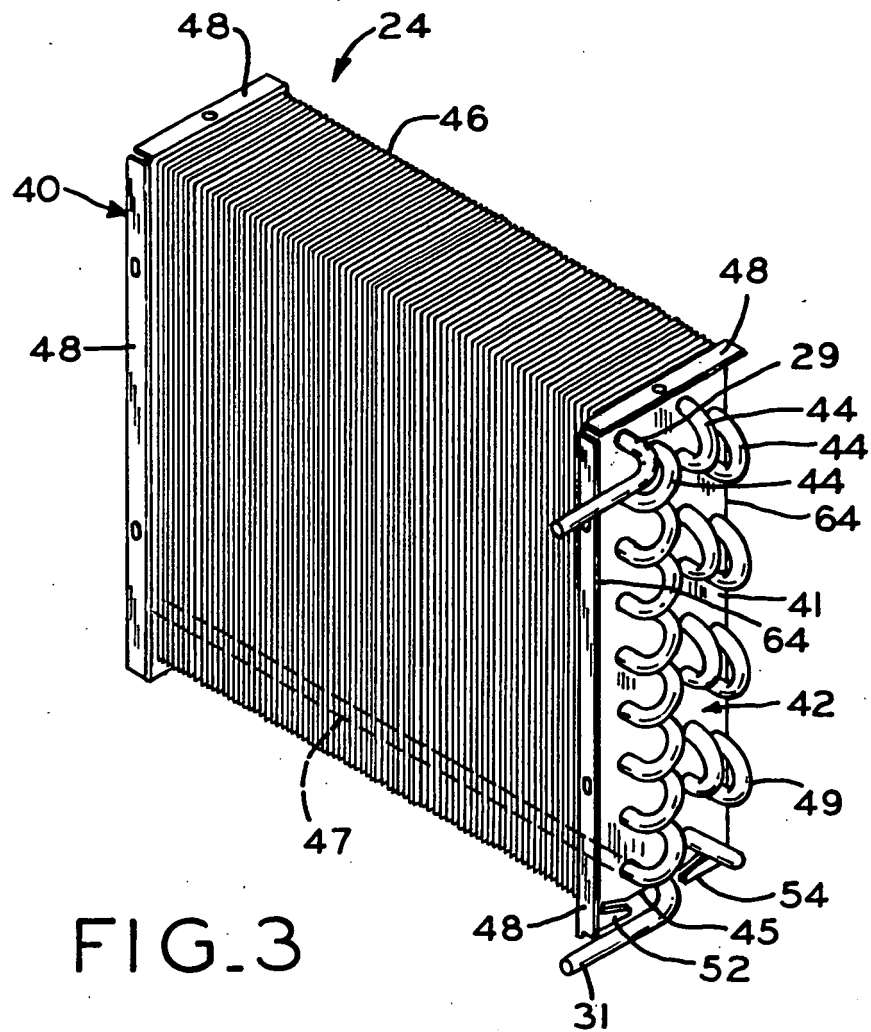
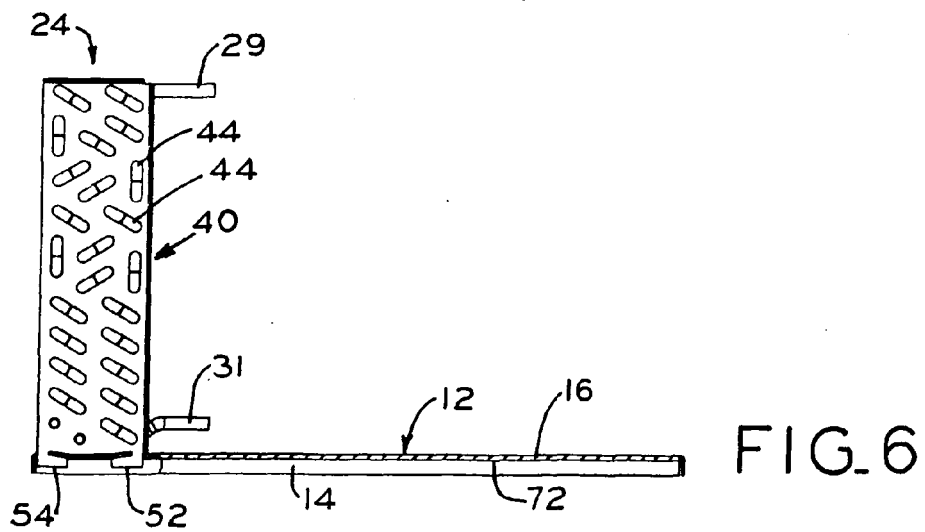
