United States Patent

[11] **3,580,190**

[72] Inventor **Timothy J. Fowler**
St. Louis, Mo.

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[73] Assignee **Monsanto Company**
St. Louis, Mo.

[54] **PALLET CONSTRUCTION**
10 Claims, 17 Drawing Figs.

[52] **U.S. Cl.** **108/58**
[51] **Int. Cl.** **B65d 19/18**
[50] **Field of Search** 108/51-58; 248/119

[56] **References Cited**

UNITED STATES PATENTS

3,007,663	11/1961	Huck	108/57
3,104,085	9/1963	Skladany	108/51X
3,118,400	1/1964	Kemp, Jr. et al.	108/58
3,149,586	9/1964	Kemp, Jr. et al.	108/58
3,204,583	9/1965	Nicholson	108/58X
3,307,504	3/1967	Cloyd et al.	108/58

Primary Examiner—Bobby R. Gay
Assistant Examiner—Glenn C. Finch
Attorneys—John W. Klooster, Arthur E. Hoffman, Richard W. Sternberg and Neal E. Willis

ABSTRACT: A substantially rectangular pallet which can be raised and transported by forklift truck arms inserted through any one of the four side edges thereof and which can span across its narrow width. The pallet has a top deck, a bottom deck, and a structural network mediate therebetween which all coact together. The structural network has longitudinally extending and transversely extending stringer members interconnecting with one another. The pallet construction is well suited for formation from two, or three preformed pieces of plastic material and is especially adapted for use by the food industry in shipping and warehousing foodstuffs.

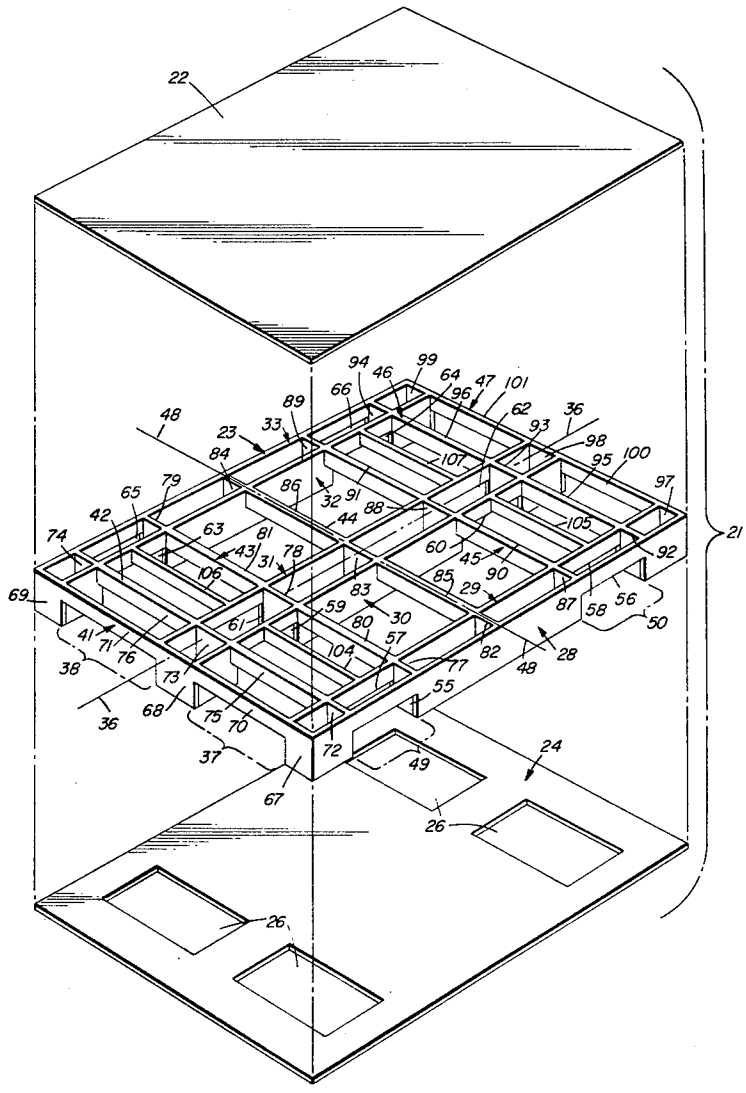

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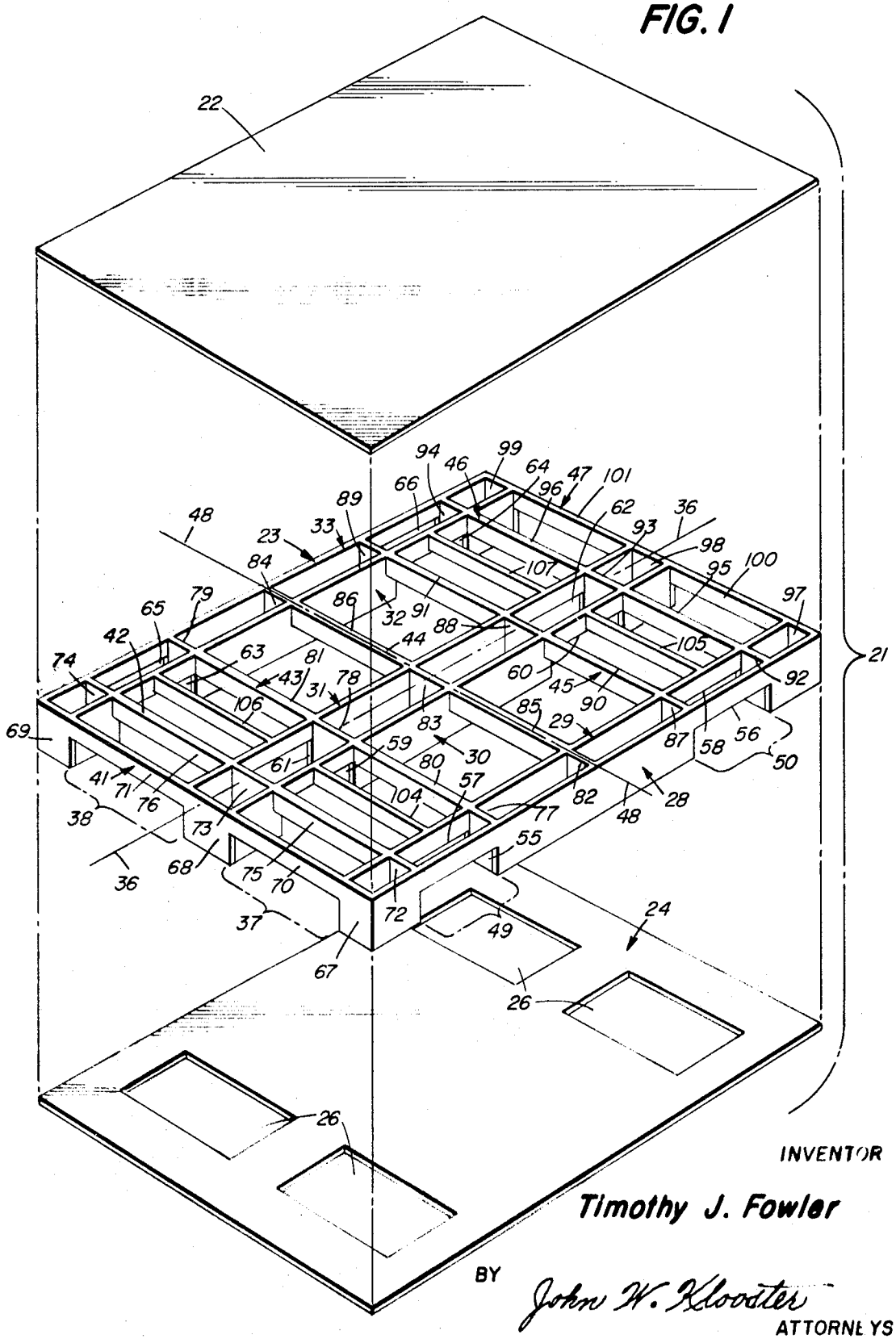
FIG. 1



