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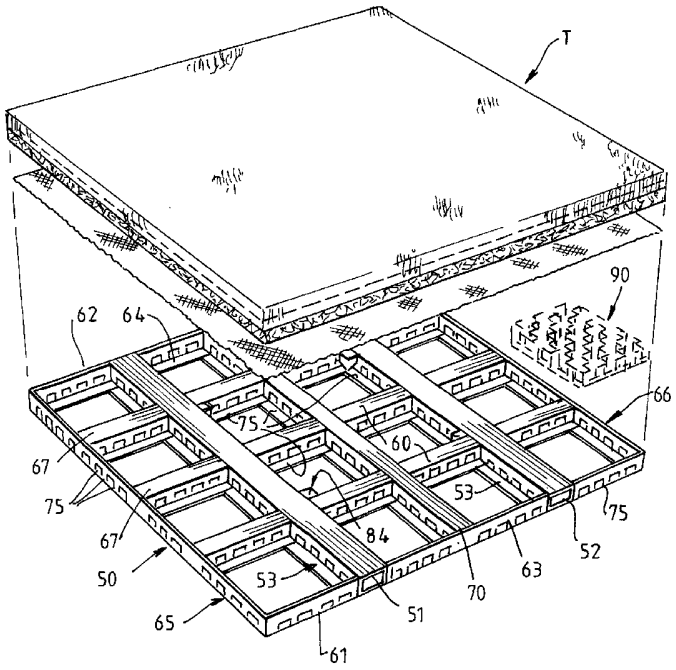
(54) Title: LIFTABLE TURFING SYSTEMS



(57) Abstract: A liftable support structure for a turf system, the support structure comprising a skeletal framework (50) having an open based structure with upstanding sides and at least two parallel spaced cross beams (51, 52), the framework (50) defining open subsections, each subsection supporting a latticework panel (90) that sits on the ledge structure. The framework (50) having a plurality of spaced lifting points and the cross beams (51, 52) defining access to forklift tines.

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LIFTABLE TURFING SYSTEMS

This invention relates to turfing systems and especially liftable turfing systems that can be used in modern stadia and are readily movable from an operative position to a storage growing environment.

Modern day stadia place enormous demands on turfing areas. If natural turf is required to play team sports and the stadia is used for other entertainment purposes such as to house concerts, the turf is placed under great stress. Modern day stadia also have cantilevered overhanging stands that place much of the turf in shade and some stadia even have closeable roof structures. In consequence, the turf does not get optimum exposure to sun and moisture to ensure healthy grass growth.

There have been many proposals to provide removable turf segments that can be removed and interchanged on demand. As the segments are removed, they can then be positioned in green houses or other environments where there are optimum growing conditions.

However, large turf segments are difficult to lift and transport without damaging the turf segment or surrounding turf areas. Whilst forklifts have proved very successful in facilitating loading and unloading of turf segments there is often no ready access for forklift tines when damaged or worn turf segments have to be removed and replaced.

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention there is provided a liftable support structure for a turf system, the support structure comprising a skeletal framework having an open base structure with upstanding sides and at least two parallel spaced cross beams, the

framework defining opens subsections, each subsection having a base defining a ledge structure, each subsection supporting a latticework panel that sits on the ledge structure, the framework having a plurality of spaced lifting points and the cross beams defining access to forklift tines.

The latticework panel may be injected molded in plastics to sit flush within each subsection. Alternatively the latticework panel may comprise a combination of a criss-cross metal structure on which is supported a thin latticework plastics panel so that the combination sits flush within each substructure.

Preferably the plurality of spaced lifting points each comprises a shaped entry portion adapted to accommodate a lifting lug which can be inserted into the shaped entry portion from above. In a preferred embodiment four lifting points are evenly spaced centrally of the support structure.

Preferably the support structure is constructed from galvanised steel. In a preferred embodiment the cross beams are interconnected by transverse beams to define the plurality of subsections.

In accordance with a further aspect of the present invention there is provided a modular turfing system comprising a liftable support structure of the kind described above, a layer of sand/loam based growing medium positioned on the framework and latticework panels and natural turf positioned on the layer of growing medium.

DESCRIPTION OF THE DRAWINGS

Embodiments of the turf system of the present invention will now be described by way of example only in which:

Figure 1 is an exploded perspective illustration of a turf module including turf on top of a support structure,

Figure 2 is a schematic cross-sectional view of the turf module,

Figure 3 is a plan view of the turf module,

Figure 4 is a perspective view of one corner of the support structure,

Figure 5 is a cross-sectional view of the support structure taken along the lines 5-5 of Figure 3,

Figure 6 is a cross-sectional view of the support structure taken along the lines 6-6 of Figure 3,

Figure 7 is an enlarged plan view of a lifting point illustrated in the circle A in Figure 3,

Figure 8 is a cross-sectional view taken along the lines 8-8 of Figure 7,

Figure 9 is a plan view showing dimensions of a tennis court with an illustration of how the turf system can be used to define a tennis court,

Figure 10 is a plan view of a turf module illustrating a support structure in accordance with a second embodiment,

Figure 11 is a cross sectional view of the turf module taken along the lines 11-11 of Figure 10,

Figure 12 is an exploded perspective view of one subsection of the support structure,

Figure 13 is an exploded perspective view of a criss-cross structure of the subsection shown in Figure 12, and

Figure 14 is an exploded perspective view of a locater that connects the adjacent corners of support structures.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In a first embodiment as shown in Figure 1 - 8 of the accompanying drawings a turf module 10 comprises natural turf T positioned on a support structure in the form of a metal skeletal framework 50 that supports a plastics latticework 90 with the turf T covering the upper surface.

The framework 50 is fabricated to be either a square (preferably 2.4m) or a rectangle in plan (5m x 3m) with subsections that are arranged to support the plastics latticework 90 that sits in each subsection. The frame 50 is fabricated from steel and essentially comprises two parallel spaced apart main beams 51, 52 of a inverted C-shape. A plate 53 is welded to the underside of the beams to extend outwardly on each side of the beam to define a small ledge 55, 56 that will run along on the underside of each edge of the beam. The main beams 52, 53 are spaced by lateral spacing beams 60 that are formed, as shown in Figure 5, to have a top hat shape in section. These beams 60 are equally spaced between the main beams 51, 52 and are welded to the main beams to define the spacing of the main beams. Two pieces 61, 62 of angle iron are then welded across the ends of the main beams 51, 52 with the vertical flange cutout to leave the end of the main beam open as shown in Figure 4. The angle iron 61, 62 has one flange 63 defining the upstanding side wall and the other flange 64 defines a ledge 64 on the base of the frame. Similar pieces 65, 66 of the angle iron are then welded to the longitudinal sides to close off the square array as shown in Figure 3. Further reinforcing transverse beams 67 are then positioned between the main beams and the lateral edges to be coaxial with the transverse beams positioned between the main beams. A final series of strengthening beams 70 are positioned longitudinally at the mid span between the main beams. All the beams have vertical flanges with equally spaced rectangular cutouts 75 towards the base of the flange. These cutouts 75 are shown with

particular reference to Figures 4 and 5.

