Sept. 16, 1969 A. L. TROUTNER 3,466,824

MODULAR SPACE DECK

Filed Jan. 10, 1968 2 Sheets-Sheet 1

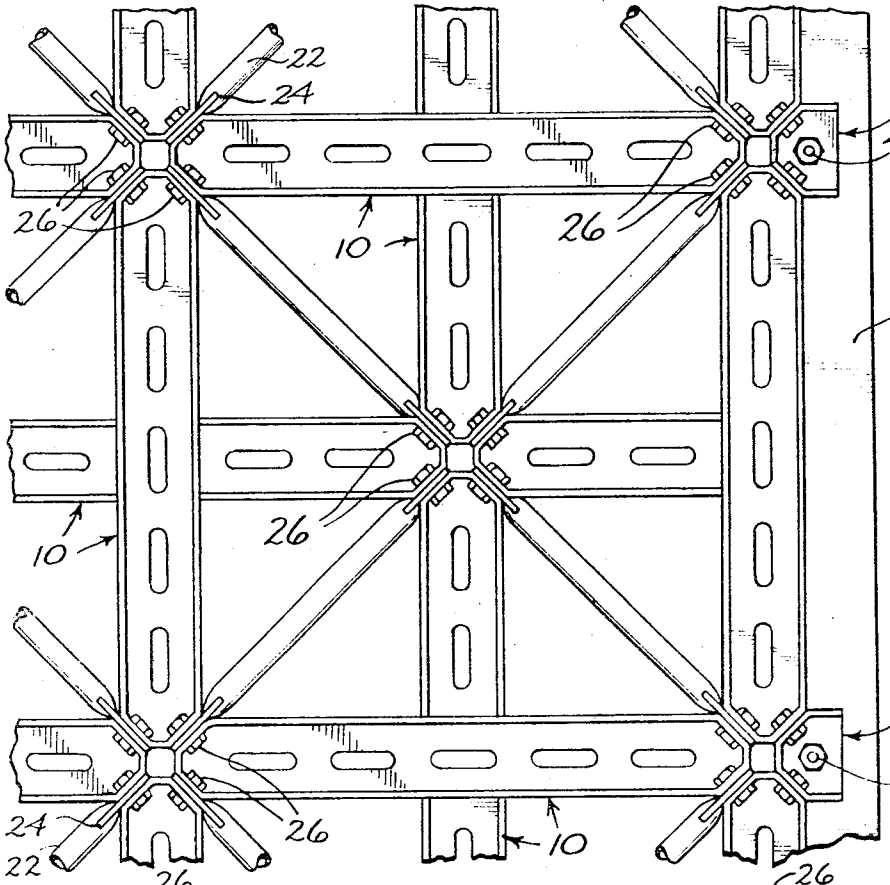


Fig. 1.

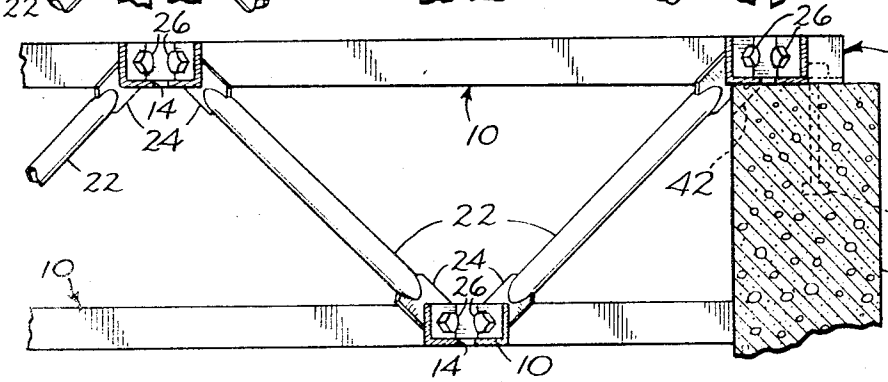


Fig. 2.

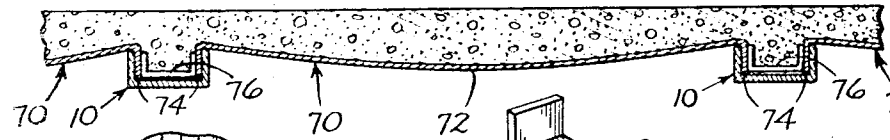


Fig. 8.