INVENTOR

Timothy J. Fowler

BY John W. Klooster

ATTORNEYS

FIG. 2

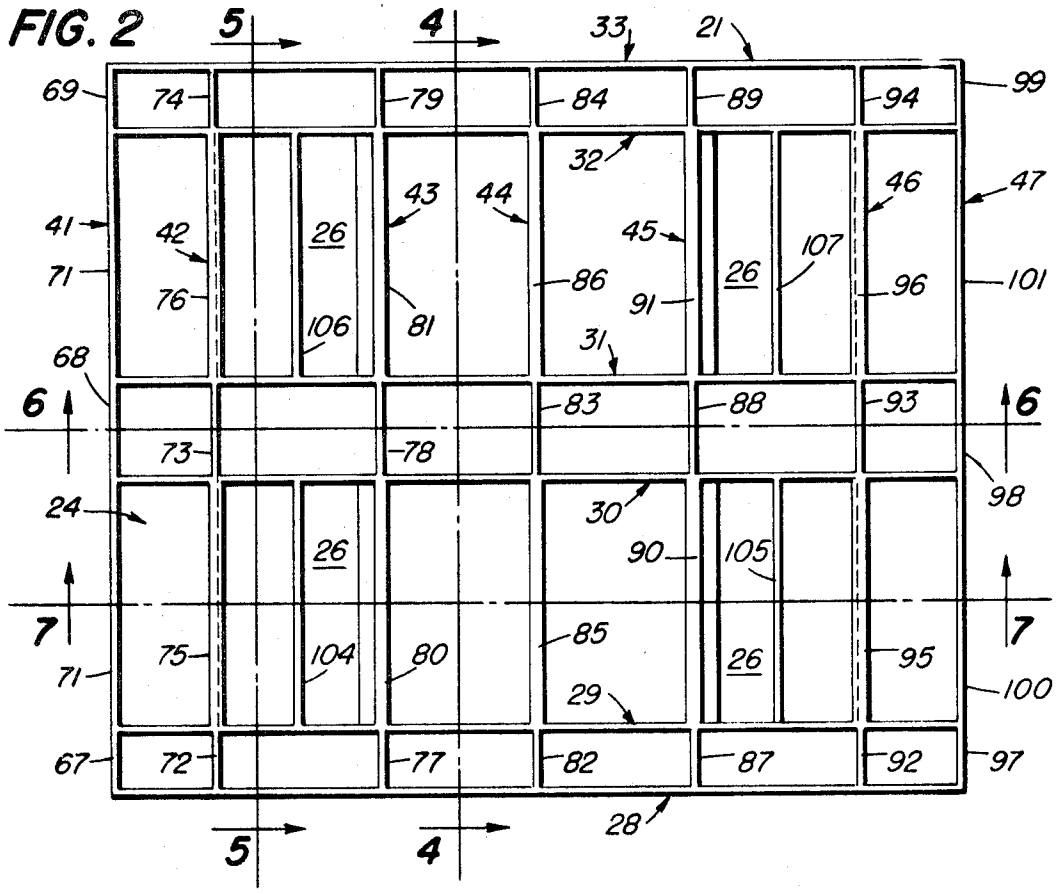
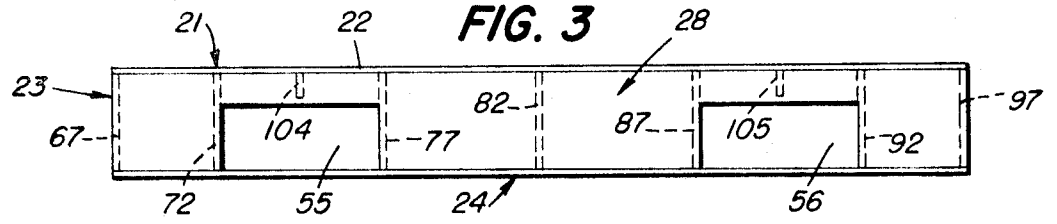


