

PALLET CONTAINER

The present invention relates to a pallet container with a thin-walled inner container of thermoplastic material for storage and transport of liquid or free-flowing goods, wherein the plastic container is closely surrounded by a lattice tube frame as support jacket, and with a bottom pallet on which the plastic container rests and with which the support jacket is fixedly secured, wherein the lattice tube frame includes vertical and horizontal tubular rods welded to one another at intersecting areas.

Prior Art:

Pallet containers are used for the storage and transport of liquid or free-flowing goods. During transport of filled pallet containers – in particular with contents of high specific weight (e.g. above 1.6 g/cm^3) – on poor roads with trucks with firm suspension, during transport on railway or ships, the lattice rod frame is exposed to significant stress as a result of surge forces of the goods. These dynamic transport loads generate significant continuously changing bending stress and torsion stress in the lattice tube frame, ultimately leading to fatigue cracks and resultant rod fracture when exposed over respectively long periods.

Such pallet containers with support jacket of lattice tube frames are generally known in various designs; all lattice tube frame configurations to date suffer however significant drawbacks.

Those configurations of lattice tube frames with uniformly continuous lattice tube profile, known, e.g., in EP 0 755 863-A (Fu), DE 297 19 830-A (V L) or U.S. 6 2244 453 B1 (Mam) experience, as a consequence of the oscillating surge pressure of the liquid content that is caused by fluctuating bending stress during transport, relatively very quickly a rod fracture which always begins or is triggered

in the tension zone of the tubular lattice rods. Rod fracture takes place predominantly in proximity of the welded intersections of the tubular lattice rods.

Those lattice tube frames with welded round rods, e.g. disclosed in EP 0 734 967 B1 (Sch), and with significantly reduced tube cross sectional height in the area of the intersections (no continuous tubular profile, dents or reduced tube cross sectional height of same depth) suffer the critical drawback that significant stress peaks are encountered in these areas of reduced tube cross section to thereby form break zones or buckling zones, e.g. during drop tests, when exposed to fluctuating bending stress as a result of transport loads, and during hydraulic internal pressure test. The rod areas between the intersections are much too rigid and stiff when exposed to any dynamic loads and they are unable to absorb deformations which occur only in the intersection area with the decreased tube cross sections. In addition, further quality deterioration or relief areas are necessarily provided in all horizontal and vertical lattice rods at all welding locations, e.g. EP 0 734 967 B1 (Sch) to protect them from tearing open/detachment during fluctuating bending stress as a result of transport loads. However, it is considered highly disadvantageous that the weakest tube cross sections are arranged in immediate proximity of the welding spots of the intersecting lattice rods so that the deformation changes continuously directly adjacent to the welding spots. As a consequence, the welding spots are overly stressed and tend to tear off. When it comes to design, the welding expert is aware not to weld dynamically stressed components in those regions that are exposed to the greatest dynamic deformation.

WO 01/89954-A as well as WO 01/89955-A further disclose a pallet container with a trapezoidal tube profile of the lattice rods, wherein the vertical and/or horizontal tubular rods have each a dimple laterally adjacent to an intersection. These partial dimples serve as "bending hinge" and decrease the resistance moment against bending. It has been shown that these limited dimples lead to

appreciable longer service life but are unable to completely eliminate a rod fracture when an area is exposed to concentrated stress peaks over a longer period.

Lattice rod frames known to date with uniformly continuous lattice tube profile have all the drawback that the horizontal and vertical tubular lattice rods are generally too rigid and torsionally stiff along their entire length when exposed to fluctuating bending stress; As a consequence, fatigue cracks and rod fracture are encountered already after a comparably short time under stress, in particular in proximity of the welded intersections of the tubular lattice rods.

