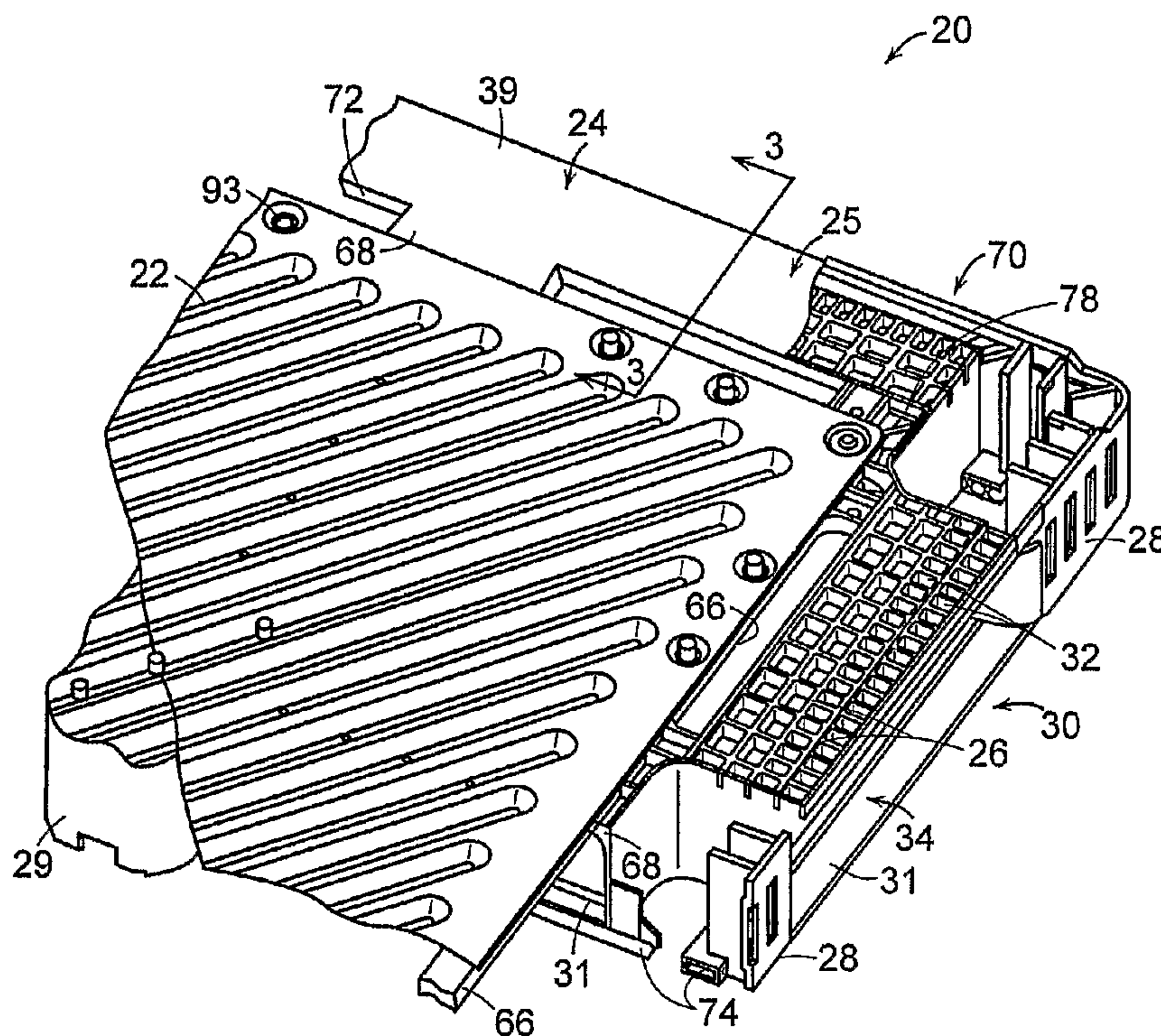




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(54) Titre : PALETTE EN MATIERE PLASTIQUE A SYSTEME DE SUSPENSION DE PLATE-FORME  
 (54) Title: PLASTIC PALLET HAVING DECK SUSPENSION SYSTEM



(57) **Abrégé/Abstract:**

The top of a thermoplastic pallet (20) for transporting goods is comprised of a frame (24), which is mounted on columns (28) extending upwardly from a base (30). A subframe (66) is attached to brackets (68, 78) within the interior opening of the frame. The edges of corrugated metal deck (22) is attached to the subframe and spaced apart inwardly from the inner edge (72) of the frame. There are lengthwise spaces between the subframe and the bridge parts (25) of the frame, which bridges span the fork opening spaces (34) between the columns (28). When the bridges are horizontally impacted, they can deform elastically into the spaces without causing any damage to the deck. Preferably the bridges (25) comprise lengthwise impact absorber zones (26) for good compliance to horizontal impacts.