FIG. 3



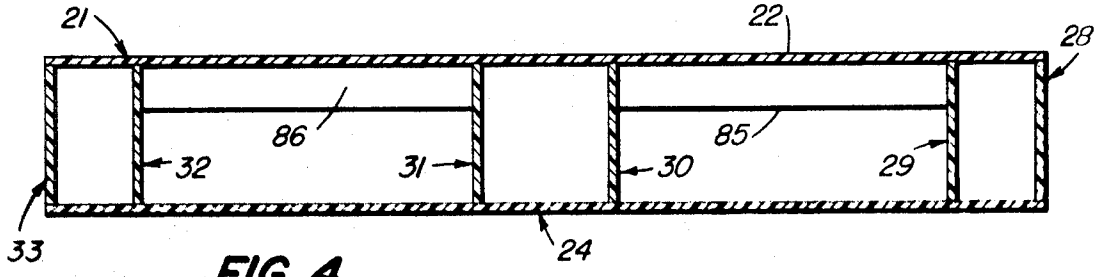


FIG. 4

INVENTOR

Timothy J. Fowler

BY John W. Kloosler

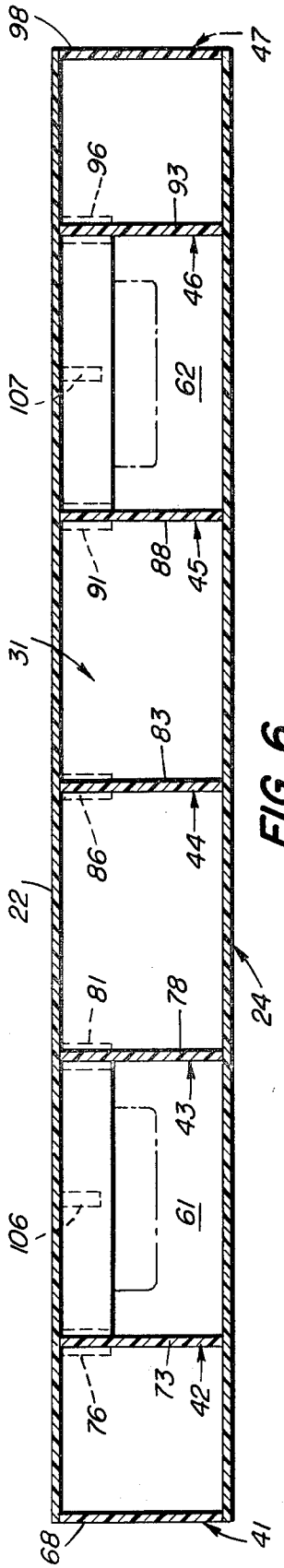


FIG. 6

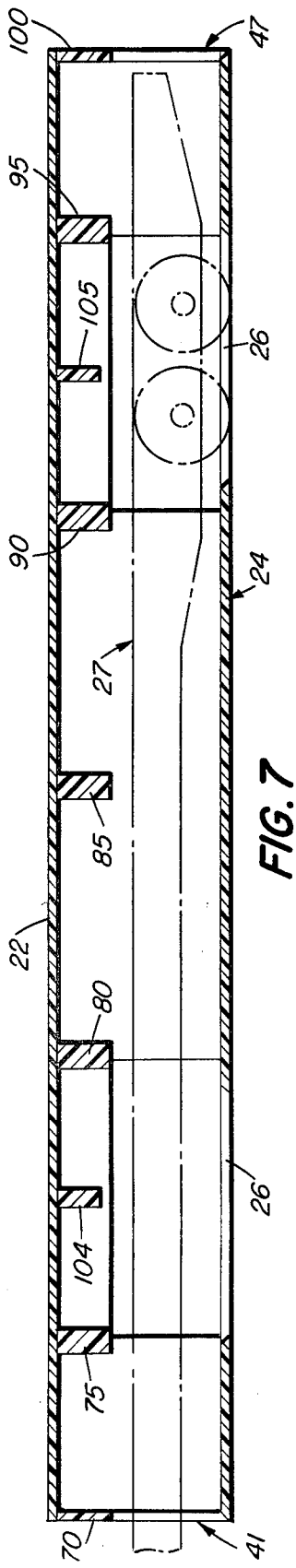


FIG. 7

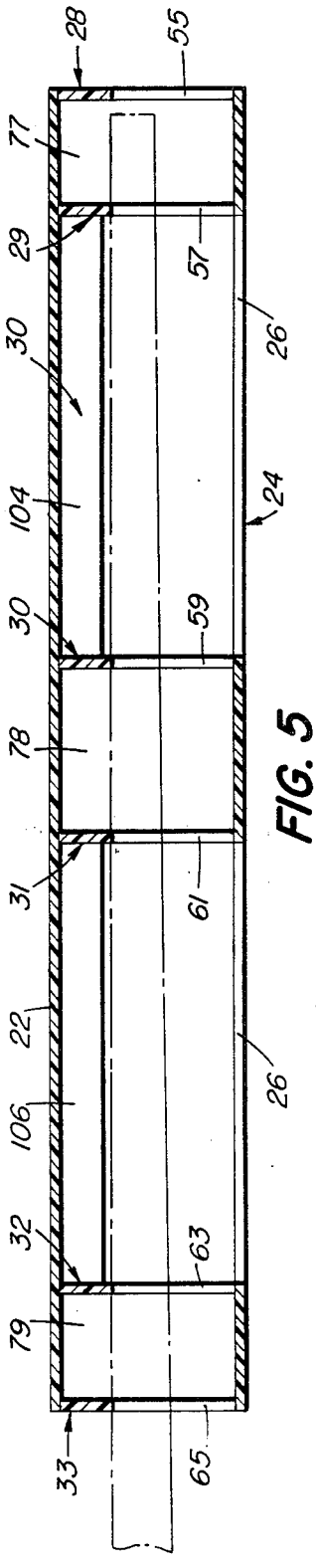
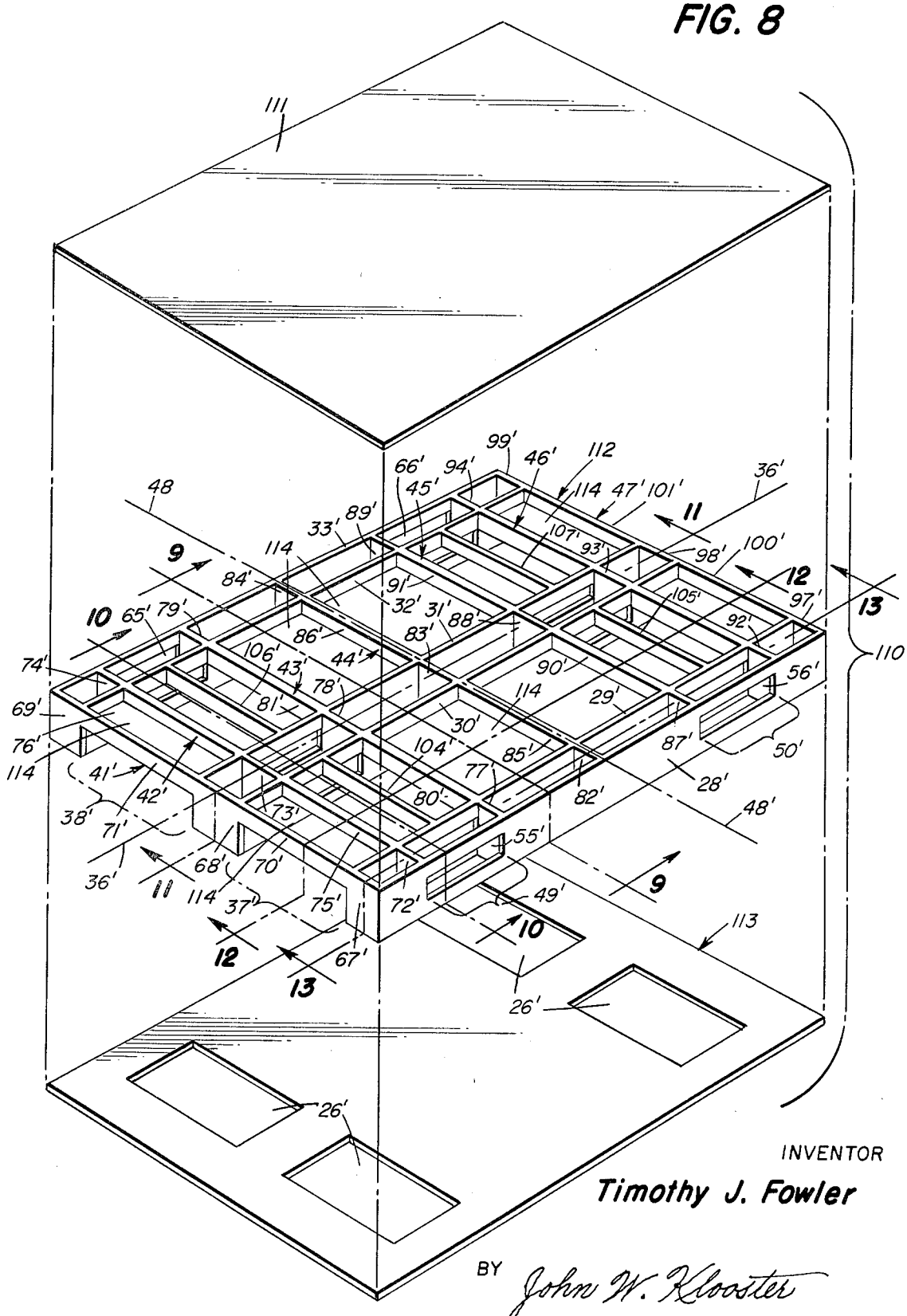