Known lattice tube frames of welded rounded tubes (Sch) with reduced tube cross section at the intersections and additional partial lateral relief zones have the following drawbacks:

- The height of the reduced tube cross sections must be the same for all welded intersections, it should not be suited to different fluctuating bending stress.
- The round tubes with circular cross section next to the intersections welded in dents are very rigid, they do not deform when exposed to fluctuating bending stress.
- The round tubes adjacent to the welded intersections are furthermore very torsionally stiff, they do not deform when exposed to torsional stress. The horizontal lattice profile rods are twisted by radial movements of the vertical rods with which they are welded, when exposed to fluctuating bending stress. As a consequence, added tension stress and pressure loads act upon the welding spots.

- All loads or stress during transport such as, e.g., pressure stress, tension stress, torsional stress, can be absorbed solely by the locally limited partial dimples (desired buckling zones or fracture zones) directly adjacent the intersections.

Object:

It is an object of the present invention to provide a pallet container with a lattice tube frame of welded tubular rods, whereby the drawbacks of the prior art are obviated and in particular vertical tubular rods are resistant to fatigue cracks and rod fracture over a longer period - while taking into account the stacking load of a loaded stacked pallet container (double stacking) besides the normal transport stress of back and forth sloshing liquid content.

This object is attained in accordance with the present invention by a pallet container of a type involved here with tubular lattice rods of continuously closed profile by providing at least the vertical lattice rods with a higher resistance moment against bending only in the area of the intersections to be welded and with a comparably lower resistance moment against bending in the entire remaining areas between two intersections. The tubular rods welded to one another have a higher tubular profile height at the intersections and therefore constitute limited areas with a high rigidity and torsional stiffness, while the lattice rods situated outside an intersection have a lower tubular profile height and constitute the areas of lower rigidity and torsional stiffness. It is hereby further provided to construct the tubular lattice rods over their entire length with two alternating arrangements of different cross sections, one with reduced tubular profile height and reduced resistance moment against bending over a comparably greater rod length, and one cross section with partially increased tubular profile height with higher resistance moment against bending extending over a comparably short rod length across the area of the welded intersections.

In view of the configuration according to the invention, in which the areas of reduced tubular profile height with lower resistance moment against bending are located always in midsection between two intersections, the area of the welded intersections is effectively protected against fatigue cracks and rod fracture, i.e. not by a local desired fracture point directly next to the welding spots with rigid zones between the intersections but by the entire area between the welded intersections which is configured as more elastic, flexible zone.

As the pallet containers have a longer and a shorter side (dimensions 1200 X 1000 mm), the greatest dynamic deformations are naturally encountered in the longer sidewalls of the tubular lattice type support jacket where typically most fractures of the tubular rods occur. As a consequence of the configuration of the tubular rods in accordance with the invention in which the areas of reduced tubular profile height – as viewed in longitudinal direction of the tubular rod – are significantly longer than the areas with higher tubular profile height of higher resistance moment against bending (at least twice as long), the longer sidewall in particular of the tubular lattice type support jacket defines a vibration unit which is so elastically adjusted, while maintaining a sufficient stiffness against stacking loads, that tubular rod fractures are no longer experienced even when exposed to transport shocks over an extended period.

Damaging fluctuating bending stress and torsional loads encountered during normal transport and additional double stacking (superimposed additive pressure load) are absorbed by the entire elastic areas between the rigid intersections so that the occurrence of locally excessive stress peaks is no longer experienced on or adjacent to the welded intersections.

Furthermore, the tubular lattice rod according to the invention is constructed torsionally softer in the long areas with smaller tubular profile height outside the

intersections, i.e. it allows more twist or generates less pressure stress and tension stress on the welded intersection at same twist angle.