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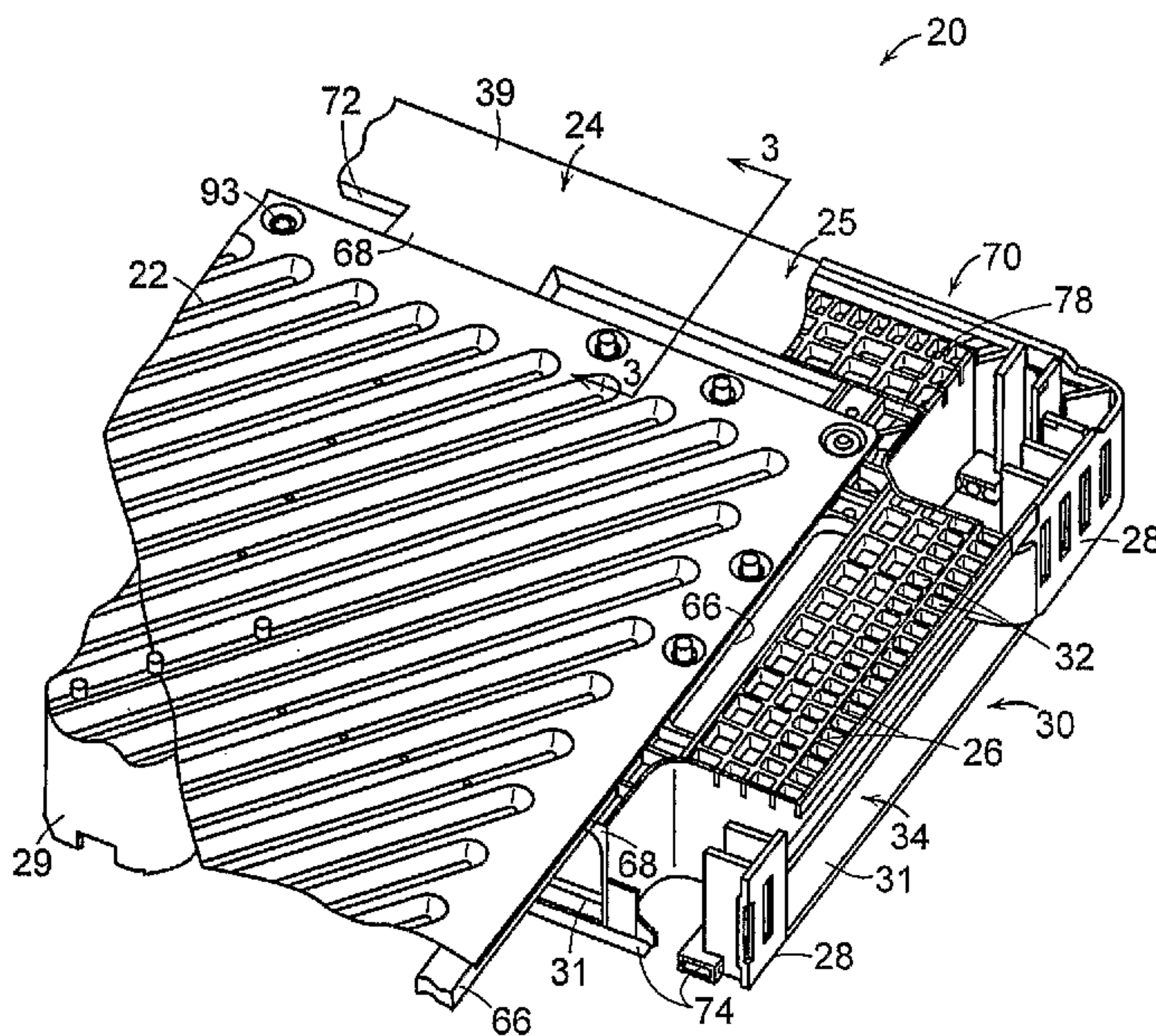
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(54) Title: PLASTIC PALLET HAVING DECK SUSPENSION SYSTEM



(57) Abstract: The top of a thermoplastic pallet (20) for transporting goods is comprised of a frame (24), which is mounted on columns (28) extending upwardly from a base (30). A subframe (66) is attached to brackets (68, 78) within the interior opening of the frame. The edges of corrugated metal deck (22) is attached to the subframe and spaced apart inwardly from the inner edge (72) of the frame. There are lengthwise spaces between the subframe and the bridge parts (25) of the frame, which bridges span the fork opening spaces (34) between the columns (28). When the bridges are horizontally impacted, they can deform elastically into the spaces without causing any damage to the deck. Preferably the bridges (25) comprise lengthwise impact absorber zones (26) for good compliance to horizontal impacts.

WO 2006/089174 A3

## PLASTIC PALLET HAVING DECK SUSPENSION SYSTEM

## TECHNICAL FIELD

The present invention relates to molded plastic pallets used with forklift devices for transporting goods.

## BACKGROUND OF THE INVENTION

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A common wood or plastic pallet design, for carrying goods with the use of fork lifting devices, has an essentially planar top deck, which is supported on columns or rails running upwardly from the base. During use a pallet may be hit horizontally and damaged by a hard object. For example, the tine of fork lift truck may hit the edge of the pallet deck, or the pallet may be rammed against a column or post. When common wood pallets are damaged in such ways, a broken end slat can be removed and replaced. However, many prior art plastic pallets have had decks and other parts which are integral, i.e., they are molded as one piece or are welded together. When such kind of pallet is damaged, any repair can be technically difficult and uneconomic. While pallets with detachable parts are known, they tend to have a disadvantage in strength compared to integrally molded or welded pallets.

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Thus, to the extent possible, a plastic pallet should be designed to resist damage, but not in a way which increases cost and weight. That has been difficult to do. One approach involves making the parts of a pallet more massive, or of a high performance material. However, that can involve unacceptable increases in weight, height, or cost.

20

In another approach, described in more detail in a related patent application referred to below, the bridge part of a frame, that part which spans the fork-opening space between adjacent columns, is configured so it partially or wholly complies with the load, that is, so it absorbs the force of the load by resiliently deforming. However when the deck is attached to such a bridge part, the deck can be buckled or torn loose, depending on how the bridge is constructed and on the extent of the impact blow. The present invention is also concerned

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with pallets having textured decks, for instance corrugated metal decks. When such decks are deformed to the extent of that pallet use is impaired, they have to be replaced or the pallet may have to be discarded.

5 Thus, there is a need for improvement in the design of pallets and in particular for enabling pallets to receive hard horizontal blows, within the context of other restraints which include having satisfactory structural strength, durability and cost.

#### SUMMARY OF THE INVENTION

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An object of the invention is to provide a predominately plastic pallet with resistance to impact damage. Another object is to provide a means for attaching a deck to a pallet, particularly a textured metal deck, in such a way that deformation of the deck is avoided when the top edge of the pallet is hit and deformed by an object. Another object is to  
15 facilitate manual handling plastic pallets.

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In accord with the invention, a predominately thermoplastic pallet has a deck, which is mounted on a subframe, which is spaced apart from the inside of the frame at the top of the pallet. The pallet comprises a rectangular base, a plurality of spaced apart columns extending  
20 upwardly, and a rectangular thermoplastic frame mounted on the columns. The frame comprises a multiplicity of bridges, which span the spaces between the columns. The subframe is supported within the interior of the frame, preferably by brackets, which cantilever inwardly from the frame in vicinity of the columns. Each bridge preferably has an impact absorber, one or more parallel zones of high compliance to horizontal impact load.

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When impacted, such a bridge can deform inwardly into the space adjacent the subframe while absorbing the blow, without causing damage to the deck.

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In a pallet embodiment in accord with the invention, the space between each bridge and the subframe has a length, which is equal or less than the length of the bridge, and at least 75  
30 percent of the length of the bridge. The space may be entirely open and of dimension sufficient to enable a worker to insert a hand, for manual movement of the pallet. In an

alternate embodiment, there is vertical ribbing within the space. It is shaped for high compliance when the bridge deforms, and for insignificant load transfer to the subframe when a bridge is horizontally deformed.

5 The deck suspension system may be used with different kinds of deck, including in a pallet having an all-plastic deck. Preferably, the deck is made of diagonally corrugated metal and has a peripheral flange. The deck flange is preferably attached to subframe only at subframe locations, which are adjacent, the spaces adjacent the bridges. In an alternate embodiment, the subframe may be formed as an integral part of the deck.

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The deck suspension system enables the use of bridges, which deform while absorbing impacts, and thus are durable. The foregoing and other objects, features and advantages of the present invention will become more apparent from the following description of preferred embodiments and accompanying drawings.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an isometric partial cutaway top view of a quadrant of a plastic pallet having a deck, which is mounted on a subframe suspension system.