FIG. 5

FIG. 8



INVENTOR

Timothy J. Fowler

BY *John W. Klooster*

ATTORNEY

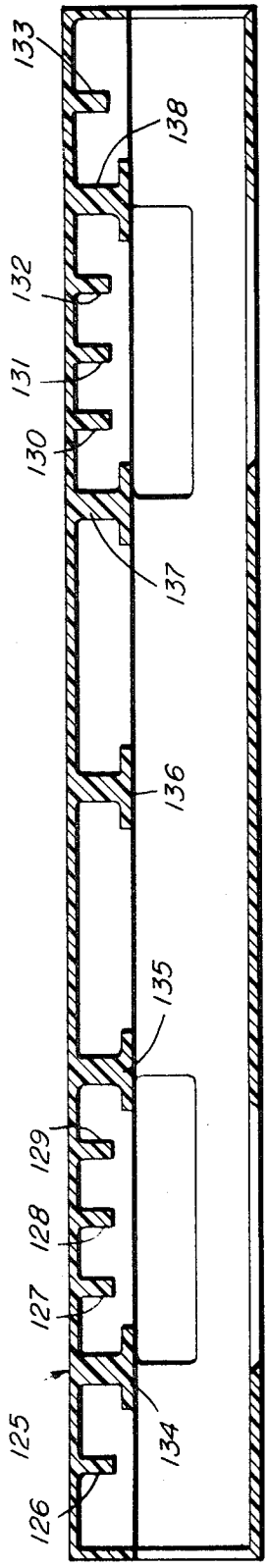


FIG. 14

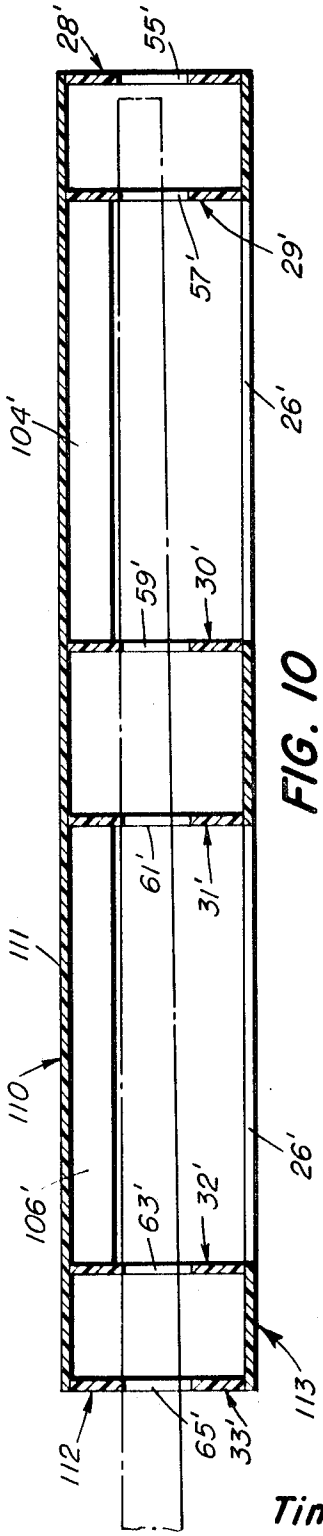


FIG. 10

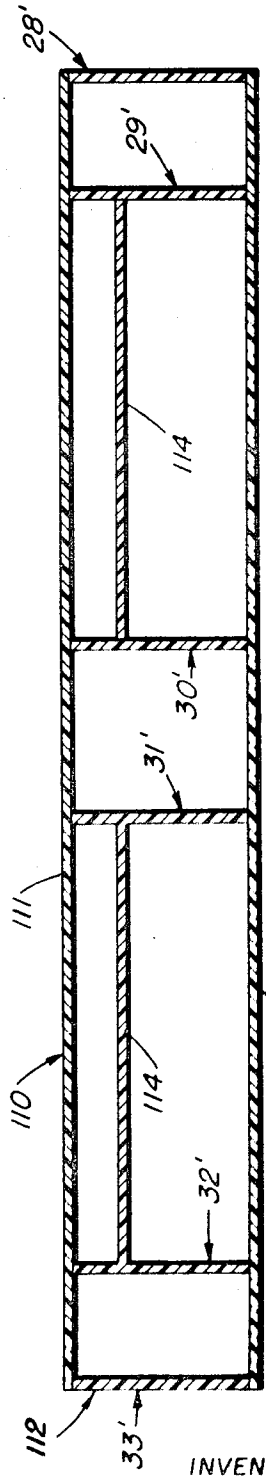


FIG. 9

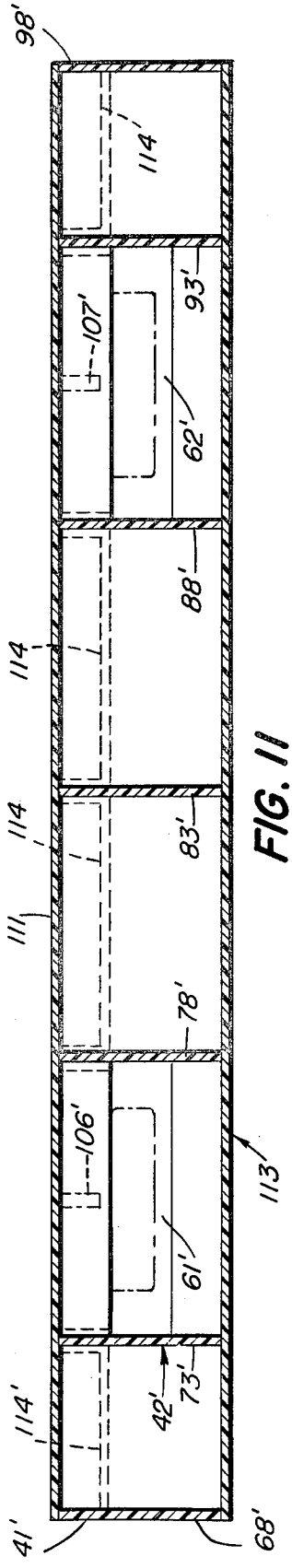
INVENTOR

Timothy J. Fowler

BY

John W. Kloosler

ATTORNEY



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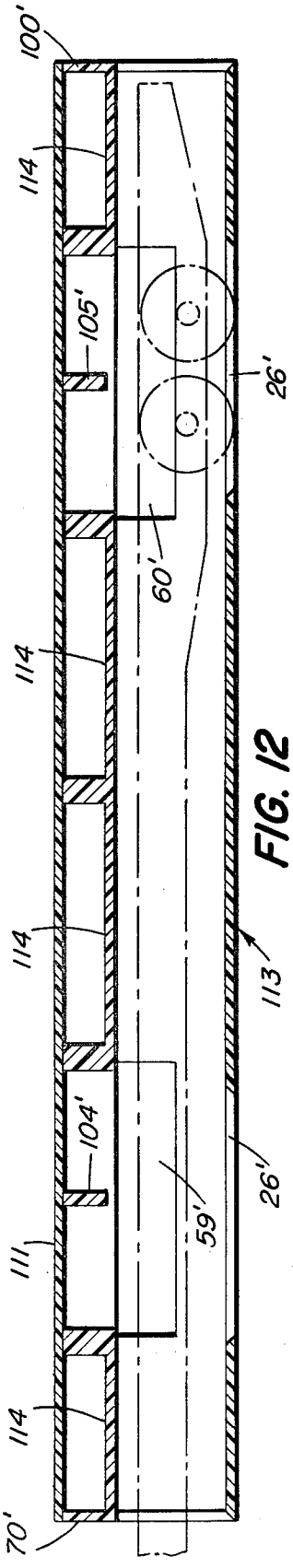

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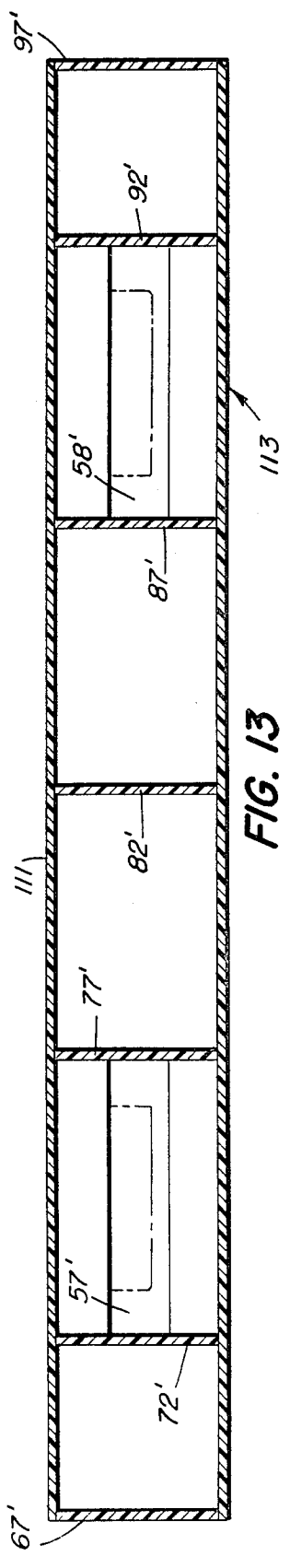