The invention will now be explained and described in more detail with reference to the drawings which schematically illustrates exemplary embodiments. It is shown in:

- Figure 1 a front view of a pallet container according to the invention,
- Figure 2 a side view of the pallet container according to the invention with stacked second pallet container (double stacking),
- Figure 3a hydrostatic pressure distribution in the plastic container,
- Figure 3b bulging of the sidewall of the plastic container,
- Figure 4 deformations of the pallet container by surge forces with superposed stacking load (side view),
- Figure 5 deformations of the pallet container by surge forces and stacking load (plan view),
- Figure 6 a sectional view of lateral deformations of a vertical lattice rod:
a) normal, b) with flexure to the outside, and c) to the inside,
- Figure 7a force considerations on a welded lattice rod intersection,
- Figure 7b crack formation as a result of bending stress at an intersection,
- Figure 7c tearing-off of a welding spot at an intersection,
- Figs. 8a,b T-beam model with associated stress distribution during flexure,
- Figs. 9a,b trapezoidal profile with associated stress distribution during flexure,
- Figure 10 tubular lattice rods according to the invention with increased tubular profile height in the intersection (square-rectangle profile),
- Figure 11 a preferred embodiment of tubular lattice rods according to the invention with increased tubular profile height in the intersection,
- Figure 12 a cross section through a profiled tubular lattice rod according to the invention at an intersection (great tubular profile height),

- Figure 13 a cross section through a profiled tubular lattice rod outside the welded intersections (low tubular profile height),
- Figure 14 a further cross section through a profiled tubular lattice rod outside the welded intersections (low tubular profile height),
- Figure 15 a further cross section through a profiled tubular lattice rod outside the welded intersections (low tubular profile height),
- Figure 16 a further cross section through a profiled tubular lattice rod outside the welded intersections (low tubular profile height),
- Figure 17a a longitudinal section of tubular lattice rods at a welded intersection (great tubular profile height),
- Figure 17b a cross section in the vertical tubular lattice rod at a welded intersection (great tubular profile height),
- Figure 17c a cross section in the vertical tubular lattice rod (small tubular profile height),
- Figure 18 an outer view upon welded intersections of the lattice tube frame with profiled tube-lattice rods according to the invention,
- Figure 19 an inside view of the welded intersections of the lattice tube frame with profiled tube-lattice rods according to the invention, and
- Figure 20 elastic deformations of a preferred vertical lattice rod caused by surge forces and stacking load a) normal, b) flexure to the outside, and c) flexure to the inside.

Figure 1 depicts a front view of a pallet container 10 according to the invention with inner plastic container 12, lattice tube type support jacket 14, and bottom pallet 16 with lower discharge fittings (pallet width 1000mm).

The pallet container 10 is shown in Figure 2 by a side view (pallet length 1200 mm), with a second identical pallet container being stacked. The lower pallet container is hereby subjected during transport, e.g. on a truck, in addition to the fluctuating surge pressure loads of the liquid content, in a significant and

superimposing manner also to the stacking load of the stacked pallet container (double stacking) which swings up and down as well as back and forth.

When an inner plastic container 12 is filled with liquid content 18, the course of the internal hydrostatic pressure P_i increases from top to bottom, as shown in Figure 3a, wherein the mass center of gravity S of the liquid content is approximately at one third of the height of the inner container. As a consequence, the inner container 12 undergoes a changing bulging when exposed to dynamic transport loads, as illustrated in Figure 3b, with the lateral bulging being at a maximum exactly at a level of the mass center of gravity S . During dynamic vibrations of the system, the inner container “pumps”, whereby the fill height of the liquid content changes by the height L (level) while the sidewall deforms elastically to the outside and inside by the amount “ O ” (outside) and “ I ” (inner side) about the normal position, and the bottom plate (up and down swinging) correspondingly deforms elastically to the outside and inside in midsection by an amount “ O ” and “ I ” (more pronounced in the subjacent pallet container).

Figure 4 shows this vibration state with added stacking load “StP” for a long sidewall of the pallet container, wherein the tubular rods of the lattice cage necessarily follow these elastic deformations to the outside and to the inside.

Figure 5 shows a plan view of the long sidewall of the pallet container. It is clear that the deformation of the sidewall to the outside is about twice as large as the compression of the sidewall to the inside.