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Fig. 2 is a top view of a portion of the pallet of Fig. 1 with the deck removed.

Fig 3 is a vertical cross section through the periphery of the pallet of Fig. 1.

25 Fig. 4 is a top view of another embodiment of pallet.

Fig. 5 is a vertical cross section like Fig. 3, for an alternative embodiment pallet.

Fig. 6 is an exploded view of a pallet like that shown in Fig. 1.

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## DESCRIPTION OF THE BEST MODE

The invention is described in terms of a pallet, which is in the shape of a 40 inch x 48 inch rectangle (1016 mm by 1219 mm) and is called a GMA pallet. A comparable European  
5 pallet is a 1000 mm by 1200 mm pallet, sometimes called a CP-1 pallet. For such a pallet to become accepted for widespread use in commerce, it must meet various technical and performance standards. The Grocery Manufacturers of America (GMA), Washington, D.C., U.S. in conjunction with other organizations has published a document entitled  
10 "Recommendations on the Grocery Industry Pallet System" (1992). From that and other references, the current user-demanded characteristics for an acceptable GMA pallet include the following: The height must be less than 5.56 inches. The pallet must allow four-way side entry by forks through side opening. The pallet should weigh no more than 55 pounds, more preferably about 50 pounds. And the pallet has to meet a variety of structural requirements. An exemplary pallet of the present invention meets such requirements.

15 The pallets of the present invention may be molded in components and subassemblies, preferably by injection molding using gas assistance. See Pat. No. 5,401,459. The several parts or subassemblies may be joined as an assembly by known thermoplastic fabrication methods, for example, by mechanical means, by hot plate welding, vibratory welding, or  
20 ultrasonic welding. See for instance, Pat. Nos. 6,250,234 and 6,283,044. The thermoplastic parts of the pallet may be made of commercial grade polypropylene, high density polyethylene or other polyolefin. Other plastics, including thermosets and engineered plastics, may be used for the portions of the pallet.

25 Figure 1 through 3 and the exploded view of Fig. 6 show pallet 20. The pallet comprises a frame 24 which is mounted on eight columns 28 which run upwardly from the outside of the rectangular pallet base 30, comprising corner columns and midpoint columns. In this embodiment, the columns are molded integrally with the frame and the top part of the base, but they may be separately formed. Pallet base 30 is comprised of outer rails 31, which form  
30 a rectangle, which matches the shape of the frame. Cross rails 33 interconnect the centers of the outer rails and intersect at the location of center column 29. In accord with Moore et al.

6,705,237 patent, metal beams 74 run within the base rails 31, 33 for strength. The exploded view of Fig. 6 illustrates how the beams may be inserted into cavities at the bottom of the molded assembly, which are then closed by base cover plate 88.

5 Frame 24 is by definition a structure, which circumscribes a central space. A subframe 66 is positioned within the opening of the frame 24. The subframe is analogous to the frame in defining a central opening, which is spanned by the deck. Subframe 66 has the shape of an open center rectangle and is mounted on midpoint brackets 68 and corner brackets 78. The combination of subframe and brackets is referred to as the deck suspension system. Deck 22,  
10 which is preferably made of textured sheet metal, for instance a corrugated aluminum alloy, is attached to the subframe. Thus the edge of the deck is spaced apart from the frame and the exterior of the pallet. The deck, with such portions of the frame as are exposed at the top of the pallet, provides the top surface of the pallet, for carrying goods.

15 Openings 34, sometimes called windows, are spaces between the columns through which forks are inserted for lifting. GMA pallet openings must be least 3.1 inches high and 12 inches wide. Bridges 25 is those portions of the frame 24 which span the openings 34. In the invention, thermoplastic bridges 25 are preferably constructed so that they resiliently deform in compliance to the load, to thus distribute and absorb horizontal impact forces. Upon  
20 removal of the impacting force, the bridge resiliently resumes its original shape. Compliance is the shape change of a bridge, responsive to an applied force or load. For a given load, a bridge or portion thereof, which has high compliance, will have greater deformation and thus more gradual absorption of the force than will one, which is low in compliance. Generally, a structural member, such as the subframe or the base is stiff and has low compliance. In the  
25 invention, an impact absorber is a structure, which has compliance higher than a comparable size structure, which is intended only for structural purpose.

As can be seen in the exposed portions of the bridges shown in Fig. 1 and Fig. 3, the impact absorbers 26 of bridges 25 comprise one or more lengthwise zones, which have high  
30 compliance, compared to a solid structural member such as the subframe. The impact absorber zones are preferably comprised of parallel rows of closed cells 32 bounded by ribs

40, which run lengthwise and transversely. In the embodiment shown, the cells 32 are smaller in the lengthwise zone, which is near the outer edge of the bridge than they are in the zones, which are near the inner edge 72 of the bridge. Part or all of the cells may be open at the top and bottom. Open cells 32B and 32A are shown in Fig. 4 and Fig 5. The radii of the interiors of the cells may be changed from large to small, along with cell size, to further accomplish desired gradation in internal compliance of the bridge across its width. A bridge may have a metal stay which extends lengthwise proximate the outer edge, to help impact resistance. The construction of impact absorbing bridges, with and without stays, is described in the patent application entitled "Plastic pallet having impact resisting top", bearing Atty. No. EPC-2437, filed on even date herewith by D. Swistak et al., the disclosure of which is hereby incorporated by reference.

With reference to Fig. 1 and Fig. 3, the outer edges of the subframe are spaced apart from the inner edges 72 of the frame. Preferably, the brackets 68, 78 are integrally molded with the frame and subframe, as shown. Other support means may be used, including that the subframe may rest on the top of columns when they wider than shown here, or where the frame is narrower than is shown. (In the exemplary pallets described here, a bracket may be alternatively conceived as being part of the top of a column, inasmuch the frame and column tops are integral in a finished pallet.) In other variations of the invention, the subframe may be comprised of multiple individual pieces rather than one rectangular piece; the plastic subframe and brackets may include metal members for strength; and, the subframe may be made of metal and may be fastened to the brackets.

The outside of subframe 66 is spaced apart from the inner edge 72 of the frame, and thus there is a space 30 adjacent each bridge 25. The brackets bound the lengthwise ends of spaces 30. Preferably, the brackets are shaped so that the ends of spaces 30 have rounded inside corners, to lessen stress concentration. The spaces 30 enable inward deformation of a bridge under horizontal impact, without consequential deformation of the subframe and attached deck. Since the columns are sturdy, compared to the bridges of the frame, the frame portions, which run over the top of the columns, are much less prone to inward deformation when impacted, although some motion may occur as indicated below.