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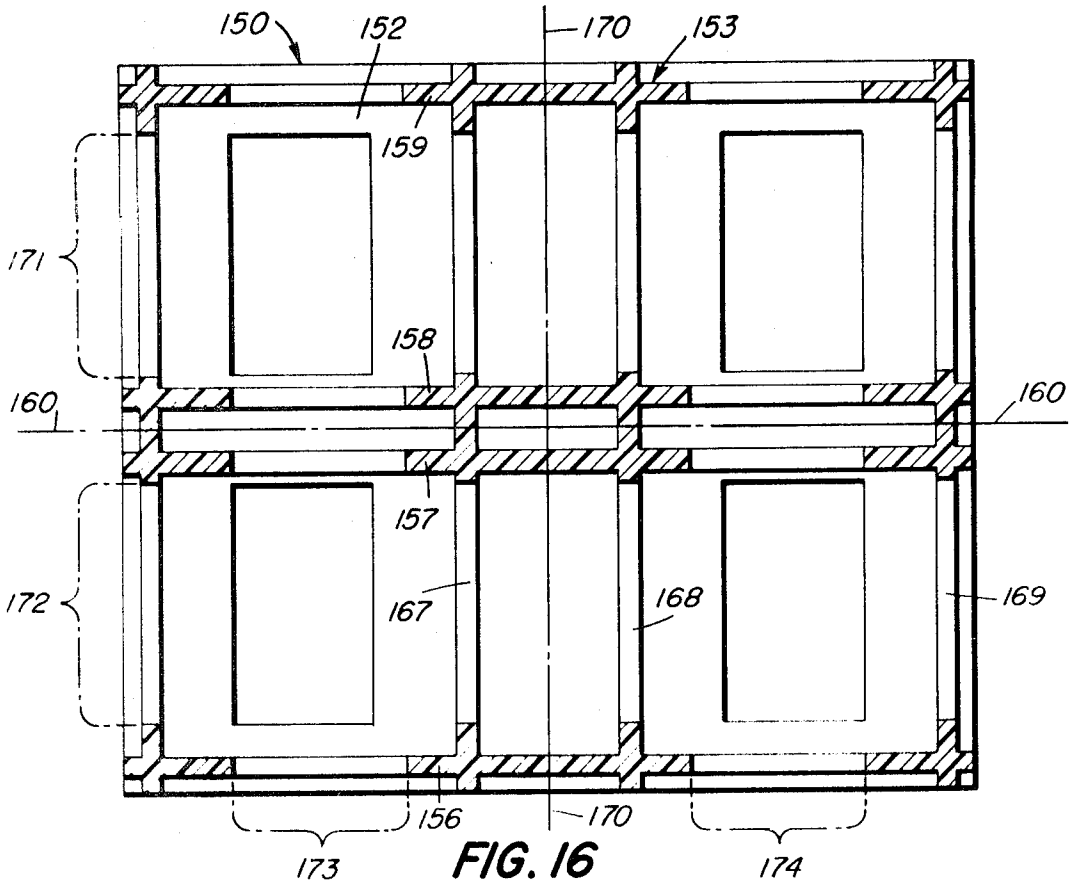
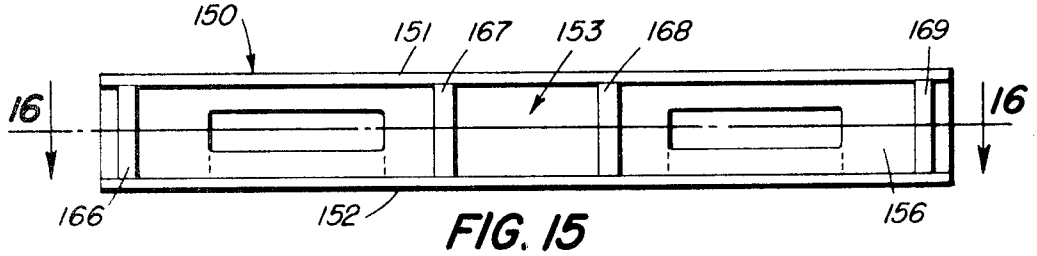


FIG. 16



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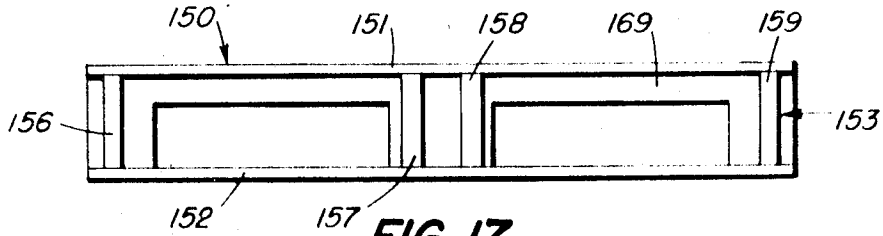

FIG. 17

INVENTOR
Timothy J. Fowler

BY John W. Klooster
ATTORNEY

PALLET CONSTRUCTION

BACKGROUND

Various specialized pallet constructions have been evolved over the years by different industries. One type of pallet construction is extensively used in the food industry for shipping and warehousing of various types of foodstuffs. This pallet construction has standardized measurements (usually set at about 48 inches ×40 inches ×6 inches), is conveniently formed primarily of wood, is adapted to be picked up from any side and to be moved by a pair of standardized forklift arms, and has a substantially flat, continuous upper surface on its top deck, and also on the lower surface of its boom deck (except that, in the latter deck, there may be four apertures through which the four wheels of a conventional type so-called "low-lift" truck's forklift arms may extend and ground engage from respective axle positions interior of the pallet during loaded pallet lifting and transport operations).

In addition, type of pallet construction is relatively light in weight (conventionally usually under about 80 pounds). In addition, it must conventionally meet various load criteria such as: (a) support with little edge or central sag, a heavy (about 4,000 pounds or more) load on its top deck while being supported by a pair of standardized forklift arms inserted through any side edge thereof; (b) support without collapse, and with conventional safety factors, a heavy (2,500 pounds or more) load on its top deck without more than a ½inch sag while spanning across its shorter width (e.g. 40 inches) between transversely extending supports positioned along and under the longer lengthwise (e.g 48 inches) opposed side edge portions thereof; (c) support, with bottom deck a substantially complete ground engaging position, without buckling or experiencing permanent change, a heavy (about 12,000 pounds or more) load; (d) be stacked in stable tiers up to and including five pallets high, each pallet bearing a load (2,500 pounds or more) with a flat upper surface, upper pallets each resting on the upper surface of the load on the pallet below; and (e) survive a full corner drop, with only localized corner failure at impact point, when dropped against flat concrete surface from a height of about **6** feet and an inclination of about 45° with the pallet unloaded.

For some time, however, users and producers of pallets have desired to make an improved pallet construction of this type which would not only be adapted to have the above-indicated standardized dimensions and load criteria, but which would also have certain preferred further advantages, such as resistance to contamination by dirt and microbiological organisms, steam cleanability, and, hopefully, lighter weight. Although plastic and metal materials which have strength characteristics suitable for use in an all-metal, all-plastic or combined metal and plastic construction, can be selected, not a single pallet construction composed of these materials, singly or in combination, is known to me which has all of the above-indicated combination of dimensional and load criteria.

I have now invented a new and very useful pallet construction which can, if desired, be formed of plastic (preferred) or metal, or some convenient combination of the two, and which is readily fabricatable if desired so as to possess all of the above-indicated combination of dimensional and load criteria. In addition, by mere selection of appropriate starting materials, my construction may be made resistant to dirt and microbial contamination, may be made steam cleanable, and may be made lighter in weight than conventional wooden pallets of this type.

SUMMARY OF THE INVENTION

The present invention is directed to an improved substantially rectangular pallet of the type adapted not only to be raised and moved by means of a pair of spaced, parallel, generally coplanar (standardized and conventional) forklift arms inserted in the pallet interior through any one of the four side thereof, but also to span when in a loaded condition across its narrow width. The pallet construction between an

interconnected coacting top and bottom decks. The structural network incorporates both a first set of at least four elongated, orthotropic beamlike members, and a second set of at least four elongated, orthotropic beamlike members. The first set members are normally positioned with respect to the second set members and are interconnected therewith at places of contact or crossover. The upper edge regions and portions of the lower edge regions of first set members and of second set members define respective upper and lower faces of said structural network. These faces are generally parallel to one another.