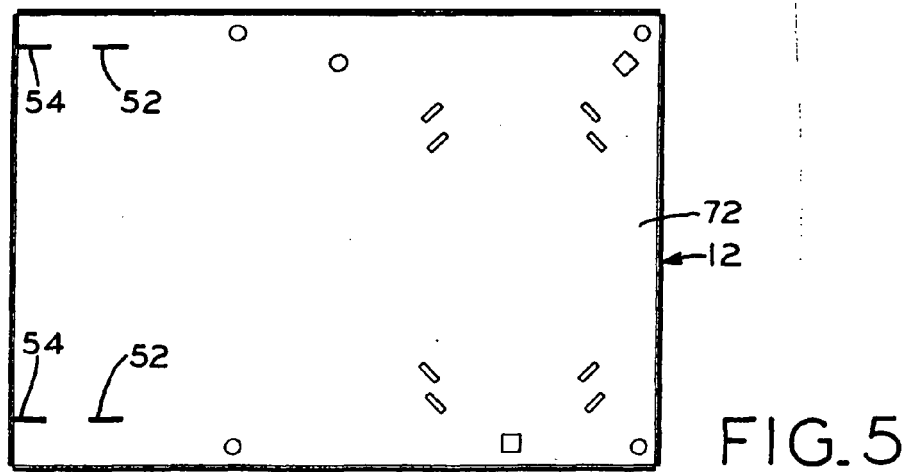
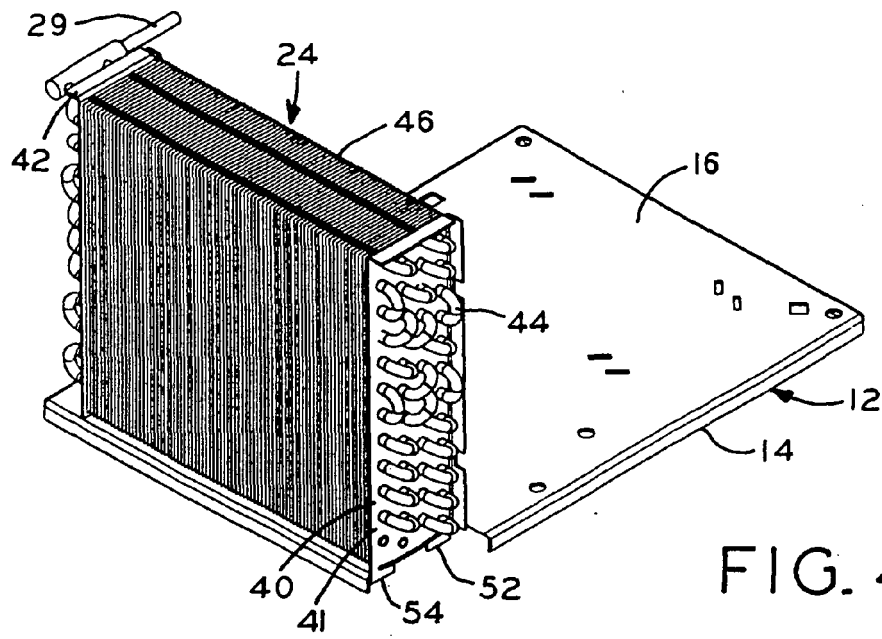