A typical space 30 has a length, which is equal to, or somewhat less than, the length of the associated or adjacent bridge. The length of each space 30 will be at least about 75 percent, preferably about 85 percent of the length of the associated bridge. Spaces 30 may be centered relative to the bridge or they may be off-center. See Fig. 2. The ends of a space 30 does not extend beyond the ends of the bridges. As a corollary, the bracket width is equal or greater than the associated column width. Having a space 30 length which is less than the full length of the bridge shortens the free span, which is between the brackets, of the associated subframe. That reduces the required section size of the subframe portion, although there is some resultant increase in the effective compliance of the bridge as a whole, since its free span is also effectively diminished.

In an exemplary 40 x 48 pallet, a bridge is about 12 inches (30.5 cm) long, about 3 to 5 inches (7.5 to 12.7 cm) wide, and about 0.7-0.8 inches (18 to 20 mm) high. The edge of the deck, where it is attached to the subframe will be 4 to 5 inches (11 to 13 cm) or more spaced apart from the outer edge of the frame. The associated adjacent subframe is about 1.5 inches (38 mm) wide and 0.7 inches (18 mm) thick. The space 30 will be about 10 inches (25.4 cm) long. For an exemplary 40 x 48 pallet, when the deck is inset about 5 inches (11 cm) the deck is 30 inch (76 cm) by 38 inch (97 cm) in dimension. Since the spaces 30 are at least 75 percent of the at least 12 inch (30 cm) length of the bridges, more than fifty percent of the edge of the deck is not connected to the bridge in a horizontal load transferring way; and when there are no ribs in spaces 30 (as described below), the at least fifty percent of the deck is not attached to anything.

Deck 22 preferably has the diagonal corrugations shown and a flat circumscribing flange, where it attaches to the subframe. The center of deck is attached to center column 29. Deck 22 is preferably attached to the subframe in the following way: Fasteners 93 run through holes in the deck at carefully chosen locations. The deck has a circumscribing flange 49, which is fastened to the subframe at locations 73, that is, where the subframe runs between the brackets and athwart the bridges. The deck is fixedly attached to the subframe at the pinning locations 73 and thus is positively located on the pallet. The deck is optionally also

attached by its corners to the subframe or to the brackets 78 at pinning locations 75, to prevent lifting and snagging of the corner during use. The holes at locations 75 are preferably short length slotted holes, running along the diagonal of the deck. They enable small movement of the deck relative to its attachment under conditions of severe impact. The midpoints of the deck edge are preferably not pinned to the brackets 68. That enables a small impact-induced movement of the frame, bracket and subframe at those midpoint column locations under severe loads. In the generality of the invention the deck may be attached to the subframe at any point along the length of the deck edge, including in vicinity of the midpoint columns. The fasteners for decks may be screws, rivets, or plastic pins which extend upwardly from the subframe and which are headed after the deck is set in place, as suggested in Fig. 1 and Fig 3. Other metal or plastic fasteners, which are known, may be used, within the meaning of pinning. Within the meaning of attaching, adhesives may be used.

The deck is preferably made of wrought aluminum alloy, such as Type 5052 alloy. The outer edge 71 of deck flange 49 is slightly down-turned into space 30, at the outside edge of the subframe. That provides strength and avoids snagging of goods moved across the pallet surface. See Fig. 3. In an alternate embodiment, the edge of the deck may extend beyond the outer edge of the subframe and overlies at least part of a space 30. For a further description of the deck and variations, see the related application entitled "Plastic pallet having metal deck", bearing Atty. No. EPC-2435, filed on even date herewith by R. Brochu et al., the disclosure of which is hereby incorporated by reference.

In the invention, the edge of the deck is inset, or spaced apart inwardly from the outer edge of the frame, by a dimension, which is at least equal to the width of the frame and part of the space. Thus, the deck will be protected from horizontal impact blows on the side of the pallet. The spaces 30 between the bridges and subframe are large enough to accommodate non-failing deformation of the bridges, especially the large deformations which can be associated with bridges having impact absorbers, which increase bridge compliance. For the exemplary pallet, the width of an open space 30 between the inner edge of the bridge and the

outer edge of the subframe and associated deck is preferably about 0.5 to 1.5 inches (13 mm to 38 mm), most preferably about 1.3 inches (33 mm).

5 Preferably, spaces 30 have a length and width, which is sufficient to enable a worker to insert his or her hand, to manually grasp and move the pallet. For such purposes, one or more of the spaces 30 will be about 5 inches (12.7 cm) long and at least one inch (2.5 cm) wide. The spaces also provide passages enabling fire sprinkler water to fall onto the cross rails and any underlying pallets or goods. Generally, the size of spaces may vary with location around the top of the pallet.

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While the spaces 30 are preferably devoid of any structure, in other embodiments there can be structure within the spaces, either to prevent objects from dropping through the spaces, or to provide additional vertical load bearing structure for the top. Fig. 4 is a top view of part of alternate embodiment pallet 20A. In Fig. 4, and in Fig. 5 discussed next, numbers with  
15 suffixes denote elements which correspond with those described above, except as stated otherwise. In pallets 20A and 20B, a row of open cells comprises impact absorber 32A, 32B in each bridge 25A, 25B. In Fig. 4, pallet 20A has spaces 30A, which have the same lengths as their associated bridges 25A, and the spaces contain a plurality of vertical vee shape ribs 80. The ribs 80 are highly compliant to horizontal load, since they readily bend or flex.  
20 Other configuration ribs, such as curved ribs, which behave analogously, can be used. Within pallet design limits, when the frame 25A is deformed, ribs 80 flex and transfer load to the subframe which is insubstantial in terms of causing the subframe and attached deck to bend inwardly.

25 Fig. 5 shows in vertical cross section a portion of another embodiment pallet 20A, which has a different subframe construction. The brackets 68B of the subframe are as previously described. Deck 22 is made of metal or plastic sheet and has a circumscribing formed or rolled edge beam 52 in place of the previous described flat flange. The edge beam 52 provides good section modulus and beam strength to the deck edge, sufficient to support the  
30 deck where it runs between the brackets. Thus, in this type of embodiment the subframe is the edge beam 52. The subframe is integral with the deck, rather than being integral with the

brackets. If the deck is a thick plastic structure, and it is attached to brackets so its edge is spaced apart from the frame, then the outer periphery of the deck will be considered the subframe within the scope of present invention.

5 The deck suspension system of the present invention may be used in pallets, which have decks of still other constructions. Plastic decks, which are taught by the prior art, may be used in substitution of the preferred metal deck. For example, the deck may be comprised of formed sheets, including extruded and pultruded sheets, one or more perforated plates, a waffled construction, a ribbed sheet, a metal-plastic composite, and so forth. A pallet of the present invention may be entirely made of plastic, when GMA requirements do not have to be met. A plastic deck may be welded to, or may be formed integrally with, the plastic subframe, as described. When deck is made of metal or non-metal sheet, the deck may be plain although that will tend to increase weight, compared to a textured sheet deck. A textured deck may have no flange and may be directly attached to the subframe.