The first set members are in generally parallel, spaced relationship to one another, and in addition are symmetrically disposed with respect to a first hypothetical centerline. At least two members thereof are disposed centrally, and these centrally disposed members cooperate with the remainder thereof to define a first pair of zones, one each between a different pair of such first set members. Each such first zone is adapted to accommodate therewithin a forklift arm.

The second set members are likewise in generally parallel, spaced relationship to one another, but are not greater in length than said first set members. Similarly, they are symmetrically disposed with respect to a second hypothetical centerline, and at least two members thereof are disposed centrally.

These centrally disposed members also cooperate with the remainder thereof to define a second pair of zones, one each between a different pair of such second set members. Each such second zone is adapted to accommodate therewithin a forklift arm.

Each member of the second set comprises three platelike portions and two riblike portions. Each such platelike portion extends vertically the full height of the first set members, with one such platelike portion comprising the central portion of each respective member, and the remaining two such platelike portions each comprising opposed terminal end segments of each respective such member. Each such riblike portion extends not more than about two-thirds the height of said first set members, and comprises a different interconnecting segment between two adjacent such platelike portions, with upper edge regions thereof being generally coextensive with those of such platelike portions. All such platelike portions and all such riblike portions in each respective such member are symmetrically disposed with respect to said first hypothetical centerline.

The first set members have defined therein generally aligned apertures in the second pair of zones, and the second set members have defined therein generally aligned apertures in the first pair of zones, so that forklift arms can pass into the structural network through any one of the four side edges thereof.

DESCRIPTION OF THE DRAWINGS

The invention is better understood by reference to the attached drawings wherein:

FIG. **1** is an exploded isometric view of one embodiment of a three-part pallet construction of this invention, having a top deck, a bottom deck, and a structural network mediate therebetween;

FIG. **2** is a top plan view of the structural network of the embodiment shown in FIG. **1**;

FIG. **3** is a longitudinal side elevational view of the embodiment shown in FIG. **1** with top deck, bottom deck and rib network in an assembled configuration;

FIG. **4** is a vertical sectional view transversely taken along the line **4–4** of FIG. **2**;

FIG. **5** is a vertical sectional view transversely taken along the lines **5–5** of FIG. **2** showing, in dotted line configuration, the position of a forklift inserted transversely to said embodiment;

FIG. **6** is a vertical sectional view longitudinally taken along the line **6–6** of FIG. **2**, showing, in dotted line configuration, the position of a pair of forklifts inserted transversely into said embodiment;

FIG. 7 is a vertical sectional view longitudinally taken along the line 7–7 of FIG. 2, showing, in dotted line configuration, the position of a forklift of the so-called low-lift type inserted longitudinally into said embodiment;

FIG. 8 is a view similar to FIG. 1 but showing a second embodiment of a three-part pallet construction of this invention having a top deck, a bottom deck, and a structural network mediate therebetween;

FIG. 9 is a vertical sectional view transversely taken along the lines 9–9 of FIG. 8;

FIG. 10 is a vertical sectional view transversely taken along the line 10–10 of FIG. 8 showing, in dotted line configuration, the position of a forklift inserted transversely into said embodiment;

FIG. 11 is a vertical sectional view longitudinally taken along the line 11–11 of FIG. 8 showing, in dotted line configuration, the position of a pair of forklifts inserted transversely into said embodiment;

FIG. 12 is a vertical sectional view longitudinally taken along the line 12–12 of FIG. 8 showing, in dotted line configuration, the position of a fork lift of the low-lift type inserted longitudinally into said embodiment;

FIG. 13 is a vertical sectional view longitudinally taken along the line 13–13 of FIG. 8 showing, in dotted line configuration, position of a pair of forklifts inserted transversely into said embodiment;

FIG. 14 is a vertical sectional view longitudinally taken similar to FIG. 7 but showing yet another embodiment of a three-part pallet construction of this invention, having a top deck, a bottom deck, and a structural network mediate therebetween;

FIG. 15 is a longitudinal side elevational view showing one additional embodiment of a three-part pallet construction of this invention, having a top deck, a bottom deck, and a structural network mediate therebetween;

FIG. 16 is a horizontal sectional view taken along the line 16–16 of FIG. 15; and

FIG. 17 is a transverse side elevational view of the embodiment shown in FIG. 15.

DETAILED DESCRIPTION

Turning to the drawings, there is seen in FIGS. 1—7 an exploded view of one preferred embodiment of a pallet construction of this invention herein designated in its entirety by the numeral 21. Pallet 21 is seen to comprise three components, a top deck 22, a structural network 23 and a bottom deck 24. Top deck 22 and bottom deck 24 are each conveniently formed of a thermoplastic polymeric material by extrusion, or similar molding technique, conventionally known to the plastics industry. Structural network 3 is conveniently formed as a single piece in a conventional molding operation using a thermoplastic polymeric material. Other materials of construction such as metal or wood can be used to fabricate in whole or in part the present invention as those skilled in the art will readily appreciate.

Although the top deck 22 is continuous and unperforated, the bottom deck 24 has formed therein four apertures 26 which are positioned so as to permit the wheels or rollers on a conventional fork lift assembly of the low-lift type to ground engage when such a forklift is operatively engaged with an assembled pallet 21 after insertion through a transverse side edge thereof. The dotted line configuration of such a forklift assembly 27 is an assembled pallet 21 is shown in FIG. 7. Such a low-lift assembly as such forms no part of this invention. In general, a deck may be regarded as a flat, sheetlike member adapted to provide either an upper surface or top deck, or a lower surface or bottom deck of a pallet construction. The top deck is preferably continuous; the bottom deck is preferably apertured as just indicated.

The structural network 23 incorporates a series of six beams or beamlike members 28, 29, 30, 31, 32, and 33. As shown, these beams 28 through 33 are each flattened, elongated, straight members which are generally vertically positioned and which extend between top deck 22 and bottom deck 24, and which extend from one transverse side edge region to the opposed side edge region, of pallet 21. In general, in a pallet, a beam or beamlike members may be regarded for present purposes as a flattened, elongated, straight configuration which is generally vertically positioned; extends between, and joins, top and bottom deck at positions of contact therebetween; extends from one side edge region to the opposed side edge region; and is apertured appropriately for the passage of forklifts therethrough. When beams interconnect or intersect, they join.

Taken together as a set, beams 28 through 33 determine, in effect, the perimeter of the pallet 21, with beams 28 and 33 defining the longitudinal side edges of pallet 21, and opposed end portions of respective beams 28 through 33 indicating the region of transverse first side edges. All the beams 28 through 33 are symmetrically positioned with respect to a first (hypothetical) center line 36. Beams 30 and 31 can be considered to be disposed centrally, while beams 28 and 29 can be considered to be disposed adjacent one longitudinally extending side edge portion of pallet 21 while beams 32 and 33 are disposed adjacent the other such side edge portion thereof. The beams 28 through 33 are arranged so as to define between, respectively, beams 29 and 30, and beams 31 and 32, a pair of longitudinally extending (with respect to pallet 21) zones 37 and 38. Each zone 37 and 38 is each adapted to receive as suggested above, one of a pair of forklift arms (not shown in FIG. 1 but shown in dotted line configuration of FIG. 7).

The structural network 23 also incorporates a second series of seven beams 41 through 47. As indicated, these beams 41 through 47 are each flattened, elongated, straight members which are generally vertically positioned and which have portions that extend between top deck 22 and bottom deck 24. Such members 41 through 47 extend from one longitudinal side edge region to the opposed side edge portion of pallet 21. Taken together as a set, beams 41 through 47 cooperate with beams 28 through 33 to define the perimeter of the pallet 21. Beams 41 and 47 operate to define the transverse side edges of pallet 21. All the beams 41 through 47 are symmetrically positioned with respect to a second (hypothetical) center line 48. Beams 43, 44 and 45 may be considered to be disposed adjacent one transversely extending side edge portion of pallet 21 while beams 46 and 47 are disposed adjacent the other transverse side edge position thereof. The beams 41 through 47 are arranged so as to define between, respectively, beams 42 and 43 and beams 45 and 46, a pair of transversely extending (with respect to pallet 21) zones 49 and 50. These zones 49 and 50 are each adapted to receive therein one of a pair of forklift arms (not shown in FIG. 1, but see FIGS. 5 and 6) which pair of forklift arms may be inserted through either opposed longitudinally extending side edge position of pallet 21.