FIG. 3



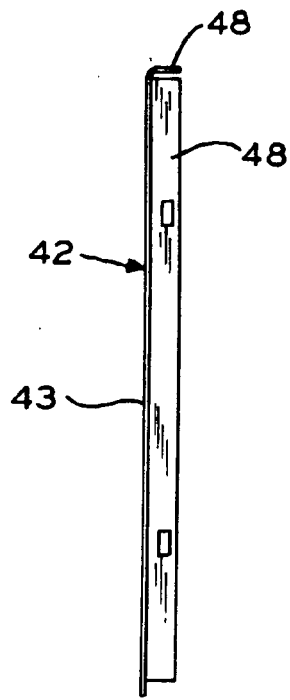


FIG. 7

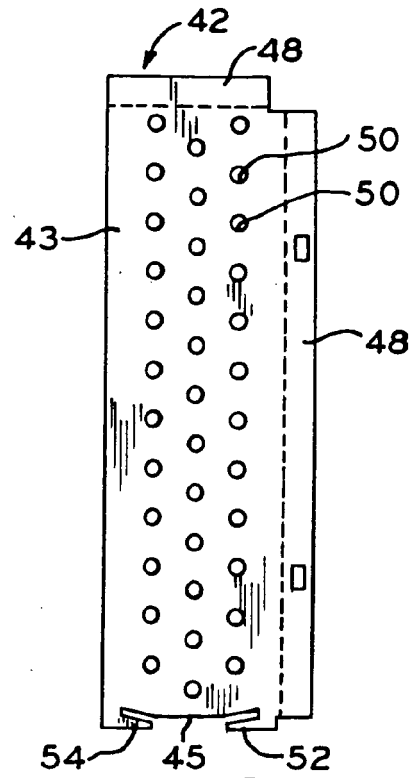


FIG. 8