When considering load conditions, the weakest spot or the area that is under stress the most must be taken into account. Both vertical rods in the middle of the long sidewalls of the lattice cage in the area of greatest bulging are also exposed to the greatest stress because these vertical rods are adversely affected

the most by the impact of the stacking load "StP" of the stacked further pallet container. Damages that occur predominantly at these vertical rods involve buckling or fracture below the lower horizontal rod and tear-off of the welded connections with the uppermost circumferential horizontal rod. The stacked pallet container (Fig. 2) also represents its own independent vibration system during transport shocks. The bottom pallet rests on the outer side circumferentially upon the lattice frame or upon the uppermost horizontal lattice rod of the subjacent pallet container and vibrates hereby – also in midsection of the long sidewall – predominantly downwards and greatly strains additionally (like hammer shocks) the middle vertical rods of the subjacent pallet container.

Shown in Figures 6a, 6b, and 6c is a vertical tubular rod 20 in the area of a lower intersection "X" with a lower horizontal tubular rod welded thereon. Figure 6a shows the standard position (normal condition), while Figure 6b illustrates the state of greatest flexure (amount "O") to the outside, and Figure 6c the state of greatest flexure (amount "I") to the inside. When the vertical tubular rod is bent outwards (Figure 6b), the outer side of the rod is exposed to high tensile stress and the inner side of the rod is exposed to corresponding pressure stress. When the vertical tubular rod is bent inwards (Fig. 6c), the outer side of the rod is exposed to low pressure stress and the inner side of the rod is exposed to corresponding tensile stress. These deformations take place in rapid change of about 3 Hz (vibrations/sec = about 180 hits/minute) during dynamic transport loads.

When looking at Figure 4, it becomes clear that the vertical tubular rod below the intersection "X" is flexed to a greater degree than above this intersection. The reason for this resides in the fact that the lower end of the vertical tubular rods is securely fixed to the bottom pallet 16 and the distance of the intersection "X" to the bottom pallet 16 is comparably short. This results in particular load situations which are illustrated in Figures 7a, 7b and 7c. As a result of the varying flexure of

the vertical rods (top, midsection and bottom; and outer side and in midsection in the long sidewall of the lattice frame), the horizontal tubular rods are twisted thereby causing torsional stress which manifests itself in the lower welding spots of the concerned intersection "X" as additional tensile stress "Z" which is additive in its effect (Figure 7a). This can lead, on one hand, to fatigue crack or rod fracture (Figure 7b) or to a tear-off/detachment of the welding spots, e.g. when circular tube profiles are involved (Figure 7c).

For explanation of occurring tensile/pressure stresses, Figs. 8a and 8b illustrate as models a T-beam with associated stress condition during exposure to bending stress. The neutral fiber layer (= elastic line) extends through the centroid S_F of a bending beam (T-beam). When a symmetric cross section (e.g. round tube, square cross section or rectangular cross section) is involved, the neutral fiber is situated in the middle of the bending beam because it is there where the centroid lies. As illustrated in Figure 8a, the centroid S_F of the T-beam is shifted downwards to the broad side of the T-beam. As a result, the section modulus of the T-beam for the lower edge fibers are greater on the broad side than for the upper edge fibers on the narrow side so that the tensions are smaller at the bottom than at the top. Typically, almost any material can be exposed to a greater extend to a pressure load than to a tensile load, i.e. it can cope with higher pressure stress than with dangerous tensile stress. This is important in relation to the correct installation of a dynamically loaded component.

A vertical rod of trapezoidal profile (with broad side and narrow side) behaves in a similar. i.e. approximated manner as a T-beam, as shown in Figures 9a and 9b. When considering the most unfavorable load situation on a long side of the lattice frame with the greatest flexure to the outside of a vertical tubular rod in the area of the trapezoidal profile, the tensile stress on the outer broadside of the tubular rod, where the welding spots are located in the intersections, are lower than the

pressure stress on the inwardly pointing narrow side of the vertical tubular rod (compare Fig. 9b): $\sigma_Z < \sigma_D$.

This makes it clear that the vertical tubular rod is exposed in the area of the beneficial trapezoidal profile to smaller dangerous tensile stress, when critically bent to the outside (T-beam model), than would be the case with the use of a symmetric tube cross section like e.g. a round tube.