The first set of beams 28 through 33 is normally positioned with respect to the second set of beams 41 through 47 and is interconnected therewith at points of intersection. Thus, taken together, all the beams cooperate to comprise the structural network 23. The opposed faces of the structural network are formed by the respective beam edges. These faces are generally parallel and opposed to one another.

Each of beams 28 through 33 can be considered to have defined therein a pair of aperture Thus, beam 28 has apertures 55 and 56, beam 29 and apertures 57 and 58, beam 30, apertures 59 and 60, beam 31, apertures 61 and 62, beam 32, apertures 63, and 64, and beam 33, apertures 65 and 66. Apertures 55, 57, 59, 61, 63, and 65 are generally aligned with one another and are generally positioned between beams 42 and 43, and apertures 56, 58, 60, 62, 64, and 66 are generally aligned with one another and are generally positioned between beams 45 and 46. Thus, a pair of forklift arms can be inserted through either beam 28 or through beam 33 so as to enable the pallet 21 to be picked up and supported by means of forklifts inserted transversely into the pallet 21.

The construction of beams 41 through 47 differs from the construction of beams 28 through 33 in pallet 21. Each of beams 41 through 47 can be considered to be composed of two riblike members and three platelike members. Thus, beam 41 employs plates 67, 68, and 69, and ribs 70 and 71; beam 42 employs plates 72, 73, and 74, and ribs 75 and 76; beam 43 employs plates 77, 78 and 79, and ribs 80 and 81; beam 44 employs plates 82, 83, and 84, and ribs 85 and 86; beam 45 employs plates 87, 88, 89, and ribs 90 and 91; beam 46 employs plates 92, 93, and 94, and ribs 95 and 96; beam 47 employs plates 97, 98, and 99, and ribs 100, and 101. 72, 77, 82, 87, 92, and 97, extend between and joins top deck 22 and bottom deck 24; each of the plates 68, 73, 78, 83, 88, 93, and 98 extends between and joins top deck 22 and bottom deck 24, and extends between and joins stringers 30 and 31; and each of the plates 69, 74, 79, 84, 89, 94 and 99 extends between and joins top deck 22 and bottom deck 24, and extends between and joins strings 32 and 33. Each of the ribs 70, 75, 80, 85, 90, 95, and 100 extends between and joins beams 29 and 30 and the upper edge of each such rib joins top deck 22; and each of ribs 71, 76, 81, 86, 91, 96 and 101 extends between and joins beams 31 and 32 and the upper edge of each such rib joins top deck 22. The space under each such tie and bottom deck 24 provides an aperture through which a pair of forklifts can be inserted for raising and transporting of a pallet 21. A "plate" generally is a nonapertured portion of a beam which extends between and joins top and bottom decks, preferably, it extends between and joins only one pair of adjacent beams in an assembled pallet. A "rib" generally is a barlike, elongated, flattened, straight member which extends between and joins only one pair of adjacent plates; preferably it extends between and joins only one pair of adjacent beams; The upper edge portion of a rib join the top deck. Such an end-aligned sequence of ribs plus plates can be considered to be a beam. In the embodiment shown, the ribs are shown thicker than the plates for reasons of added strength and load-bearing capacity.

In pallet 21, midway between ribs 75 and 80, and midway between ribs 90 and 95, extending between beams 29 and 30, are flexural members 104 and 105 which have their respective upper edges joining top deck 22. Similarly, midway between ribs 76 and 81 and midway between ribs 91 and 96, extending between stringers 31 and 32, are flexural members 106 and 107 which have their respective upper edges joining top deck 22. Each such flexural member can be considered to be barlike, elongated, flattened and straight. Such flexural members are optional in a pallet construction of this invention, though are preferred in pallet 21. A flexural member generally is like a rib except that it characteristically extends between and joins one pair of adjacent beams at positions where there are no corresponding plates, usually normally.

As indicated, in pallet 21, top deck 22 and bottom deck 24 are each joined to the edge surfaces of the indicated portions of structural network 23. The actual joining, since pallet 21 is formed in three parts, can be achieved by any means known to the art such as adhesives, sonic welding (preferred), dielectric fusion, mechanical fastening means, some combination thereof, or the like. Since the top deck, the bottom deck, and the structural network coact, it is preferred that these members interconnect with one another at all places of contact and joining.

Observe that while the flexural members 104 and 105, and 106 and 107 are shorter in depth than ribs 90, 91, 95, and 96 and 75, 76, 80 and 81 in the pallet 21, the flexural members may have and, preferably, do have a depth equal to the ribs. In general, the depth of the flexural members are equal to or shorter than the depth of the ribs. The ribs extend not more than about two-thirds the height of the first set members.

Observe that the beams 28 through 33 may be structured like the beams 41 through 47, if desired. The pallet 21 is adapted to span across its width and may, if desired, also span across its length if one thickness or strengthens the various beams in the first set and the second set, especially in the first set.

If desired, the top deck and the bottom deck may be perforated by small holes, preferably not larger than the width of a beam, so as to reduce the weight of pallet 21.

In FIGS. 8 through 13 is shown an exploded view of another embodiment of a pallet construction of this invention herein designated in its entirety by the numeral 110. Pallet 110 is seen to comprise like pallet 21 three components, a top deck 111, a structural network 112, and a bottom deck 113. Pallet 110 may be fabricated similarly to the manner in which pallet 21 is fabricated and is similar in appearance and structure except that a third incomplete deck 114 is positioned in the structural network 112 in a horizontally extending configuration in the mid region between upper and lower faces of the structural network 112. This incomplete third deck 114 of pallet 110 is discontinuous in various regions, such as those where transversely inserted forklifts are extended through longitudinal side edges of pallet 110 and in regions between edge pairs of longitudinally extending beams. Third deck 114 adds strength and structural rigidity to pallet 110.

Observe that the longitudinally extending beams analogous to the first set beams of pallet 21 are apertured so that these beams are continuous in regions below the aperture instead of being open down to the bottom deck 113 as was the case in pallet 21. Since the pallet structure of FIGS. 8 through 13 is otherwise similar to that of the pallet structure of FIGS. 1 through 7, no detailed description thereof is given herein except that like parts in the structure of FIGS. 8 through 13 are similarily numbered to the parts of FIGS. 1 through 7 but with the addition of prime marks thereto for reference purposes.

In FIG. 14 wherein a third embodiment of a pallet construcure 125 of the present invention is depicted, there is seen a three-part pallet structure similar to that of pallet 21. In this embodiment, the structural network incorporates a plurality of flexural members 126, 127, 128, 129, 130, 131, 132, and 133. In addition , the ribs 134, 135, 136, 137 and 138 are flanged on their bottom edges, as shown.

In FIGS. 15 through 17 is seen a fourth embodiment of a pallet structure of this invention designated in its entirety by the numeral 150. Pallet 150 incorporates a top deck 151, a bottom deck 152 and a structural network 153.

Structural network 153 incorporates a first set of beams 156, 157, 158, and 159 in parallel spaced relationship to one another which are symmetrically arranged with respect to a hypothetical center line 160. Beams 157 and 158 are disposed centrally. Beam 156 is disposed adjacent one side edge of pallet 150 and beam 159 adjacent the opposed side edge thereof. A second set of beams 166, 167, 168 and 169 is similarily arranged in parallel spaced relation to one another and the individual beams are symmetrically arranged with respect to a second hypothetical center line 170. The beams 167 and 168 are disposed centrally with stringer 166 being adjacent one transverse side edge of pallet 150 with beam 169 adjacent the opposed side edge thereof. The first set of stringers 156 through 159 is interconnected with the second set of stringers at intersection points. Longitudinally extending apertured, longitudinally extending zones 171 and 172 and transversely extending zones 173 and 174 provide four-way forklift axis to pallet 150 in a manner similar to that accomplished with pallet 21.