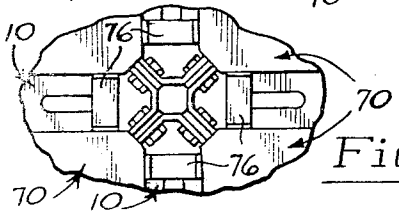


Fig. 9.

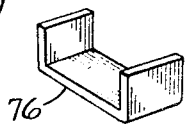


Fig. 10.

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MODULAR SPACE DECK

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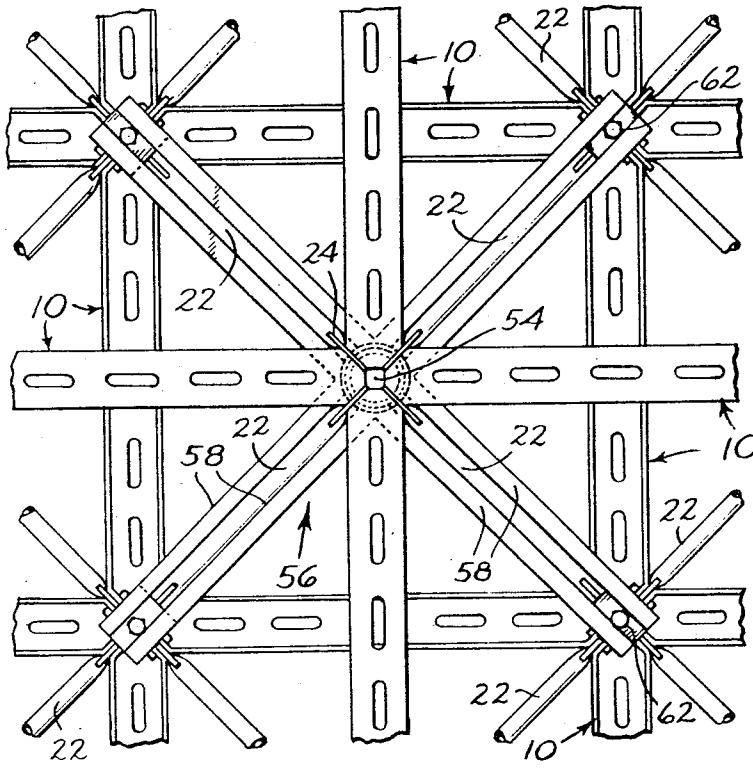


Fig. 5.

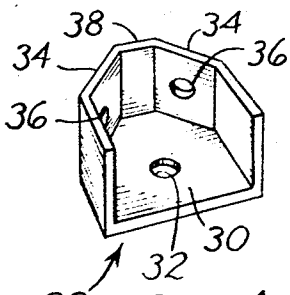


Fig. 4.

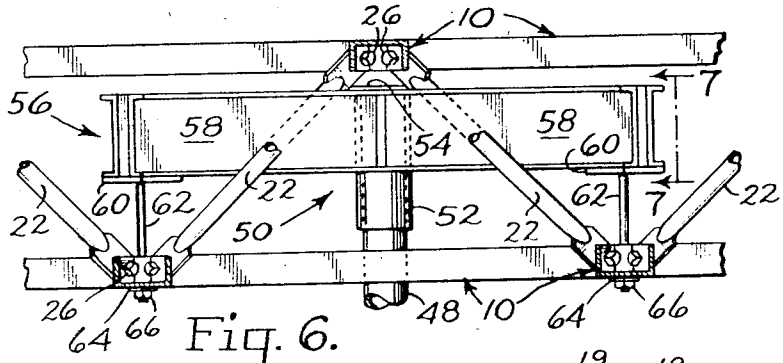


Fig. 6.

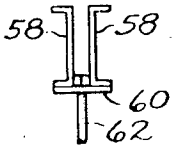


Fig. 7.