As described above, the subsections have inwardly turned ledges which act as support for a square shaped array of plastics latticework 90 available as a proprietary item sold under the trade mark ATLANTIS™.

The latticework 90 that is manufactured of heavy duty polypropylene. In one embodiment the latticework is 52mm x 260mm x 480mm and sits approximately 25mm below the top surface of the frame. A fine cloth or plastics mesh is placed over the latticework 90 and then the gap between the top of the latticework 90 and the frame is filled with sand and leveled off. The fine cloth prevents the sand filtering through the latticework. Turf is then placed on top of the sand. Other options include placing a fine mat or mesh on the top of the plastics latticework, placing a layer of plastics panelling to bring the infill up to the level of the steel structure. A second mat is then positioned over the assembly prior to the turf.

In another option the latticework 90 is of sufficient height to finish flush with the top of the steel structure.

The turf T is a product of the kind described in many of our earlier patents. This turf product T comprises a sand and peat moss base including reinforcing elements in the form of plastics mesh elements sold under the registered trade marks NETLON or REFLEX. A suitable grass may be sown in the sand plastics base and raised in optimum glasshouse conditions. The turf can be planted by seeding or by locating sprigs or stolons of a grass such as couch grass. In one embodiment the turf can be grown in situ on the support structure 50. The top of the latticework cells is covered by a fine mesh cloth. The gap between the top of the sides of the frame and the latticework elements is filled with a growing medium preferably a mix of sand and plastics mesh elements. The mesh elements are cut to a

suitable length and then homogeneously mixed with sand at about 5-6 kg per m^3. Elevated sides of wood, metal or plastics can be placed against the sides of the frame and more growing medium (100-150mm) is added. The turf is then added by seeding or sprig location. Once the turf is established and matured the module is then transported to the site of usage at which time the elevated sides are removed.

In another embodiment the turf is grown off site until matured. The matured turf product is normally between 10 to 40mm in thickness and this can be positioned on top of the sand covered frame that supports between 100 and 150mm of growing medium including mesh elements.

In the embodiment shown in Figures 10 to 13, a turf module 10 is illustrated in which the framework 50 is similar to the first embodiment. However in this embodiment, the plastics latticework 19 is replaced by a composite structure in the form of a crisscross metal support structure 100 and a thin plastics latticework panel 120 that sits on top of the crisscross structure 100. A row of cloth or fine plastics mesh 125 is then rolled onto the assembly as shown in Figure 10 to cover the framework 50 at which time turf may be placed directly on top of the framework to complete the module. As described earlier in the specification, turf could also be grown *in situ* on the framework in the manner described above.

The crisscross support structure 100 is shown in Figure 13 and comprises a first plurality of elongate planar metal strips 105 that each have an upper flange 106 turned through 90° to the planer surface 107 of the strip. The underside of each strip 105 has four equally spaced rectangular cut-outs 108 and a series of five equally spaced slots 109 extending approximately halfway up the side 107 of the strip 105. A second plurality of strips 110 complete the crisscross structure 100 are substantially

similar except that the slots 111 are provided equally spaced downwardly extending from the flange 116 at the top of the strips 110. The members inter-fit together in a mutually perpendicular array as shown in Figure 13 by interaction between the slots 109, 111 in each strips 105, 110. As shown in Figure 11, the crisscross steel structure 100 sits on the base of the framework on the inturned lips and the base structure and extend upwardly to about three quarters of the height of the framework. The remaining quarter is filled by a thin plastics latticework panel 120 that is shown in cross-section in Figure 11, in plan in Figure 10 and in a perspective view in Figure 12. The latticework panel 120 has a series of diagonally extending cross-members 121 that ensure that there are no large voids in its upper surface and thus adequately support the cloth surface 125 that is placed directly under the soil/sand aggregate. As shown in Figure 11, the combination of the crisscross steel structure 100 and the thin latticework panel 120 causes each sub-section to be flush with the side wall of the frame work.

Where turf modules of the kind described above are to be placed together, a locater 130 is illustrated in Figure 14. The locater 130 comprises a flat substantially square shaped plate 131 that has four pairs 132, 133, 134 and 135 of upstanding spigots which are positioned so that they fit into apertures 140 in the base of the framework adjacent each corner of the framework as shown in Figure 14. Thus, each corner of each framework can be located on a pair of upstanding spigots so that each locater has the effect of locating four modules in a square array. The flat plates are manufactured of galvanised steel and can be simply placed on the base structure which is usually concrete, and it is a simple matter to lower the modules so that the studs located in the apertures in the base structure of each framework. The locaters 130 keep the turf modules in close proximity with about a 10mm gap between each module. The turf modules can then only be separated from each other

by lifting them clear of the locaters 130.

The turf module can be simply lowered directly into a prepared recess that can be lined with concrete. In other alternatives the turf module can be positioned on a sand base. In some situations where the module is used for a cricket wicket the sides of the module could be slightly tapered to diverge upwardly. A suitable taper would be approximately 10mm outward diversions per side in a depth of 150 to 200mm. A similarly profiled female receptor can be positioned in the ground defining the position of the cricket wicket. The female receptor would also be tapered so that the module can be lowered as a tight fit into the receptor. The female receptor could be manufactured in galvanised steel, concrete or other suitable materials.

In a preferred form the female receptor will be 25m in length and 3m in width. The elongate sides will be tapered to diverge outwardly and upwardly from the base at about an angle of 8° to the vertical. The end walls of the receptor will also be similarly tapered. The cricket wicket would comprise five support structures laid end to end in abutting contact. Each structure will be 5m by 3m thus producing the 25m by 3m cricket wicket. Each structure would have its longer sides tapered to correspond with the taper of the female receptor. The end two structures would also have a tapered end to mate with the short ends of the receptor. However the abutting edges of the structures would be perpendicular to ensure parallel abutment. A long strip of turf would be placed on the array of structures to ensure the absence of lateral seams. In this embodiment each structure would have connectors for lifting lugs positioned at spaced intervals along the lateral edges. At least three pairs of connectors will be provided on each structure. The structures could be bolted together end to end and would be transported in one piece. Alternatively the structures could be transported individually and then assembled on site and covered in turf. In a situation

where a whole cricket square is to comprise modules of the kind described above then it would be understood that a series of receptors would be placed in a spaced parallel array with a grass gap of between 0.5 and 1.0m between adjacent receptors.

Similar modules can be used to cover horse racing track crossovers. On non race days a recessed concrete, gravel or bitumen road crosses the grass race track. On race days turf modules having frames of the kind described can be lowered into position onto the recessed road to provide a turf surface flush with the rest of the grass track. The modules would be stored in a nearby nursery site on non race days.