The pallet of this invention is preferably constructed of materials whose flexural strength is greater than about 4,000 p.s.i. and whose flexural modulus (or Young's Modulus) is greater than about 200,000 p.s.i. A preferred class of materials for use in making pallets of the invention are glass fiber reinforced; another preferred class are structural foams. A presently most preferred material of construction is glass fiber filled styrene/acrylonitrile copolymers which are foamed. When construction of a foamed material, is preferred that the foam have a density ranging from about 0.3 to 0.9 grams per cubic centimeter.

EXAMPLES

The following Examples are given to illustrate the invention and not intended to be limitations thereof.

EXAMPLE 1 through 8

Using various thermoplastic materials, a series of pallet constructions of the type shown in the embodiment of FIGS. 1 through 7 are prepared. The materials of construction, dimensions, and physical characteristics are as given below in Tables I and II.

TABLE I.—MATERIAL PROPERTIES

Ex. No.	Material	Tensile strength, p.s.i.	Flexural strength, p.s.i.	Elastic modulus, k.s.i.	Specific gravity
1	High density polyethylene	4,000	2,500	200	0.96
2	High impact polystyrene	4,500	6,500	370	1.05
3	60% polystyrene foam	2,160	3,120	178	0.63
4	50% polystyrene foam	1,800	2,600	148	0.525
5	Polypropylene	3,700	6,000	150	0.91
6	High impact ABS	5,080	8,800	320	1.05
7	Medium impact ABS	7,000	10,000	400	1.06
8	20% glass reinforced polystyrene	11,500	13,000	840	1.20

TABLE II.—PALLET DIMENSIONS IN INCHES

Ex. No.	Material	Thickness top deck	Thickness bottom deck	Beam thickness	Plate thickness at center	Openings over fork lift zones		Plate thickness at outside edges	Ribs over fork lift openings	
						Thickness	Depth		Depth	Thickness
1	High density polyethylene	0.20	0.375	0.75	1.04	6.	1.9	1.10	1.5	1.45
2	High impact polystyrene	0.14	0.20	0.26	0.37	1.55	2.175	0.43	1.5	0.52
3	60% polystyrene foam	0.25	0.30	0.38	0.61	3.9	2.075	1.09	1.5	1.06
4	50% polystyrene foam	0.25	0.375	0.55	0.83	6.	2.	1.4	1.5	1.32
5	Polypropylene	0.15	0.25	0.27	0.39	1.85	2.125	0.56	1.5	0.56
6	High impact ABS	0.12	0.20	0.19	0.27	1.2	2.175	0.35	1.5	0.38
7	Medium impact ABS	0.11	0.175	0.17	0.25	1.	2.2	0.27	1.5	0.33
8	20% glass reinforced polystyrene	0.10	0.15	0.13	0.18	0.75	2.225	0.18	1.5	0.2

Pallets of this invention may be constructed of composite materials; for example, a pallet of this invention can be constructed of a foamed fiberglass filled styrene/acrylonitrile material which uses a core of material so foamed with face members being formed of a substantially nonfoamed material.

Preferably, the bottom deck is champfered at edge regions where the wheels or skids associated with a low lift truck enter the pallet interior in lifting and moving operations.

If desired, a pallet construction of this invention can incorporate metal reinforcement in a thermoplastic material such as rods or wires of steel or the like.

If desired, the top deck and/or the bottom deck may be corrugated, especially on the side thereof which faces inwardly toward the structural network, but the structural network is uniformly bonded to the so-corrugated member, as described above.

Two classes of thermoplastic polymeric materials suitable for use in making pallets of this invention are polyolefins (including polyethylene, polypropylene, and copolymers thereof), and polyvinyl aromatic polymers (including polymers of styrene, and copolymers thereof).

A pallet of this invention contains not more than 12 beams in either the first set or the second set (as these terms are used herein).

If desired, as those skilled in the art will realize, a pallet of this invention may incorporate not only transversely extending flexural members (as this term is used herein), but also longitudinally extending flexural members, in, for example, the zones.

What I claim is:

1. A substantially rectangular pallet construction comprising, in combination,

A. a top deck,

B. a bottom deck, and

C. a structural network interposed between, and interconnecting, said top and said bottom deck,

D. said structural network comprising a first set of at least four elongated, orthotropic beamlike members, and a second set of at least four elongated orthotropic beamlike members,

E. said first set being normally positioned with respect to said second set, and interconnected therewith, whereby upper edge regions and portions of lower edge regions of first set members and second set members define respective upper and lower faces of said structural network, and which faces are generally parallel to one another,

F. said first set members

1. being in generally parallel, spaced relationship to one another,

2. being symmetrically disposed with respect to a first hypothetical centerline,

3. having at least two members thereof disposed centrally, and

4. having such centrally disposed members cooperating with the remainder thereof to define a first pair of zones, one each between a different pair of such first set members, each such first zone being adapted to accommodate therewithin a forklift arm,

G. said second set members

1. being in generally parallel, spaced relationship to one another and not greater in length than said first set,

2. being symmetrically disposed with respect to a second hypothetical centerline,

3. having at least two members thereof disposed centrally,

4. having such centrally disposed members cooperating with the remainder thereof to define a second pair of zones, one each between a different pair of such second set members, each such second zone being adapted to accommodate therewithin a forklift arm, and

5. each comprising three platelike portions and two riblike portions, each such platelike portion extending vertically the full height of said first set members, one such platelike portion comprising the central portion of each respective member, the remaining two such platelike portions each comprising terminal end segments of each respective such member, each such riblike portion extending not more than about two-thirds the height of said first set members and comprising a different interconnecting segment between two adjacent such platelike portions with upper edge regions thereof being generally coextensive with those of such platelike portions, all such platelike portions and all such riblike portions in each respective such member being symmetrically disposed with respect to said first hypothetical centerline, and

H. said first set members having defined therein generally aligned apertures in said second pair of zones, and said second set members having defined therein generally aligned apertures in said first pair of zones whereby such forklift arms can pass into said structural network through any one of the four side edges thereof.

2. A pallet construction of claim 1 wherein each of said first set members comprises three platelike portions and two riblike portions, each such platelike portion extending vertically the full height of said first set members, one such platelike portion comprising the central portion of each respective member, the remaining two such platelike portions each comprising terminal end segments of each respective such member, each such riblike portion extending not more

than about two-thirds the height of said first set members and comprising a different interconnecting segment between two adjacent such platelike portions with upper edge regions thereof being generally coextensive with those of such platelike portions, all such platelike portions and all such riblike portions in each respective such member being symmetrically disposed with respect to said first hypothetical centerline.

3. A pallet construction of claim 1 having flexural members symmetrically positioned in said structural network over said first pair of zones between said centrally disposed members and the remainder thereof.

4. A pallet construction of claim 1 composed of a thermoplastic material having a flexural modulus of at least about 200,000 p.s.i.

5. A pallet construction of claim 1 composed of a thermoplastic material having a flexural strength of at least about 4,000 p.s.i.

6. A pallet construction of claim 1 having at least a partially formed third deck positioned in said structural network and extending generally parallel to said top deck.

7. A pallet construction of claim 1 wherein said bottom deck has apertures formed therein which are adopted to receive therethrough the ground-engaging members functionally associated with a pair of forklift arms in a low lift truck.

8. The pallet construction of claim 1 which is comprised of a polyolefin polymer.

9. The pallet construction of claim 1 which is comprised of a polyvinyl aromatic polymer.

10. The pallet construction of claim 1 which is composed of a fiberglass reinforced thermoplastic polymer.