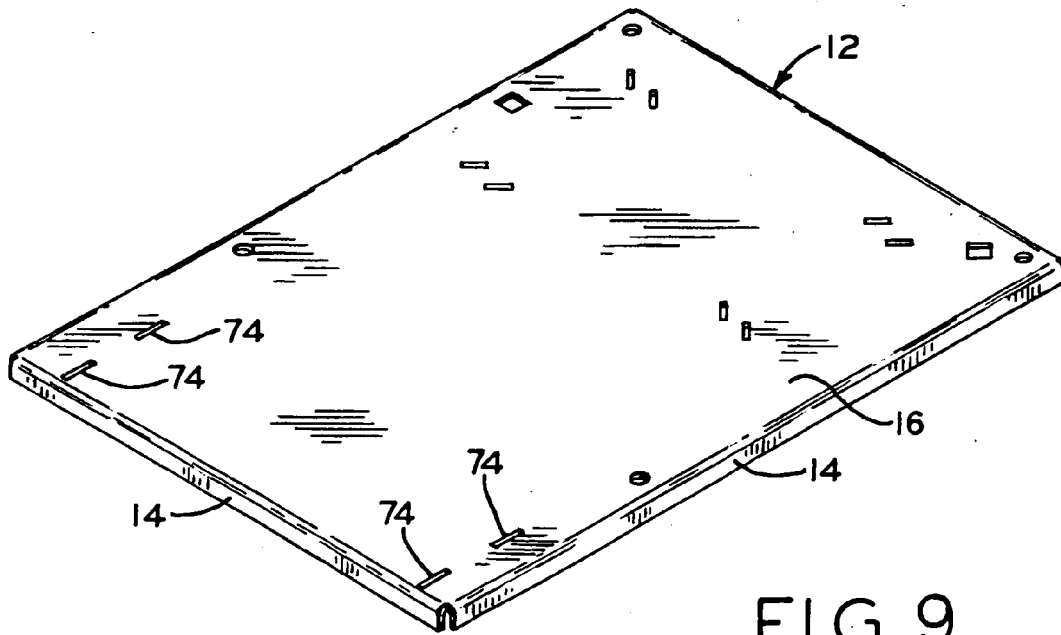


FIG. 9

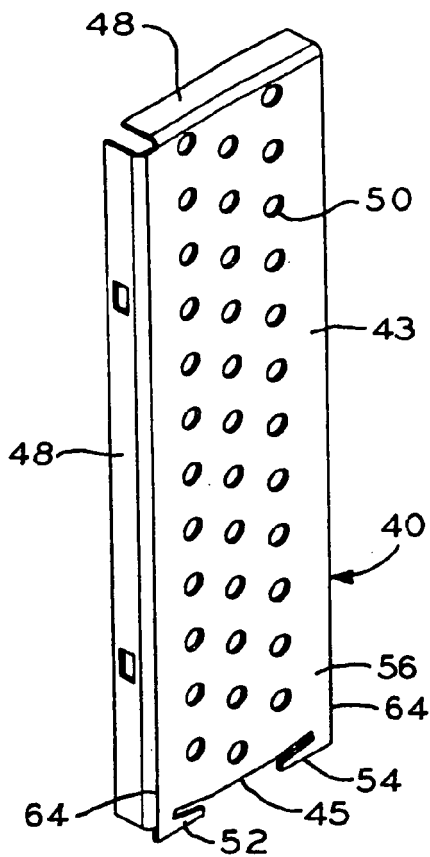


FIG. 10

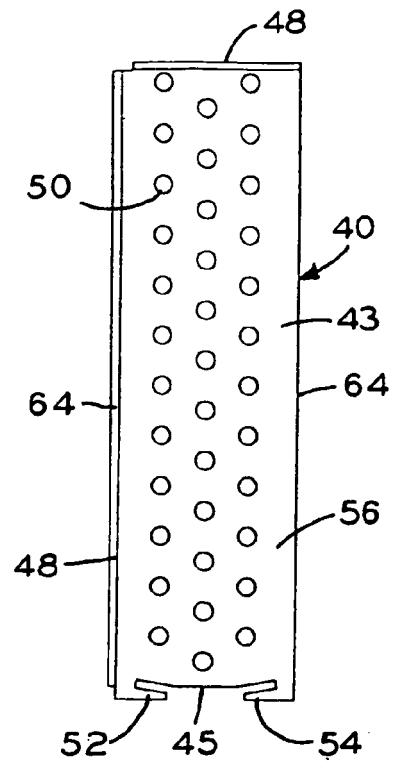