The exposed plastics latticework cells together with the base of the framework provide an aerobic irrigation channel for the root structure of the turf. The open structure of the underside of the module not only provides an aerobic irrigation channel but provides a vehicle for warm air to be passed under the module to encourage root growth in cold climates. The main beams define access to the tines of a fork lift from any side. The rectangular cutouts 75 at the base of the assembly allow free movement of water for irrigation purposes.

Although the frame can be lifted by use of forklift tines, it has been designed so that it can also be lifted from above. As can be seen in Figure 3, in four corners of an inner square of the frame are positioned fabricated brackets 80, 81, 82, 83 into which a lug 85 can be vertically inserted and then turned to lock against the bracket. Each bracket 80, 81, 82 & 83 includes a funnel shaped entry 86 terminating in a rectangular slot 87 in the base. The lugs 85 have a projection 88 that locates against the wall of the slot 87 when the lug is turned through 90° thereby locking the assembly together. The locked position is shown in dotted profile in Figure 8. In

this manner four lugs 85 are vertically inserted into the brackets 80, 81, 82, 83 to provide four spaced lifting points. A tractor or a crane can then be used to lift the whole slab vertically. Lugs are inserted through the turf that sits on the top of the slab and the funnel shaped entry is provided to make it easier to line up the lugs with the brackets. The positioning of the overhead lug assembly can be determined by eyeing the lateral edges of each square and positioning the lifting assembly directly over the center so that the lugs line up with the brackets. Other means of determining the lifting points is to use a surveying system that can position the lifting points to within 1 or 2mm. A mark can then be placed on the turf above the lifting points to direct entry of lugs through the turf. One such system would include mapping out the turfed surface to locate pipework, sprinkler heads and turf modules. This map would then be programmed into a computer that has appropriate location software. A surveyor's theodolite can then be used to ascertain the exact location of the mapped parameters stored by the software.

The penetration of the lugs through the turf causes little damage to the turf yet provides a ready means of lifting slabs of the turf without having to use a forklift against the underside of the frame.

The frames 50 can be bolted or secured together using locaters 130 of the kind shown in Figure 14 to define much larger surfaces such as a cricket wicket or half a tennis court. A single layer of turf is positioned and grown over the top of the assembly of frames to ensure there are no transverse seams and the whole assembly can be lifted through the top of the turf via the lifting points.

The provision of a turf system that is as wide as 13 sq metres allows for instance, as illustrated in Figure 9, two turf assemblies 80 to be used to make a tennis court 100. The recommended size for a tennis court 100 from baseline

to baseline is about 24m and the width of a tennis court is traditionally 11m. Thus, a 12.5m long by 11.5m wide assembly 80 of frames 50 can be used as one-half of the court and this can be butted to another assembly of frames 50 (not shown) to define the rectangular tennis court shown in Figure 9. The abutting join J-J would be placed under the net where there is no play and thus it is possible to immediately erect a tennis court 100 with optimum turf with a single join that has no effect on play.

Similarly it is understood that larger surfaces such as the various codes of football fields can be formed using a small number of very large assemblies. A single long thin assembly (25m by 3.0m) can be used as a cricket wicket. A number of such assemblies can be placed together longitudinally to form a whole cricket "square". Alternatively a gap of grass of between 0.5 and 1.0m could be left between each wicket to assist in drainage and reduce wear. At the end of the season the assemblies can be removed and replaced by other turf products so that the stadium can be used for football without damaging the cricket wicket.

The metal frame may be constructed in galvanised steel or may be in steel covered with a rubber or plastics coating to protect it from corrosion. The frame is sturdy yet sufficiently light for easy transportation and the combination of the frame and the plastics latticework cells provides a very efficient and transportable turf product particularly for use in sporting environments such as soccer fields, tennis courts and cricket squares.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A liftable support structure for a turf system, the support structure comprising a skeletal framework having an open based structure with upstanding sides and at least two parallel spaced cross beams, the framework defining open subsections, each subsection having a base defining a ledge structure, each subsection supporting a latticework panel that sits on the ledge structure, the framework having a plurality of spaced lifting points and the cross beams defining access to forklift tines.

2. The support structure according to claim 1 wherein the latticework panel is injected molded in plastics and sits flush within each subsection.

3. The support structure according to claim 1 wherein the latticework panel comprises a combination of a criss-cross metal structure on which is supported a thin latticework plastics panel so that the combination sits flush within each subsection.

4. The support structure according to any one of the preceding claims wherein the plurality of spaced lifting points each comprises an entry point adapted to accommodate a lifting lug which can be inserted into the entry portion from above.

5. The support structure according to claim 4 wherein four lifting points are evenly spaced centrally of the support structure.

6. The support structure according to any one of the preceding claims when it is constructed from galvanised steel.

7. The support structure according to any one the preceding claims wherein the cross beams are interconnected

by transverse beams to define the plurality of subsections.

8. A modular turf system comprising natural turf positioned on a array of liftable support structures according to any one the preceding claims in abutting contact side to side or end to end.

9. A modular turf system according to claim 8 wherein a fine cloth or mesh is placed between the support structure and the natural turf.

10. A modular turf system according to claim 8 wherein each structure is located in abutting contact on locater plates that engage with the framework of each adjacent structure.

11. A portable tennis court comprising two modular turf systems according to claim 8 joined in abutting contact whereby the line of abutting contact defines the line of the net.

12. A cricket wicket comprising an elongate receptor having an open top and inwardly inclined sides, the receptor being arranged to be located in the ground surface with the top flush with the surface, a modular turf system being positioned with the receptor, the turf system comprising a plurality of rectangular liftable support structures positioned in end to end abutting contact and covered by natural turf, each support structure comprising a skeletal framework having an open based structure with upstanding sides and at least two parallel spaced cross beams, the framework defining open subsections, each subsection having a base defining a ledge structure, each subsection supporting a latticework panel that sits on the ledge structure, the framework having a plurality of spaced lifting points, the longer sides diverging upwardly and outwardly to mate with the inclined sides of the receptor.

13. The cricket wicket according to claim 12 wherein the lifting points are spaced along and adjacent the longer sides of the support structures.