15

Most usually, all bridges in a pallet will have the same construction, although they may vary. In the generality of the present invention, bridges may be constructed in an ordinary manner, which is associated with plastic structural parts. That is, they may lack impact absorbers. Even though not specially designed for compliance, and not as good in sustaining repeated blows, such bridges nonetheless may be sufficient in some applications

20

While the invention has been described in terms of the familiar U.S. 40 x 48 pallet, it may be applied to smaller and larger pallets, including pallets, which do not have columns at their side midpoints or base rails. The invention facilitates the use of metal decks in thermoplastic pallets, which are described in related applications, and enables the pallets to be stronger, lower in height, and better in meeting fire test requirements than heretofore was possible with predominately plastic pallets. The deck suspensions system also enables better accommodation of such thermal stresses as may arise during temperature changes, particularly when the deck is metal.

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What is claimed is:

1. A pallet comprising:

5 a plurality of spaced apart columns;

a rectangular frame, attached to the tops of the columns and having inner edges and outer edges, comprising a multiplicity of bridges, which span the spaces between the columns;

10 a subframe, spaced apart from the inside edges of the frame;

means, adjacent the columns, for supporting the subframe; and,

a deck attached to the subframe;

15

wherein there are lengthwise spaces between the inside edge of each bridge and the adjacent subframe.

2. The pallet of claim 1 further comprising a rectangular base, wherein said columns extend upwardly from the periphery of the base.

3. The pallet of claim 1 wherein the means for supporting the subframe comprises a multiplicity of brackets attached to the inner edge of the frame; and wherein each pair of adjacent brackets bounds the ends of one of said lengthwise spaces.

4. The pallet of claim 1 wherein each space has a length, which is at least 75 percent of the length of the adjacent bridge.

5. The pallet of claim 4 wherein each space has a length, which is equal to the length of the associated bridge.

6. The pallet of claim 1 wherein each space has a length which is at least 75 percent of the length of the adjacent bridge, wherein each bridge further comprises at least one lengthwise impact absorber zone.
7. The pallet of claim 6 wherein the pallet is composed predominately of thermoplastic; and, wherein each bridge further comprises a metal stay running along the length of at least one bridge in proximity to the outer edge thereof.
8. The pallet of claim 1, further comprising: vertical ribs, running transversely within at least one space, the ribs shaped for low resistance to bending, to enable the bridge associated with the space to deform inwardly under a horizontal impact load.
9. The pallet of claim 1 wherein a multiplicity of said spaces are each at least one inch wide and 5 inches long, and sufficient in shape to enable manual grasping of the pallet.
10. The pallet of claim 1 wherein the frame is comprised of thermoplastic and the deck is a textured metal sheet.
11. The pallet of claim 10 wherein the deck has a circumscribing flange where the deck is attached to the subframe.
12. The pallet of claim 1 wherein the deck is predominately thermoplastic.
13. The pallet of claim 1 wherein the outer edges of the subframe and of the deck are at least about 4 inches from the outside edge of the frame.
14. The pallet of claim 1 wherein the edge of the deck extends outwardly from the subframe over said spaces.

15. The pallet of claim 1 wherein the base is comprised of one or more cross rails which run across the center of the base; wherein the pallet further comprises a center column at the center of the base; and, wherein the deck is attached to the top of the center column.

16. The pallet of claim 3 wherein the subframe is an integral part of the deck.

17. A rectangular pallet comprising:

a base comprised of outer rails interconnected to form a rectangle;

5 eight spaced apart outer columns extending upwardly from the outer rails and one center column extending upwardly from the center of the base;

a rectangular frame, attached to the tops of the outer columns, the frame having inner edges and outer edges and comprised of a multiplicity of bridges, which span the spaces between  
10 the columns;

a subframe, spaced apart from the inside edge of the frame;

means for supporting the subframe; and,

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a deck attached to the subframe, the edges of the deck spaced apart from the inner edges of the frame; wherein the deck and frame comprise the top of the pallet.

18. The pallet of claim 16 wherein the means for supporting the subframe comprises a plurality of brackets, one each extending inwardly from the frame at the location of each outer column; and wherein each pair of adjacent brackets bounds the ends of a space running lengthwise between each bridge and adjacent portion of subframe.

19. The pallet of claim 17 wherein each base rail comprises a metal beam.

20. The pallet of claim 17 wherein the each bridge comprises an impact absorber, and wherein the portions of the frame, which overlie the columns, are free of impact absorber.

21. The pallet of 20 further comprising: metal stays proximate the outside edges of each bridge; wherein the stay is closer to the outer edge than is the impact absorber.

22. The pallet of claim 18 wherein the deck is fastened to the subframe only at points between the columns and at the corner column brackets.

23. In a rectangular predominately plastic pallet for use with a forklift device, of the type having a top comprising a deck, where the top is mounted on spaced apart columns which extend upwardly from a pallet base, the improvement which comprises: a top comprised of a rectangular frame which forms the periphery of the top; the frame comprised of bridges  
5 which span spaces between the columns; and a deck having edges which are spaced apart from the inner edge of the frame along at least 75 percent of the length of each bridge.

24. The pallet of claim 23 wherein the deck is connected to the frame by means of brackets located in vicinity of the columns; and wherein the bridges comprise length wise impact absorbers.

25. The pallet of claim 23 wherein the total of the lengths of all spaces is greater than 50 percent of the length of the inner edge of the frame.