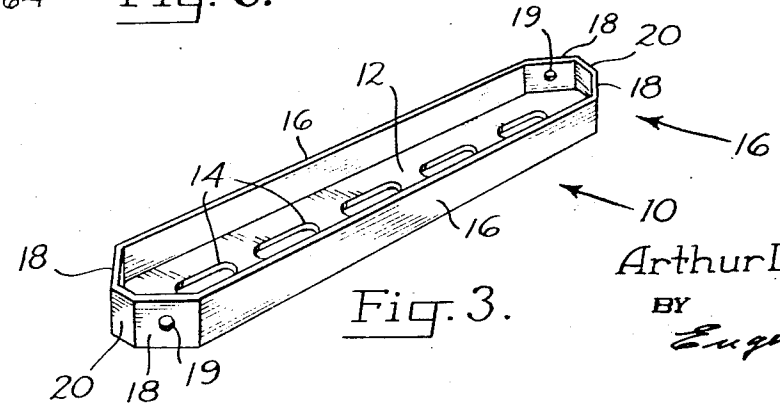


Fig. 3.

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MODULAR SPACE DECK

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Int. Cl. E04b 7/00; E04c 2/38, 3/30
U.S. Cl. 52—262 10 Claims

ABSTRACT OF THE DISCLOSURE

A modular space deck comprises a plurality of chords arranged in upper and lower planes interconnected by a plurality of diagonal links having flattened ends. The chords comprise elongated, channel-shaped structural members having parallel side walls and opposite ends contoured in plan as truncated right triangles. This provides opposite abutment walls lying in an angle of substantially 45° to the side walls. The chords are arranged in clusters of four placed end to end at right angles to each other. In the resulting panel points, each pair of adjacent chord abutment walls receives the end of one of the links, the assembly then being bolted or otherwise secured together. Clips secure the perimeters of the deck to a bearing wall. A central hanger supports the central portion of the deck from a vertical post. Other clips secure convex, concrete-receiving pans to the chords when it is desired to support a concrete floor on the deck.

This invention relates to modular space decks of the class employed in lieu of conventional joists or trusses to erect structural floor and roof supprts.

It is the general purpose of the invention to provide a space deck which is simple in construction, which is modular so that it may be extended to any desired limit, which is demountable so that it may be disassembled and rebuilt in a new form or a different location, which makes use of only two types of structural elements, which requires a minimum of fasteners, which is self-aligning during construction, which makes possible the erection of a long span bay system without the use of beams, which in assembled form provides a smooth top and bottom slab effect with no protrusions whatsoever extending beyond the plane of the slab, which is stackable into multi-stored structures, which may be shipped to the building site in short, small packages, which may be assembled at the building site with a minimum crew without the use of special tools, and which is readily adaptable to the support of a concrete floor or roof.

In the drawings:

FIG. 1 is a fragmentary plan view of the modular space deck in a first embodiment;

FIG. 2 is a side elevation of the space deck of FIG. 1;

FIG. 3 is a perspective view of a chord to be used in the fabrication of the space deck;

FIG. 4 is a plan view of a clip used for connecting the space deck to a bearing wall;

FIG. 5 is a plan view of the space deck in a second embodiment;

FIG. 6 is a view in side elevation of the space deck of FIG. 5;

FIG. 7 is a transverse sectional view taken along line 7—7 of FIG. 6;

FIG. 8 is a fragmentary sectional view;

FIG. 9 is a fragmentary plan view illustrating the adaptation of the space deck to the support of a concrete floor; and

FIG. 10 is a perspective view of a locking clip employed in the concrete floor-supporting adaptation of FIGS. 8 and 9.

In essence, the space deck of my invention comprises a plurality of chords, all of which may be of the same size and shape, arranged in upper and lower planes. Each chord comprises an elongated, channel-shaped structural member having parallel side walls and two ends contoured in plan as truncated right triangles. This provides opposite abutment walls lying at an angle of substantially 45° to the side walls.

The chords in each plane lie in groups of four arranged at right angles to each other with the abutment walls positioned in adjacent pairs to form a rectangular pattern of spaced panel points. The panel points of the chords of the upper plane are horizontally offset from those of the chords of the lower plane.

A plurality of links having flat ends are arranged diagonally between the planes with the flat ends of the links disposed one between each of the abutment wall pairs. Fastening means fasten the adjacent pairs of abutment walls and link ends together. Clips secure the space deck to bearing walls. A central support ties the space deck to a vertical post. Other clips support convex pans between the chords. These may be filled with concrete when a concrete floor or roof is desired.