Figure 10 depicts an embodiment according to the present invention. The base profile of the tubular lattice rods is configured here as square profile (edge length e.g. 16 mm = high rectangular profile). The horizontal and vertical tubular rods 20, 22 have in the intersections a great tubular profile height "H" of e.g. 16 mm, while the free areas of the tubular rods outside the intersections have a short rectangular profile with reduced, lower tubular profile height "h" of e.g. 12 mm. The reduction of the tubular profile height from "H" to "h" is respectively realized here from the side on which the horizontal and vertical tubular rods are welded to one another.

A preferred embodiment according to the present invention is shown in Figure 11. The base profile of the tubular lattice rods is configured here as trapezoidal profile. The horizontal and vertical tubular rods 20, 22 have also in the intersections a great tubular profile height "H" of e.g. 16 mm, and in the free areas of the tubular rods outside the intersections a reduced, lower tubular profile height "h" of about 12 mm in an approximately rectangular cross section (low rectangular profile). The reduction of the tubular profile height from "H" to "h" was, however, respectively realized here from the side which opposes the welding spots. This has the advantage that the sides on which the horizontal and vertical tubular rods are welded to one another, are linearly continuous and non-deformed. Thus, no substantial changes or jumps in the height of the

maximum tensile stress are experienced when a vertical tubular rod is subjected to a flexure to the outside (amount "O").

The lower area of the vertical tubular rod 29 is here shown with a further advantageous constructive variant in which the reduction of the tubular profile height from "H" to "h" is respectively realized from both sides (welded side and the side opposite to the welding spots), so as to provide advantages with respect to manufacture and to prevent one-sided deformation stress. Furthermore, the reduction on both sides of the tubular rod height per side requires formation of only a small, i.e. half the height difference $(H-h)/2$ (per side e.g. 2-3 mm) in the high base profile.

Figure 12 shows a preferred trapezoidal tube profile as high base profile by way of a cross sectional view through a profiled tubular lattice rod according to the invention at a welded intersection (great tubular profile height). The height "H" is hereby 16 mm and the width is about 18 mm. Figure 13 shows the cross section through the a profiled tubular lattice rod according to Fig. 12 outside the welded intersection with low tubular profile height "h". The height "h" is hereby 12 mm and the width is about 20 mm. The reduction of the tubular profile height from "H" to "h" is realized here from the broadside of the trapezoidal base profile. Figure 14 depicts another cross sectional version of a profiled tubular lattice rod outside the welded intersection with low tubular profile height "h". The height "H" is hereby 12 mm and the width is about 19 mm. The reduction of the tubular profile height from "H" to "h" is realized here from the narrow side of the trapezoidal base profile; the profile approximates a rectangular configuration. Another version of a tube cross section reduced in height is shown in Figure 15. The reduction of the tubular profile height H of the trapezoidal base profile is here also realized by shaping the narrow side inwards into the tube cross section, thereby establishing again a substantially rectangular profile.

A further version of a tube cross section reduced in height is illustrated in Figure 16. The reduction of the tubular profile height H is here also realized by shaping both opposite slanted sidewalls of the trapezoidal base profile inwards into the tube cross section.

Figure 17 shows the preferred embodiment with trapezoidal base profile H above the intersection and height-reduced rectangular tubular rod profile h between the intersections. The reduction of the tubular profile height from “ H ” to “ h ” has been realized respectively from the side of the horizontal and vertical tubular rods 20, 22 in opposition to the welding spots.

Figure 18 shows a cutaway plan view of a lattice frame from outside with four intersections. The horizontal and vertical tubular rods are welded to one another by means of four welding spots per intersection (by stacked intersecting outer ribs of the tubular lattice rods).

The entire tubular rod length L_h between two intersections with low tubular profile height h has been flattened (or rolled down, compressed flat, shaped inwards) from the great tubular profile height H = base profile and amounts to between 100 mm to 260 mm, preferably about 130 mm.