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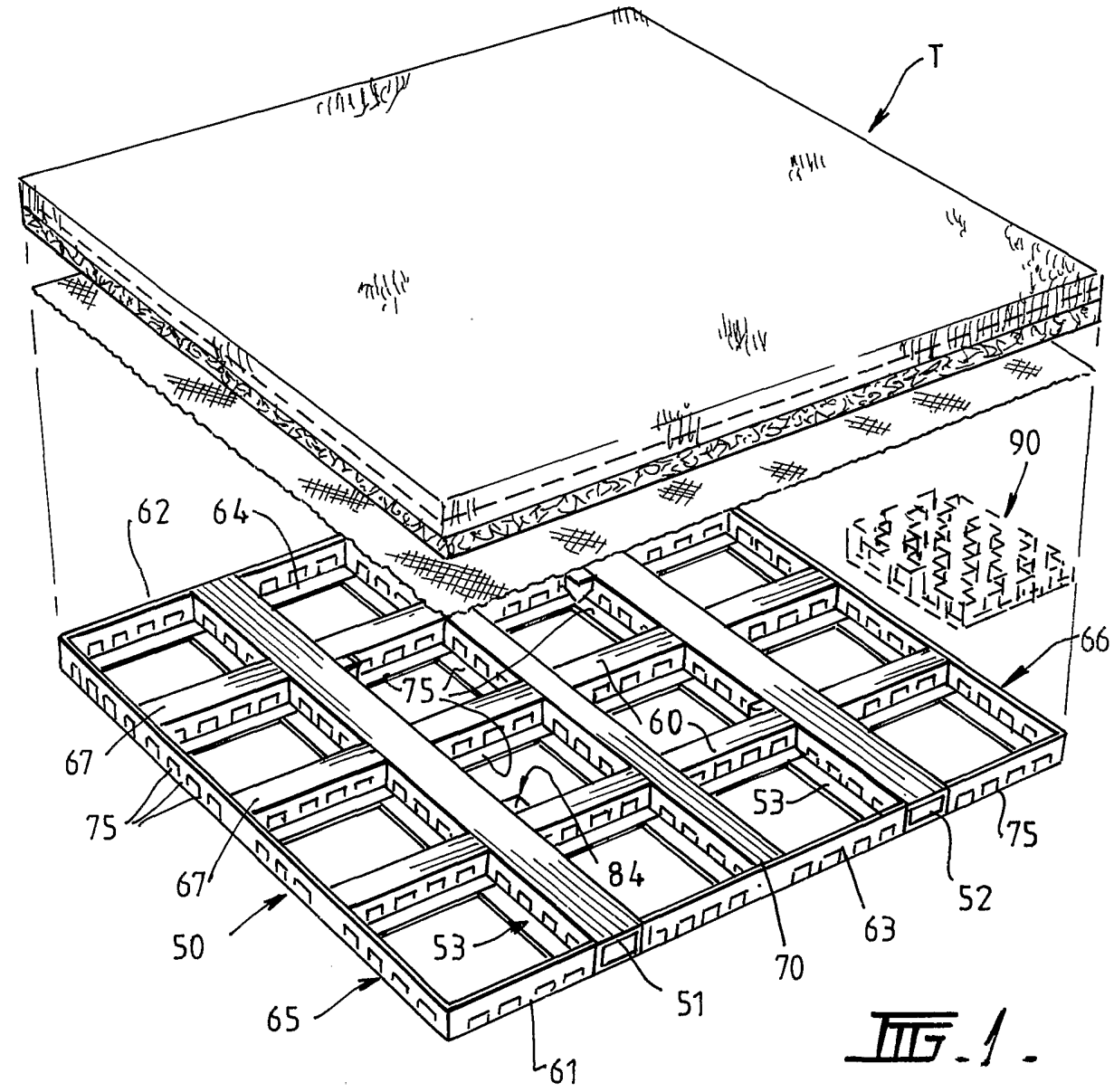
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FIG. 1.

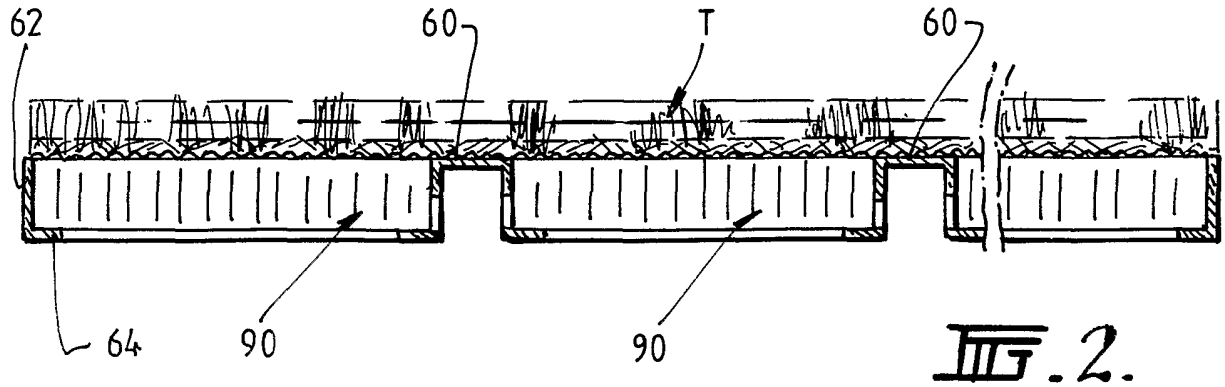
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FIG. 2.

FIG. 3.

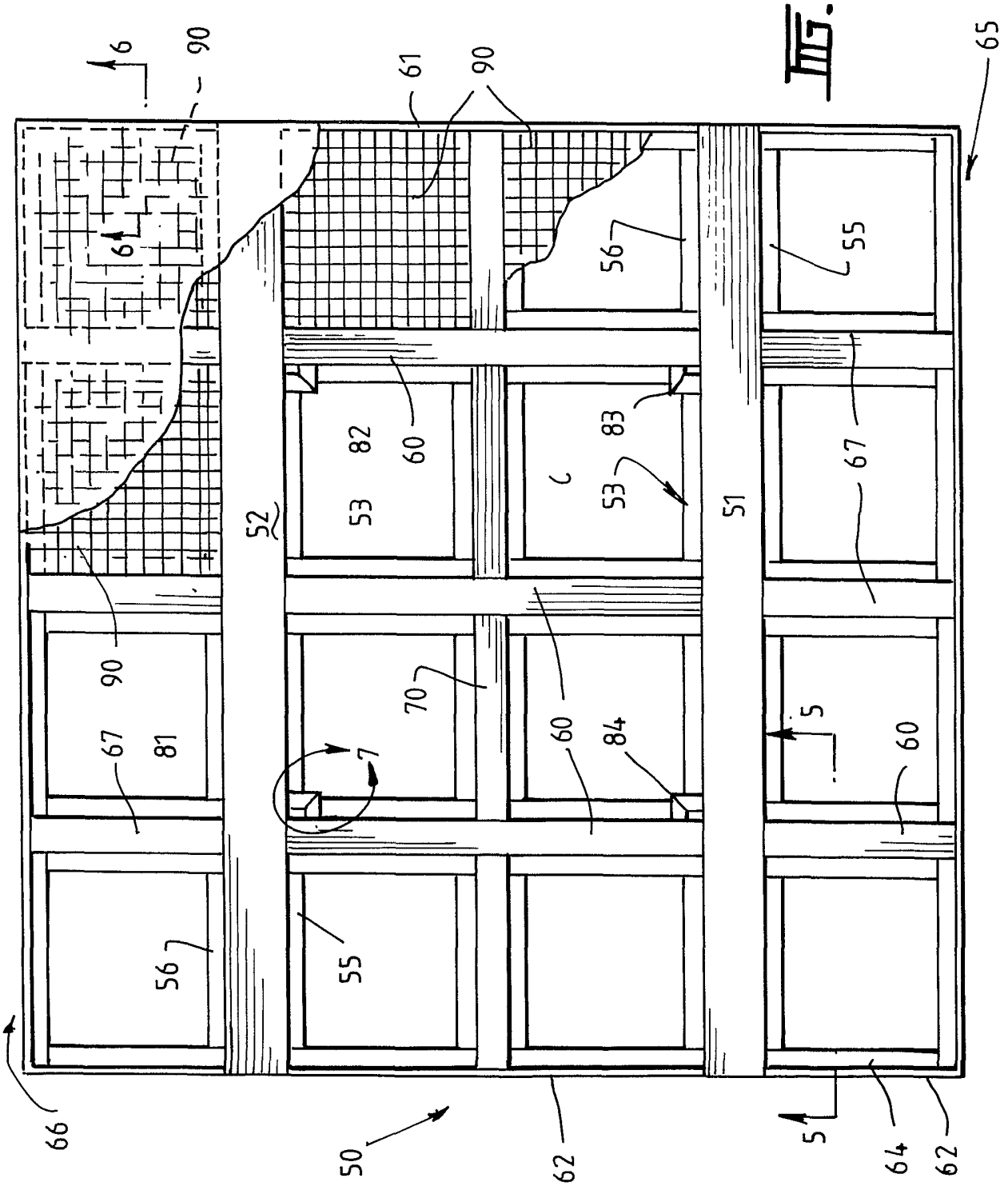
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Fig. 4.