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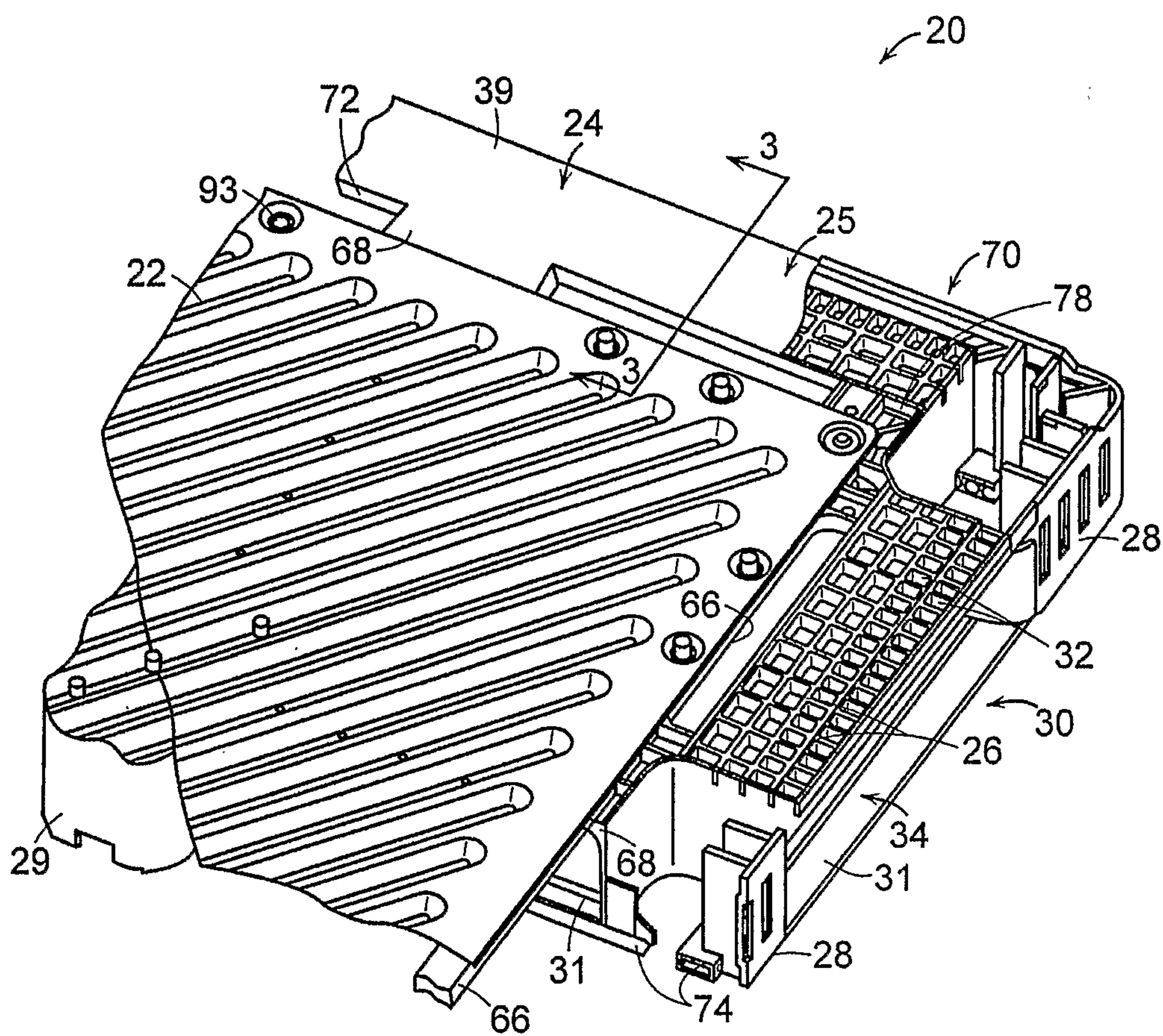


FIG. 1

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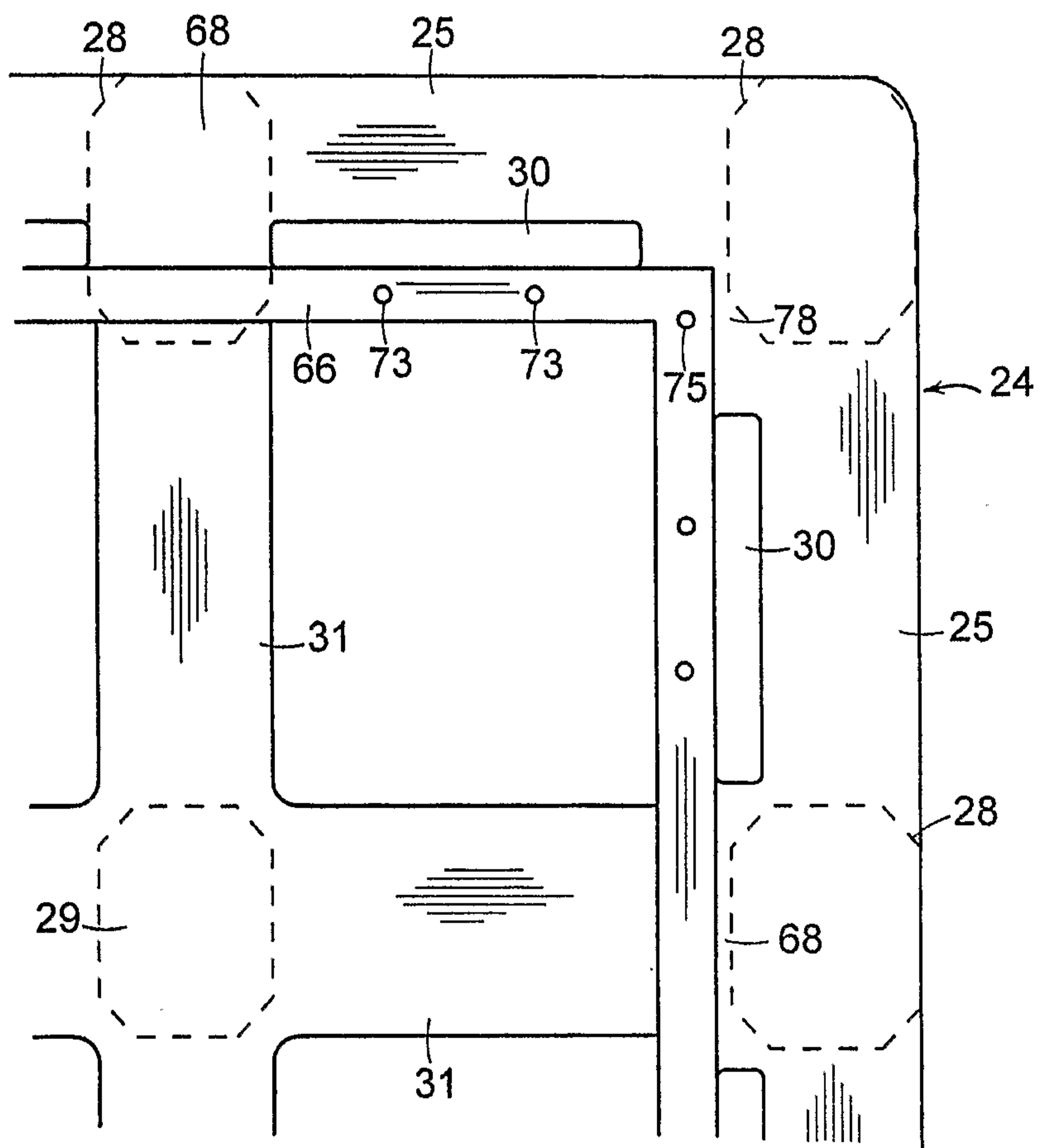