The comparably short tubular rod length L_H , extending across an intersection, with high tubular profile height H amounts to between 40 mm to 120 mm, preferably about 60 mm (= 3 x tubular rod width of 20 mm).

Figure 19 shows the respective view from inside (onto the elevations H of the vertical tubular rods 20).

In order to attain a high bending resistance in the area of the welded intersections while having a lower bending resistance or higher elasticity in the

entire are of the lattice rods outside the intersections, various advantageous measures can be realized. On one hand, the horizontal tubular lattice rods 22 can be provided outside the intersections with a same or lower tubular profile height than the vertical tubular lattice rods 20 outside the intersections. On the other hand, the vertical tubular lattice rods 20 can be provided within the intersections with a same or higher tubular profile height than the horizontal tubular lattice rods 22. Furthermore, the horizontal or/and vertical tubular rods 20, 22 can extend within the intersection over a length L_H of the respective tubular rod 20, 22 in longitudinal direction of the tubular rod from at least twice the tubular rod width ($2 \times 20 \text{ mm}$) up to a sixfold tubular rod width, preferably about threefold tubular rod width. Recommended for the lower rod profile (low tubular profile height) of the horizontal or/and vertical tubular rods 20, 22 outside the intersections is a length L_h of the respective tubular rod 20, 22 - in longitudinal direction of the tubular rod - from at least a threefold tubular rod width ($3 \times 20 \text{ mm}$) up to an eightfold tubular rod width, preferably about sixfold tubular rod width.

It is hereby advantageous for manufacturing reasons to provide regions of the lower tubular profile height h by lateral dimpling (burnishing) on both sides of the original profile rod with continuously high tubular profile height H .

Another possibility to reduce the tubular profile height H can be realized by dimpling (burnishing, rolling), regions of two opposing sides of the original profile rod (base profile) on one side or/and on both sides.

These measures result individually or in advantageous combination to a significant improvement of the entire elasticity behavior of a lattice wall plane and relief of the regions of welded intersections and provide an appreciable decrease of the sensitivity to rod fracture (= fatigue fracture) when subjected to long-term

and strong fluctuating bending stress like e.g. during extraordinary transport loads of filled pallet containers on trucks along poor roads.

The differences in the tubular profile height of the vertical or/and horizontal tubular lattice rods can be realized in accordance with the following variations:

1. different across the tubular lattice rod length,
2. solely on vertical tubular lattice rods,
3. on vertical and horizontal tubular lattice rods, or/and
4. solely realized in regions of the tubular lattice rods where required as a consequence of encountered load.

Figure 20a depicts a preferred configuration of a vertical tubular rod 20 according to the invention in normal position. When subject to dynamic load, the vertical tubular rod 20 oscillates about this normal position and bends outwards according to Figure 20b and inwards according to Figure 20c.

Compared to known pallet containers, the configuration of the tubular rods according to the invention enables – in particular for the long sidewalls of the lattice frame, a greater amount “O” of the greatest elastic flexure to the outside and a greater amount “I” of the greatest elastic flexure to the inside, without encountering stress peaks of such high values that the vertical lattice rods which are strained predominantly experience fatigue cracks and brittle fracture in shortest time.

The lattice cage with its many “long” regions of low profile rod height thus results in a substantially more elastic spring system in comparison to known lattice cages of conventional pallet containers.