FIG. 11

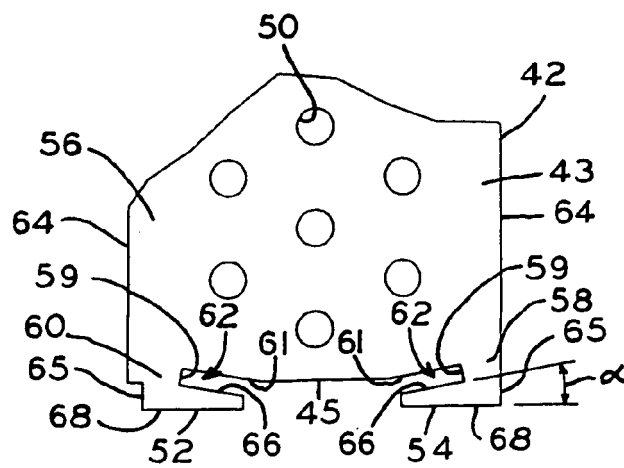


FIG. 12

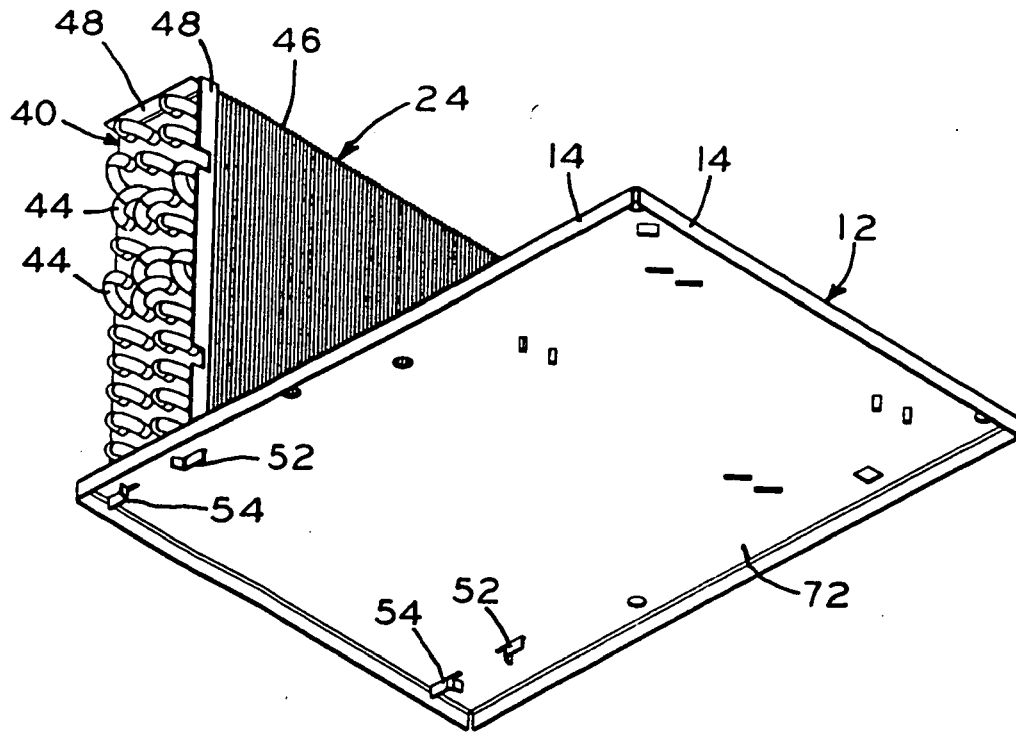