In the fabrication of the herein described modular space deck only two basic types of structural elements are required, a chord and a link. In a given installation the chords are identical in size and shape to each other, as are the links. A typical chord is illustrated in FIG. 3.

As shown in that figure the chord comprises a channel-shaped member, indicated generally at **10**, and made from steel, aluminum or other structural metal. Each chord includes a bottom plate **12** which may have apertures **14** for weight reduction and design effects.

Each chord also has a pair of parallel side walls **16**, and end sections contoured in plan in the shape of truncated right triangles. This provides opposite abutment walls **18**, which lie substantially at 45° to the side walls, and end walls **20**. Abutment walls **18** are provided with transverse apertures **19**.

Shear links **22**, which constitute the other essential component of the space deck assembly, comprise elongated members having flat ends. Although they may be variously constituted and designed, it is preferred to fabricate them from tubular metal, for example, from tubular aluminum, with the ends **24** of each link flattened to provide flat terminal portions each having a punched out transverse opening.

The remaining elements constituting the space deck assembly comprise bolts or rivets **26** used to couple the components together and a connecting clip **28** employed to secure the assembled space deck to a bearing wall or other support.

Connecting clip **28** in effect comprises the cut off end of one of the chords. Thus in plan it, too, has the configuration of a truncated right triangle. It is comprised of a bottom plate **30** having an aperture **32**, a pair of abutment walls **34** provided with openings **36**, and an end wall **38**.

In erecting the modular space deck of FIGS. 1–4, the chords are arranged at right angles to each other with their ends substantially meeting to form panel points. A characteristic spacing of panel points thus is created in the upper and lower planes of the deck. The panel points are interconnected by means of shear links **22**, the flattened ends of which are interleaved between adjacent abutment walls **18** of the chord ends.

In this interleaved relationship, openings **19** of the chord ends are aligned with the openings punched through flattened portions **24** of the links. Bolts **26** accordingly may be inserted and tightened down, whereupon the chords automatically are drawn into their proper right angled positioned to each other.

Where it is desired to support the perimeter of the space deck on bearing walls **40**, the latter are provided with diagonal slots **42** on their inner margins. These are dimensioned to receive flat ends **24** of links **22**.

The assembled spaced deck is dimensioned so that its perimeter overlies walls **40**, with the ends of links **22** received in slots **44**.

In this arrangement, three chords only form the panel points along the perimeter of the unit. This leaves a space which normally would be occupied by the fourth chord. Advantage is taken of this in securing the space deck to the bearing wall.

Connecitng clips **28** are inserted in the vacant panel point spaces and bolted to the adjacent chords. Stud bolts **46** extending upwardly from the bearing wall are inserted through openings **32** of the connecting clips, thus fixing the deck to the bearing walls.

The embodiment of FIGS. 5–7 illustrates a hanger support which may be used to support the space deck centrally in long span situations. In this embodiment the deck is mounted on one or more spaced vertical posts **48** suitably designed to carry the load.

The hanger support, indicated generally at **50**, is mounted on a central sleeve **52**. The sleeve is of substantial construction and has a diameter such that it will slip over post **48** in sliding engagement therewith. It may be open at both ends and secured with pins. Preferably the top is provided with a cap piece **54** which overlies and abuts the upper end of post **48**.

Extending radially from sleeve **52** are a plurality of arms, indicated generally at **56**. These are stout structural members having a length sufficient to span the desired space deck area. They may be fabricated from a pair of channel irons **58** arranged back to back and spaced apart sufficiently to afford entrance to the end of links **22**. The inner ends of arms **56** are welded securely to sleeve **52**.

Hanger means are provided for hanging the space deck unit from the assembly, thus supporting it on post **48**.

In the illustrated form of the invention, the underfaces of arms **56** mount substantial plates **60** having openings centrally therethrough. Hanger bolts **62** penetrate the openings, with the heads of the bolts bearing against the upper surfaces of plates **60**.

The threaded ends of bolts **62** penetrate the panel points located immediately below. When the hanger bolts thus have been located, washers **64** are slipped over their ends and nuts **66** threaded thereon to secure the space deck to the support.