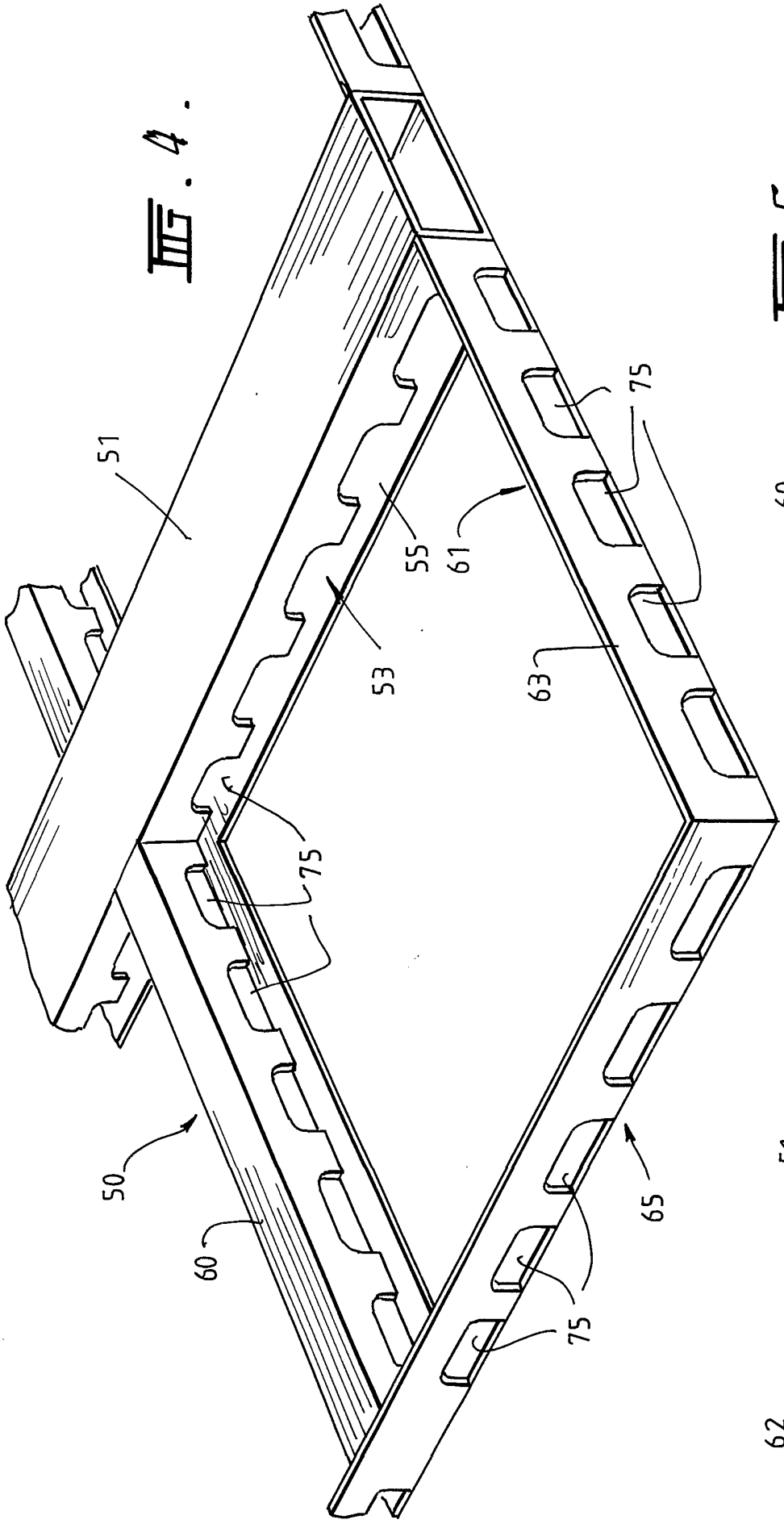
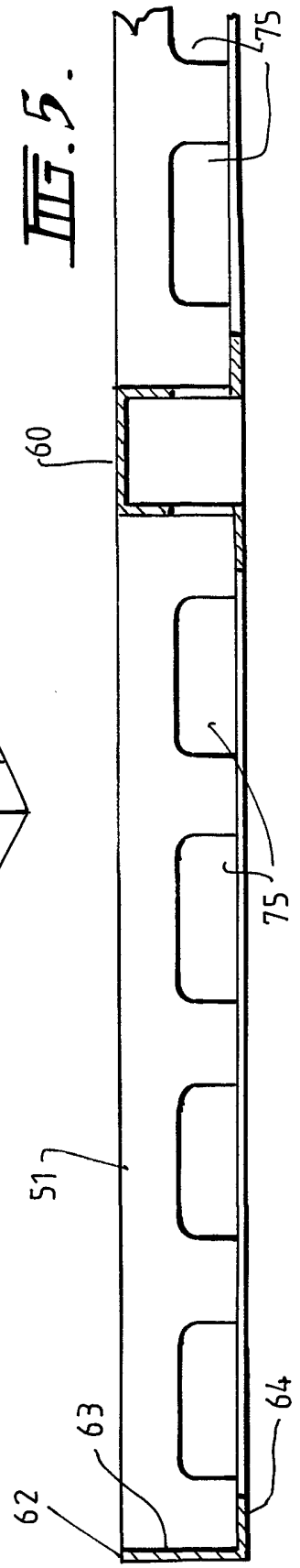


Fig. 5.