LIST OF REFERENCE NUMERALS

10	pallet container	P_i	internal hydrostatic pressure
12	inner container HD-PE	S	mass center of gravity
14	lattice tube type support jacket	O	outward flexure
16	bottom pallet	I	inward flexure
18	liquid content	O'	outward flexure
20	vertical tubular rod	I'	inward flexure
22	horizontal tubular rod	"X"	lower intersection
"Z"	tensile stress	H	high tubular profile height
M	center	h	short tubular profile height
S_F	centroid	σ_z	tensile stress
A_1	area rectangle 1	σ_D	pressure stress
A_2	area rectangle 2	e_1	distance $S_F - A_1$
L_H	length of high tubular profile height	e_2	distance $S_F - A_2$
L_h	length of short tubular profile height		

CLAIMS

1. Pallet container (10) with a thin-walled inner container (12) of thermoplastic material for storage and transport of liquid or free-flowing goods, wherein the plastic container (12) is closely surrounded by a lattice tube frame (14) as support jacket and with a bottom pallet (16) on which the plastic container (12) rests and with which the lattice tube frame (14) is fixedly secured, wherein the lattice tube frame (14) includes vertical and horizontal tubular rods (20, 22) welded to one another at intersecting areas,

characterized in that

at least the vertical tubular rods (20) have regions with varying tubular profile height, wherein the regions with lower tubular profile height (h) are provided uniformly linear continuously between the intersections or outside the intersections, and the regions with higher tubular profile height (H) are provided on the intersections or within the intersections.

2. Pallet container according to claim 1,
characterized in that

the tubular rods (20, 22) are provided over their entire length with two alternating cross sections of different configuration, one cross section having reduced tubular profile height (h) and reduced resistance moment against bending along a comparably greater rod length (L_h), and one cross section having partially increased tubular profile height (H) with higher resistance moment against bending extending along a comparably short rod length (L_H) across the area of the welded intersections.

3. Pallet container according to claim 1 or 2,
characterized in that
the areas of low tubular profile height (h) extend in midsection between two intersections, and the areas of high tubular profile height (H) are constructed in midsection above each intersection.
4. Pallet container according to claim 1, 2 or 3,
characterized in that
the areas of low tubular profile height (h) between two intersections – as viewed in longitudinal direction of the tubular rod – are twice as long ($L_h > 2 \times L_H$) as the areas with high tubular profile height across each intersection.
5. Pallet container according to claim 1, 2, 3 or 4,
characterized in that
the tubular profile height of the tubular lattice rods (20, 22) outside the intersections are constructed as low rectangular profile, and in the area of the intersections as high rectangular profile.
6. Pallet container according to claim 1, 2, 3 or 4,
characterized in that
the tubular profile height of the tubular lattice rods (20, 22) outside the intersections are constructed as low rectangular profile, and in the area of the intersections as high trapezoidal profile.
7. Pallet container according to one of the claims 1 to 6
characterized in that
the horizontal tubular lattice rods (22) have a same or lower rod profile (tubular profile height) outside the intersections than the vertical tubular lattice rods (20) outside the intersections.

8. Pallet container according to one of the claims 1 to 7 characterized in that the vertical tubular lattice rods (20) have a same or lower rod profile (tubular profile height) within the intersections than the horizontal tubular lattice rods (22).

9. Pallet container according to one of the claims 1 to 8 characterized in that the high rod profile (tubular profile height) of the vertical or/and horizontal tubular lattice rods (20, 22) extend within the intersections over a length (L_H) of the respective tubular rod (20, 22) in longitudinal direction of the tubular rod from at least twice the tubular rod width up to a sixfold tubular rod width, preferably about threefold tubular rod width.

10. Pallet container according to one of the claims 1 to 9 characterized in that the low rod profile (low tubular profile height) of the vertical or/and horizontal tubular lattice rods (20, 22) extend outside the intersections over a length (L_h) of the respective tubular rod (20, 22) - in longitudinal direction of the tubular rod - from at least a threefold tubular rod width up to a eightfold tubular rod width, preferably about sixfold tubular rod width.

11. Pallet container according to one of the claims 1 to 10 characterized in that regions of the lower tubular profile height (h) are constructed by lateral dimpling (burnishing) on both sides of the original profile rod with continuous high tubular profile height (H).

12. Pallet container according to one of the claims 1 to 11 characterized in that regions of the lower tubular profile height (h) are constructed on one side or/and both sides by dimpling (burnishing, rolling) two opposite sides of the original profile rod with continuous high tubular profile height (H = base profile).