In the erection of the space deck of FIGS. 5–7, all of the elements are assembled at the construction site. A crane then lifts the assembled unit and positions it with sleeve **52** slipped over post **48**. After the deck has been adjusted to proper elevation, the sleeve is secured to the post by the application of suitable pins, bolts or other fastening media. In the alternative, the sleeve is provided with a cap and the space deck lowered until the cap engages the upper end of the post.

The construction may proceed on this manner, the space deck units being fabricated, mounted and their adjoining sides coupled together until the area to be decked has been completed.

FIGS. 8, 9 and 10 illustrate the adaptation of the space deck described above to the support of a concrete floor or ceiling.

In this adaptation, there are provided rectangular pans **70** dimensioned to span upper level chords **10** and to be supported thereby. Each pan may comprise a metal sheet having its margins bent substantially at right angles to form a unit having a concavely dished central portion **72** and marginal flanges **74**.

The flanges engage side walls **16** of the chords in the manner shown in FIGURE 8. U-shaped clips **76** are nested within the chords and wedged between the margins of adjacent pans, securing them in position. The pans then may be filled with concrete in the indicated manner to form a floor or ceiling.

It is to be understood that the forms of my invention herein shown and described are to be taken as illustrative examples of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. A modular space deck comprising:

(a) a plurality of chords arranged in upper and lower planes;

(b) each chord comprising an elongated, channel-shaped structural member having parallel sides walls and its two ends contoured in plan as truncated right triangles providing opposite abutment walls lying at an angle of substantially 45° to the side walls;

(c) the chords in each plane being in groups of four arranged at right angles to each other with the abutment walls lying in adjacent pairs to form a rectangular pattern of spaced panel points, the panel points of the chords of the upper plane being horizontally offset from the panel points of the chords of the lower plane;

(d) a plurality of links having flat ends arranged diagonally between the planes with the flat ends of the links disposed one between each of the abutment wall pairs; and

(e) fastening means fastening snugly together the adjacent pairs of abutment walls and the interposed link ends.

2. The modular space deck of claim **1** wherein the chords of the upper plane are dished upwardly and including a plurality of pans each comprising a central section having marginal flanges, the pans being sized to span the distance between adjacent chords with the flanges engaging the chord side walls, and support clip means securing the plan flanges to the chord side walls.

3. The modular space deck of claim **2** wherein the support clip means comprise U-shaped clips nested in the chords and wedged against oppositely placed flanges.

4. The modular space deck of claim **1** including a central support comprising a sleeve dimensioned to receive in sliding engagement the upper end of a vertical support post at an elevation intermediate between the elevation of the upper and lower chords, a plurality of horizontal arms extending radially from the sleeve and hanger means supporting the deck from the arms.

5. The modular space deck of claim **4** wherein the sleeve comprises a cap piece dimensioned to cap over the end of the support post.

6. The modular space deck of claim **4** wherein each arm comprises a pair of horizontally-spaced, vertically-arranged channel structural members.

7. The modular space deck of claim **4** wherein the meeting ends of the chords at the panel points of the chords of the lower plane have an opening therebetween and wherein the hanger means comprises hanger bolt means arranged vertically with their upper ends secured to the arms and their lower ends penetrating the openings and secured to the lower chords.

8. The modular space deck of claim **1** wherein the abutment walls and interposed link ends have aligned openings therethrough and the fastening means comprise bolt or rivet means penetrating the openings.

9. The modular space deck of claim **1** wherein the upper chords are arranged in a pattern of rectangular outline having a perimeter overlying a structural bearing wall, the perimeter being defined by perimeter panel points comprising the meeting ends of three chords only and associated link ends, and connecting clip means securing the perimeter panel points to the bearing wall.

10. The modular space deck of claim **9** wherein the connecting clip means comprises a channel-shaped clip

contoured in plan as a truncated right triangle providing opposite abutment walls lying at an angle of substantially 45° to the axis of the clip, an apertured floor, and stud bolt connecting means dimensioned for insertion in the aperture for securing the clip means to the bearing wall.

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U.S. Cl. X.R.

52—648, 656, 726; 287—189.36