FIG. 2

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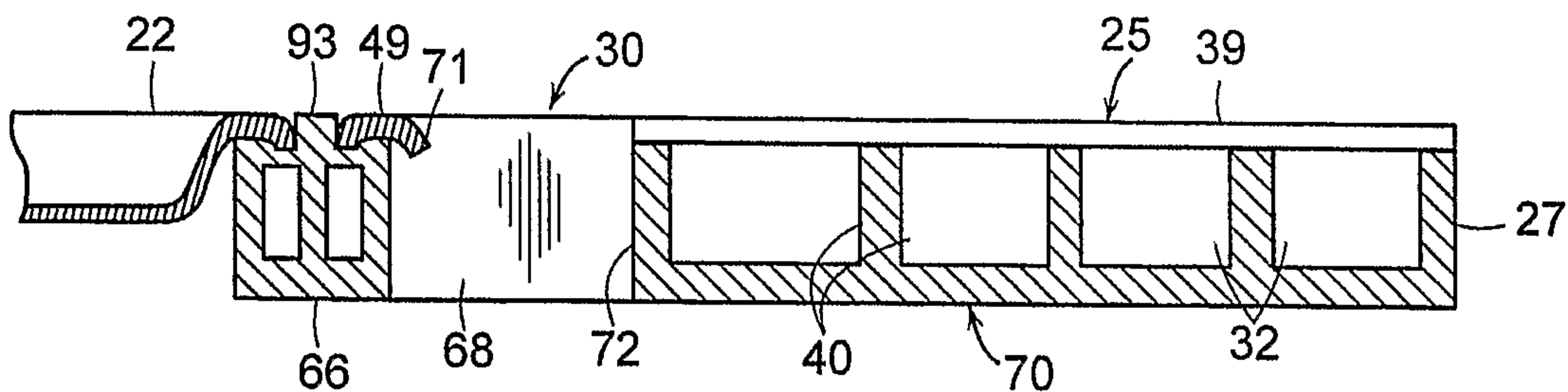