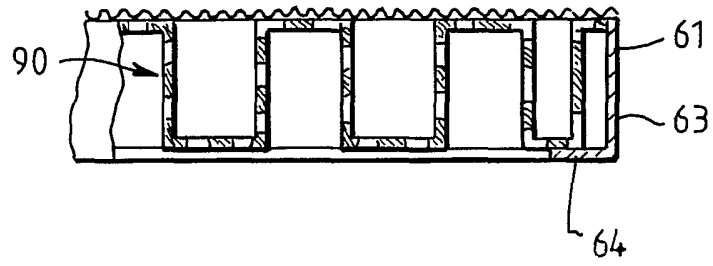


FIG. 6.

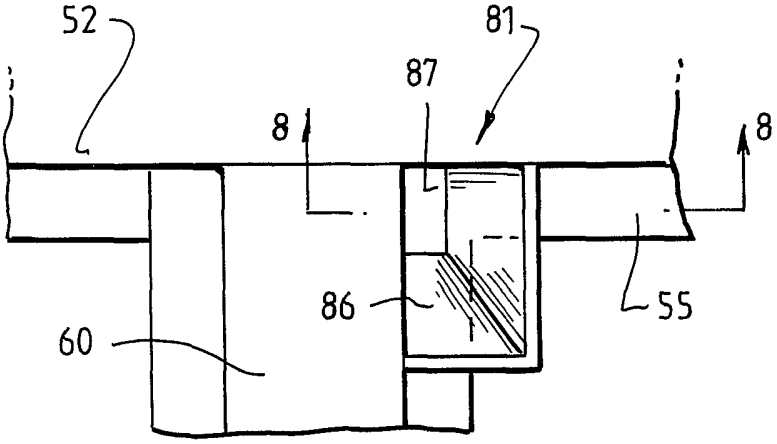


FIG. 7.

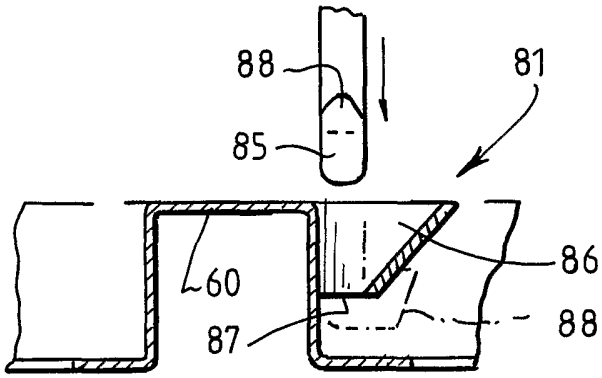


FIG. 8.

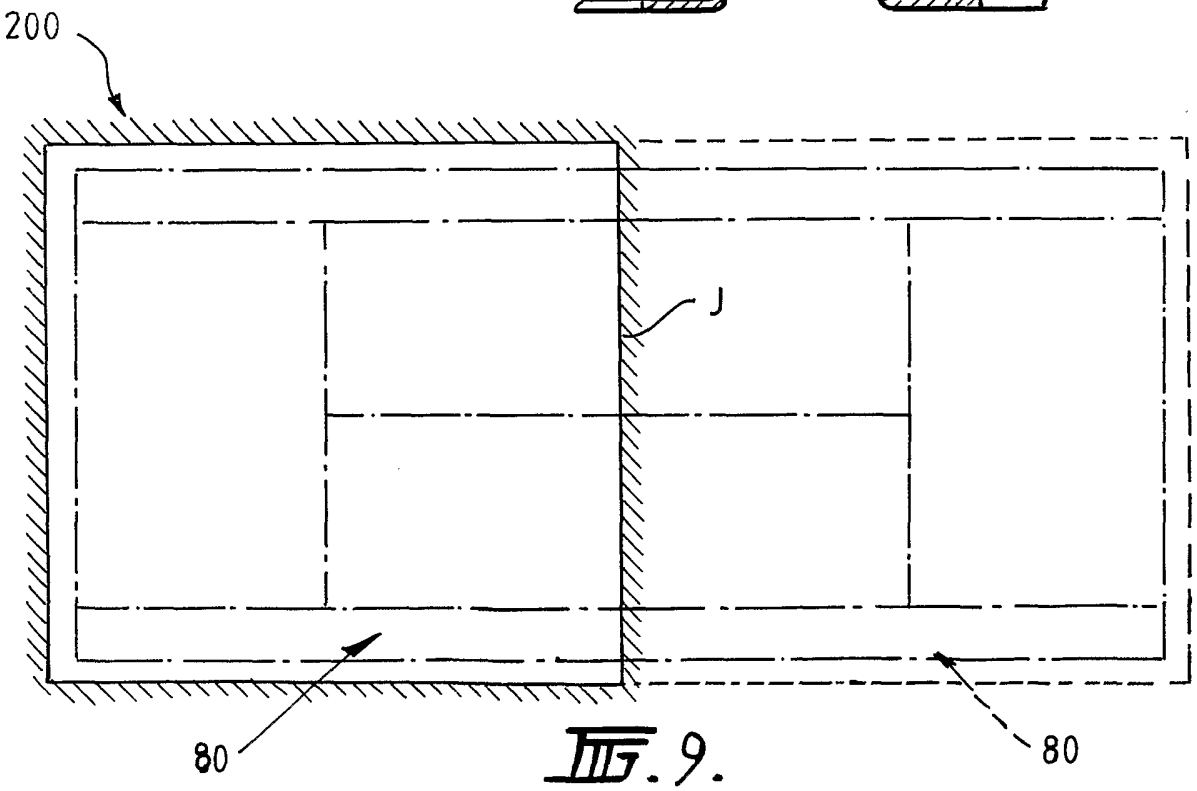


FIG. 9.