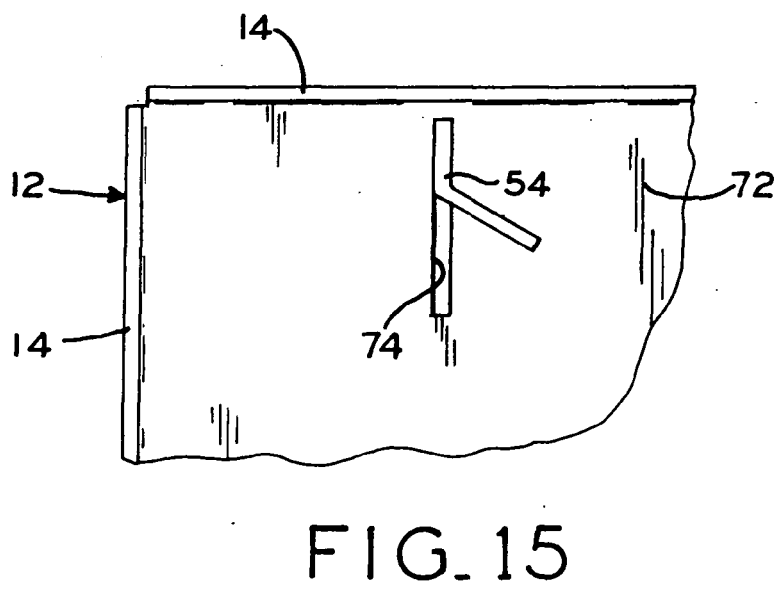
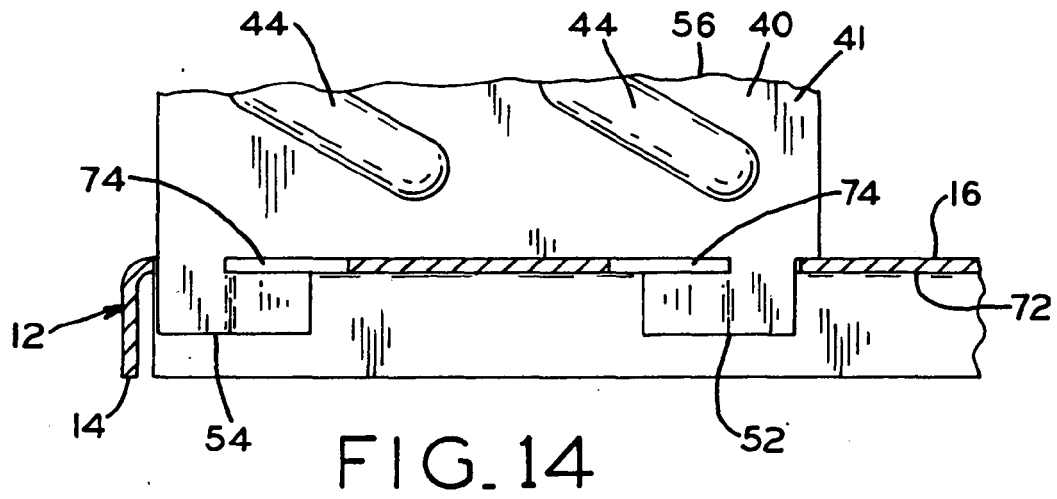
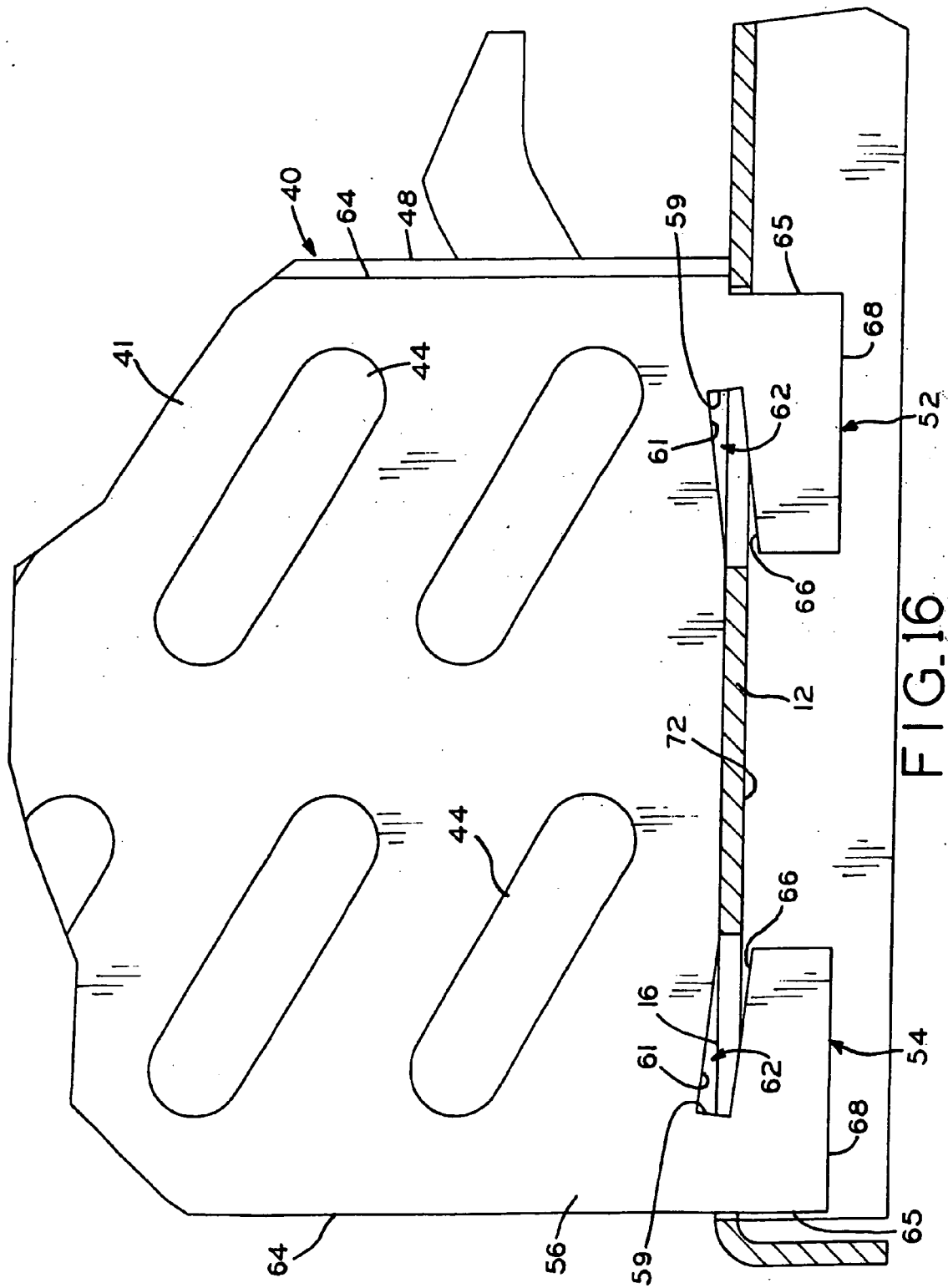
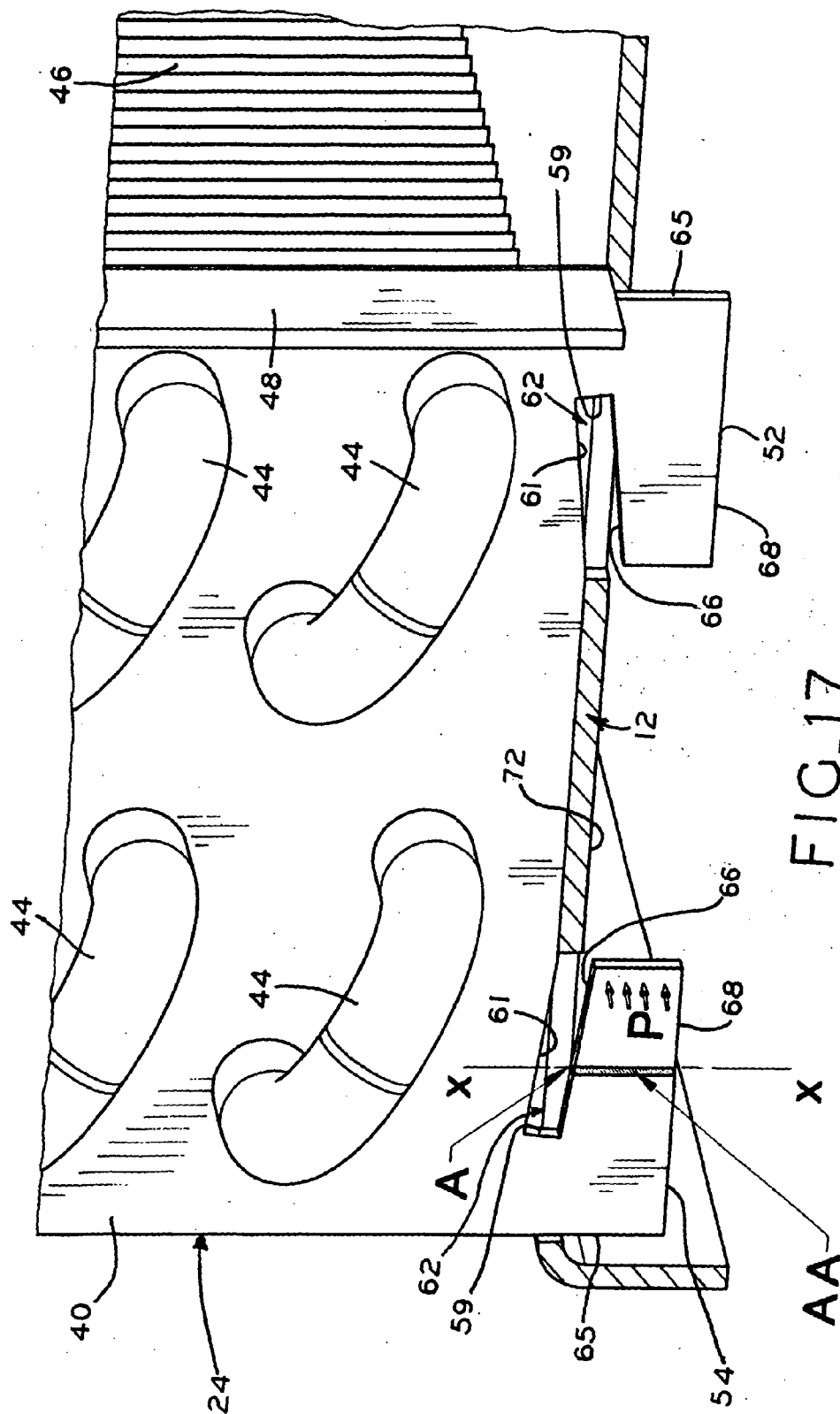


FIG. 13







REFERENCES CITED IN THE DESCRIPTION

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