FIG. 3

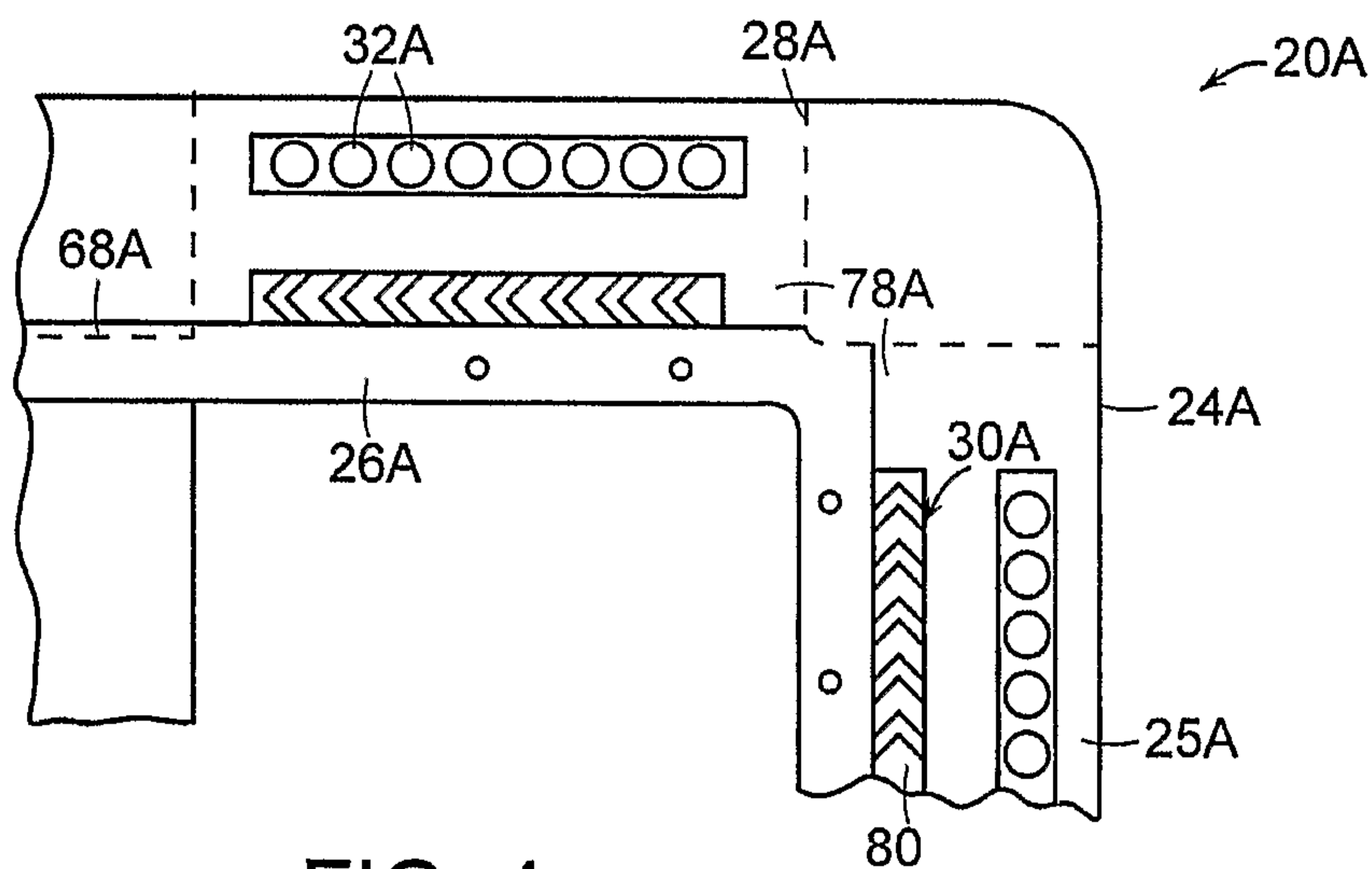


FIG. 4

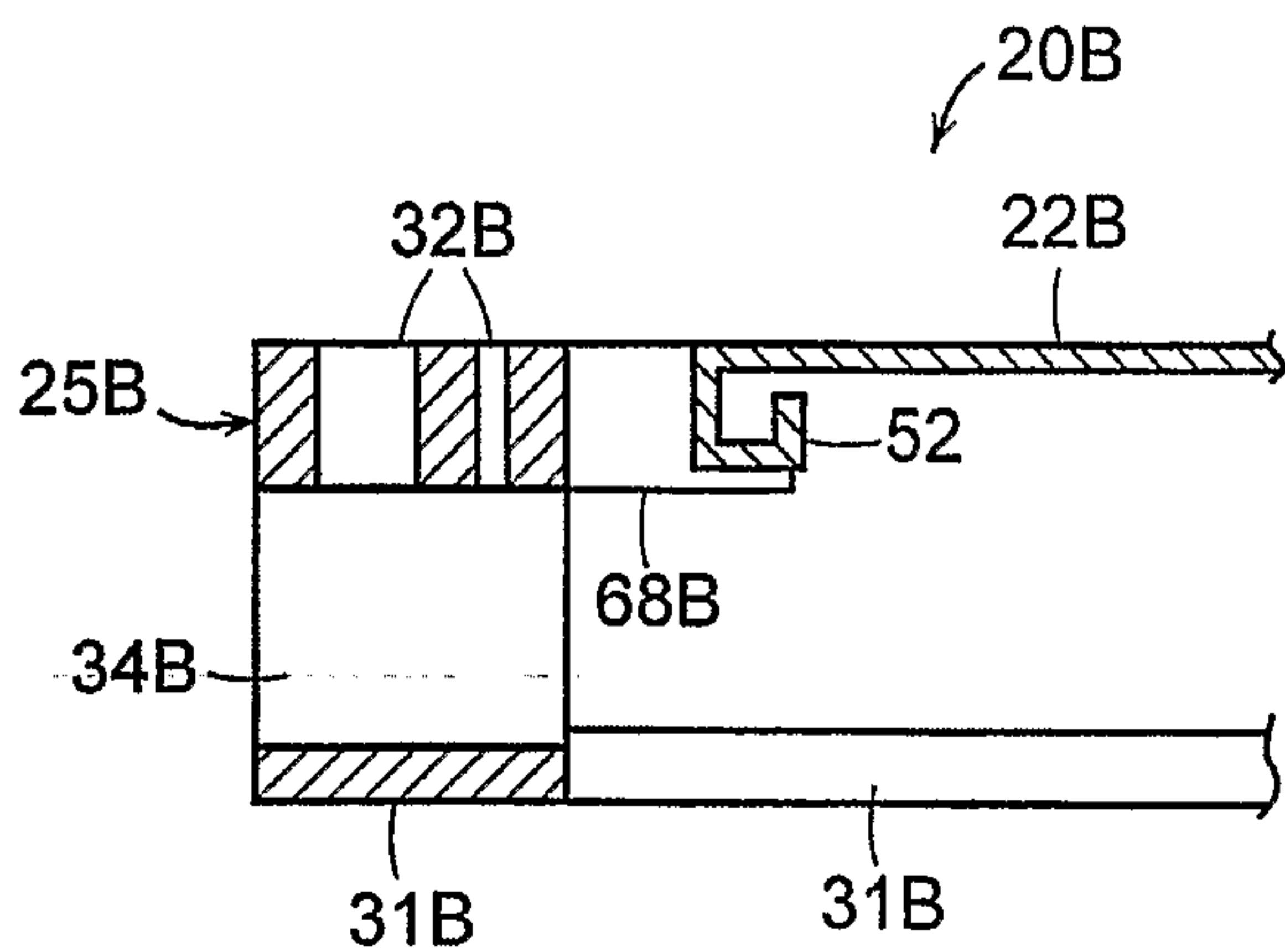


FIG. 5

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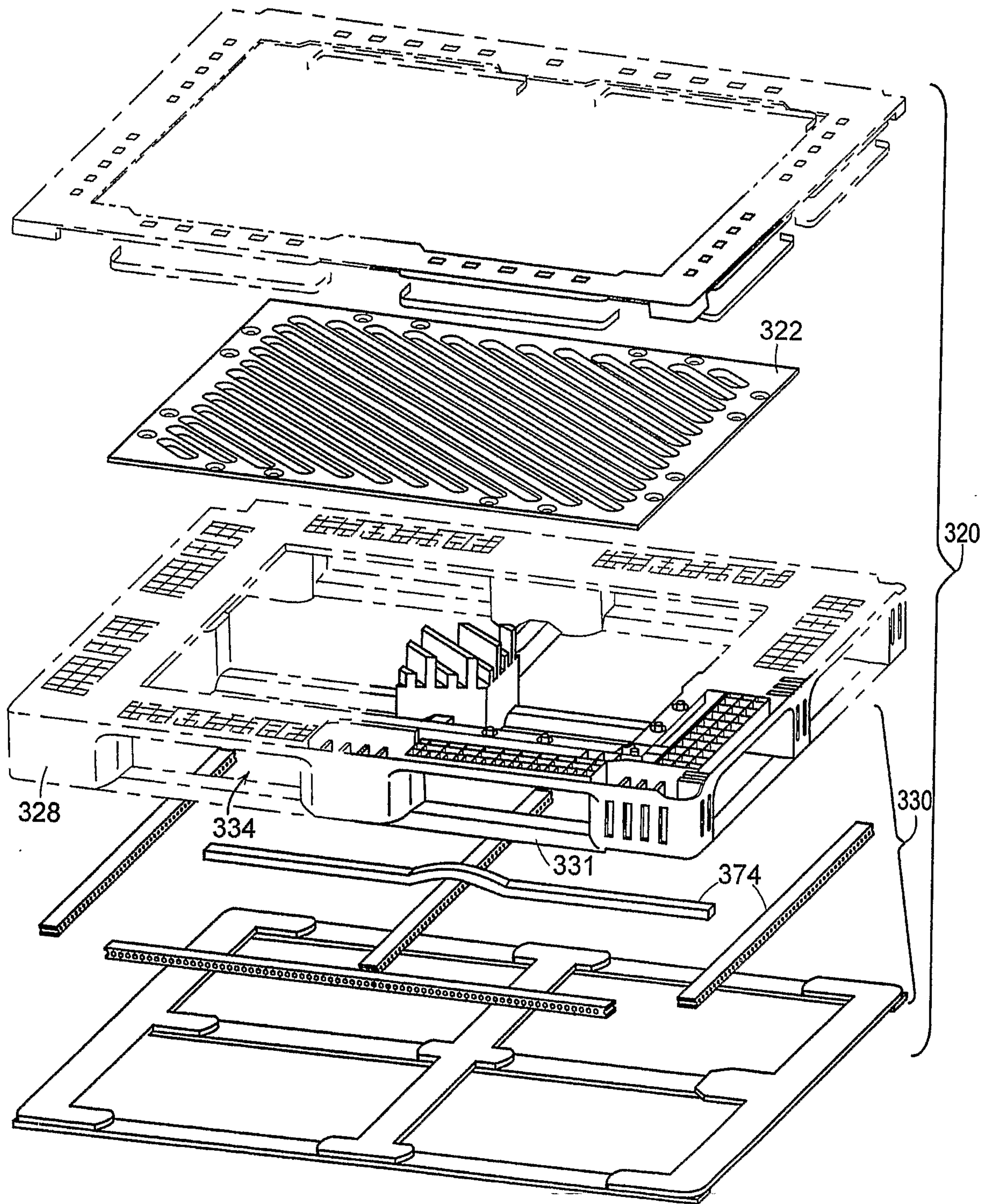


FIG. 6