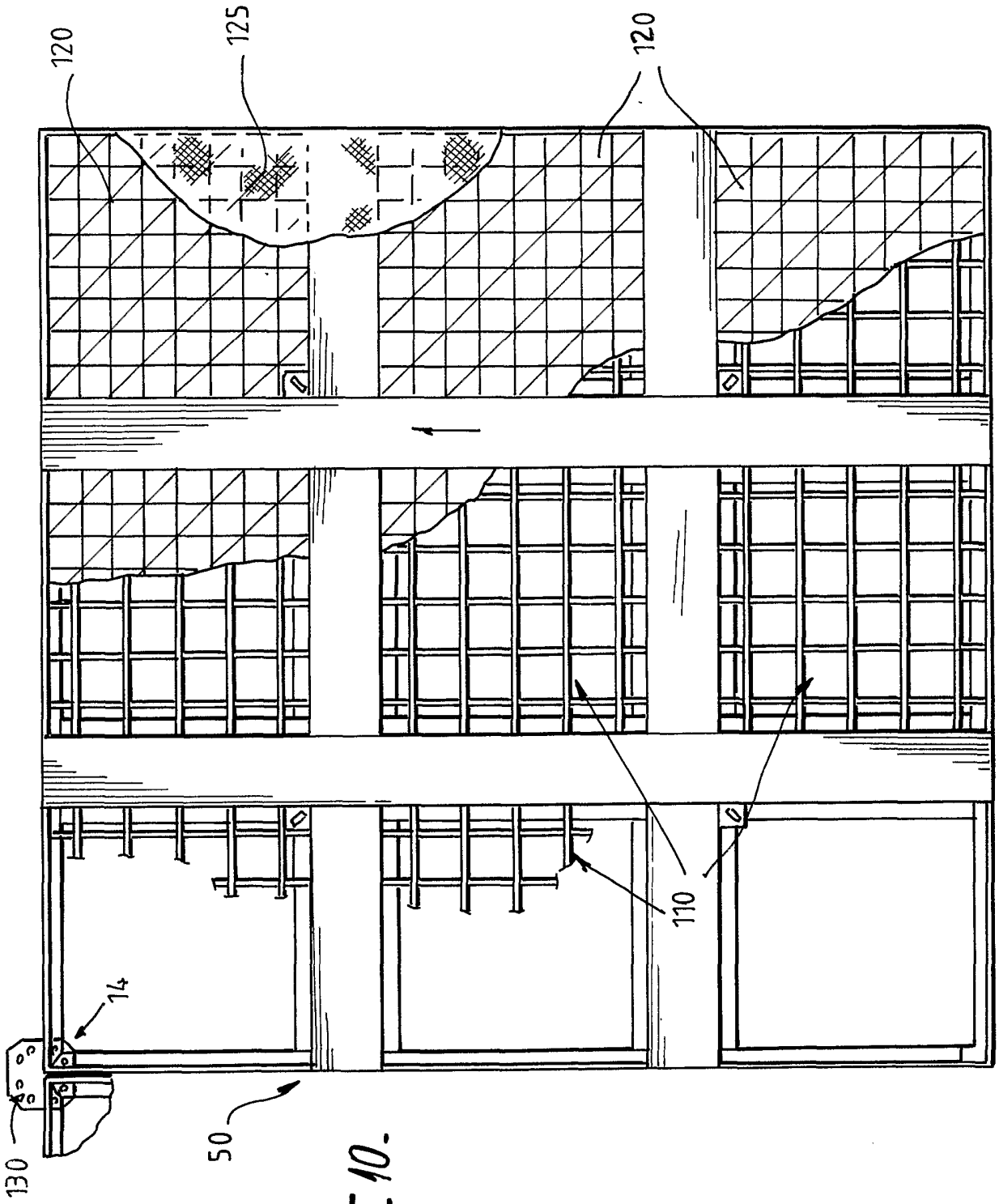


FIG. 10.

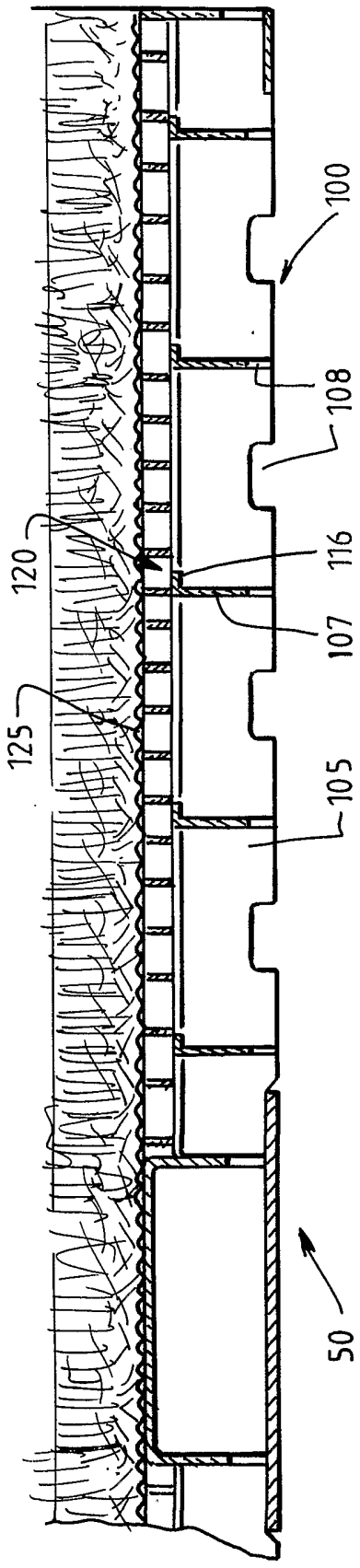


FIG. 11.

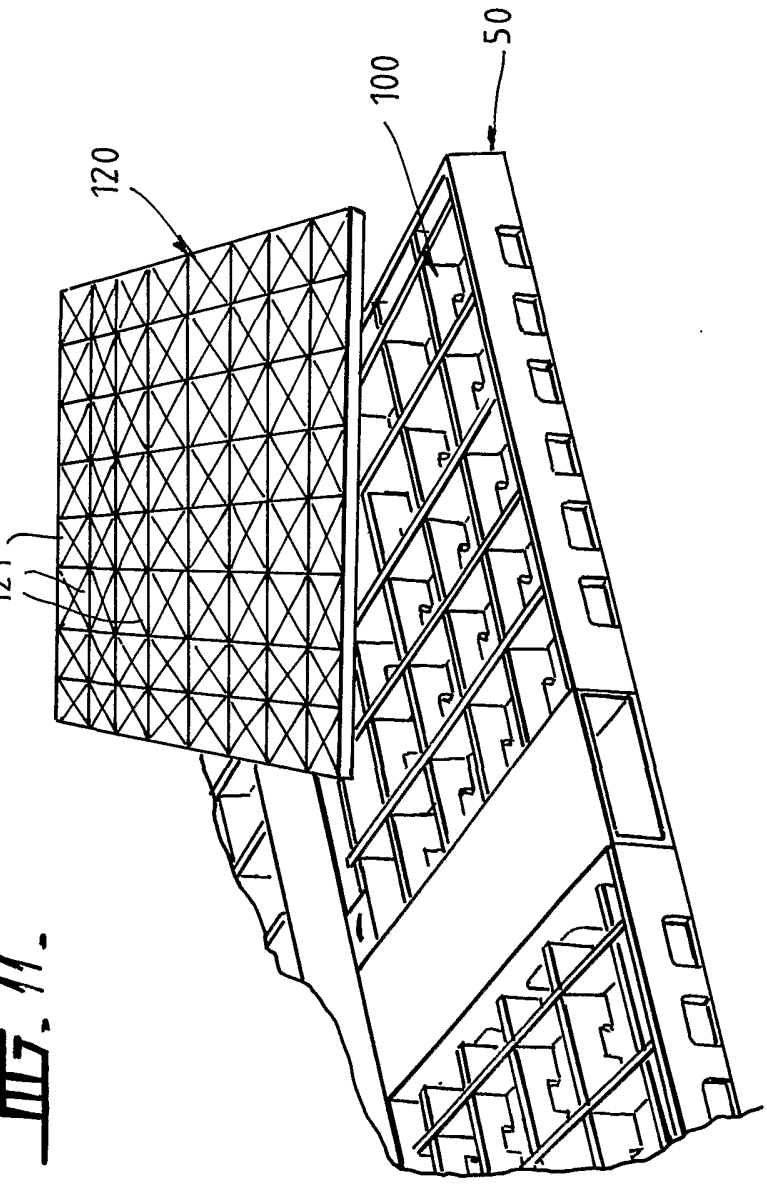


FIG. 12.

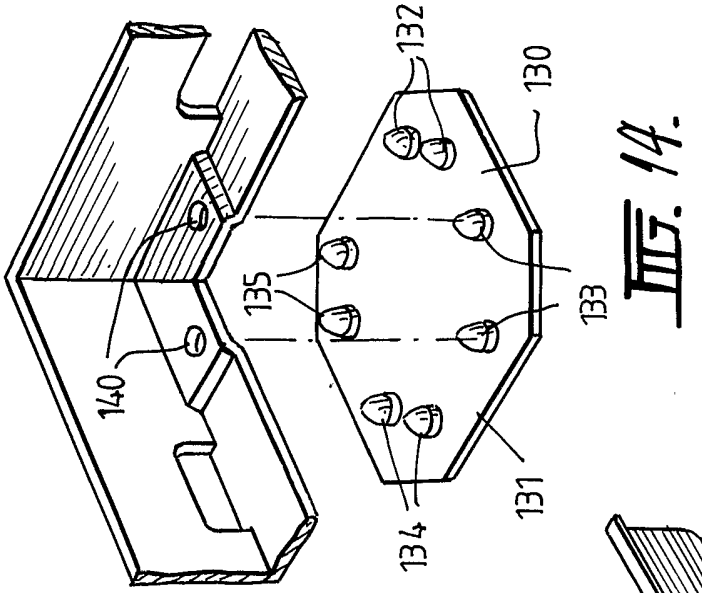

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Fig. 14.

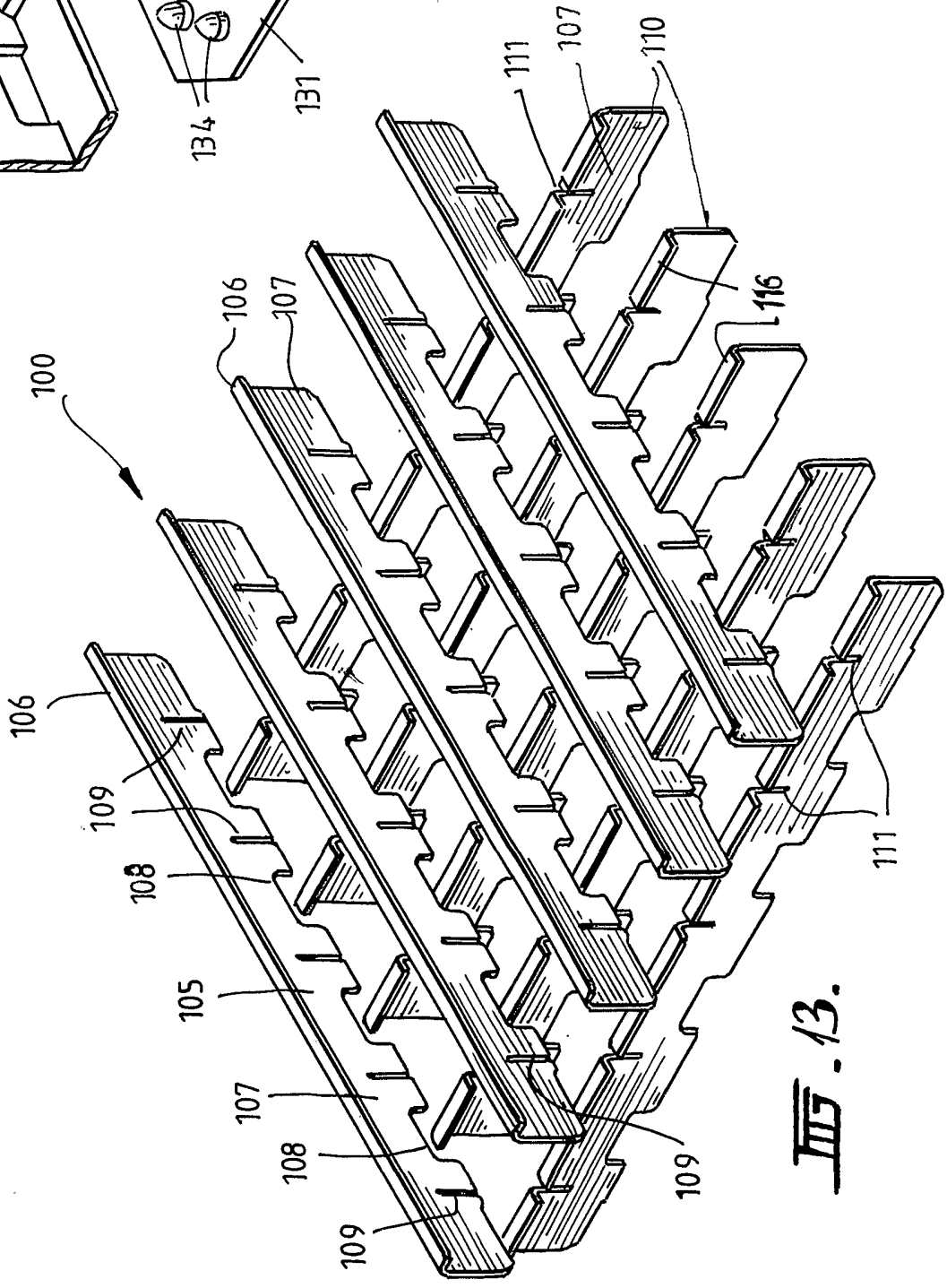
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Fig. 13.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU02/00512

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: B65D 19/00, A01G 1/12, A63C 19/00, E01C 13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI IPC A63C 19/-, E01C 13/-, A01G 1/00, A01G 1/12, B65D 19/-, 1/34, 88/12 & keywords turf, lift, pallet, lattice and similar terms and ESP@CE with key words.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Derwent Abstract accession no. 97- 466023/43, Class Q 32, JP 09216628 A, (SUMITOMO CHEM CO LTD) 19 August 1997 Abstract	
A	Patent Abstracts of Japan JP 7124286 A (KUMAGAI GUMI COM LTD) 16 May 1995 Abstract	
A	Patent Abstracts of Japan JP 7079642 A (FUKUOKA DAIEE RIARU ESTATE:KK) 28 March 1995 Abstract	

☐ Further documents are listed in the continuation of Box C ☒ See patent family annex

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 June 2002	28 JUN 2002
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized officer **SOOSA GNANASINGHAM** Telephone No : (02) 6283 2172

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU02/00512

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member
JP	09216628 A	NIL
JP	7124286 A	NIL
JP	70797642 A	NIL

END OF ANNEX