

March 18, 1952

W. B. SPANGLER

2,589,304

INTERLOCKING STRUCTURAL UNITS

Filed July 29, 1947

2 SHEETS—SHEET 1

Fig. 1.

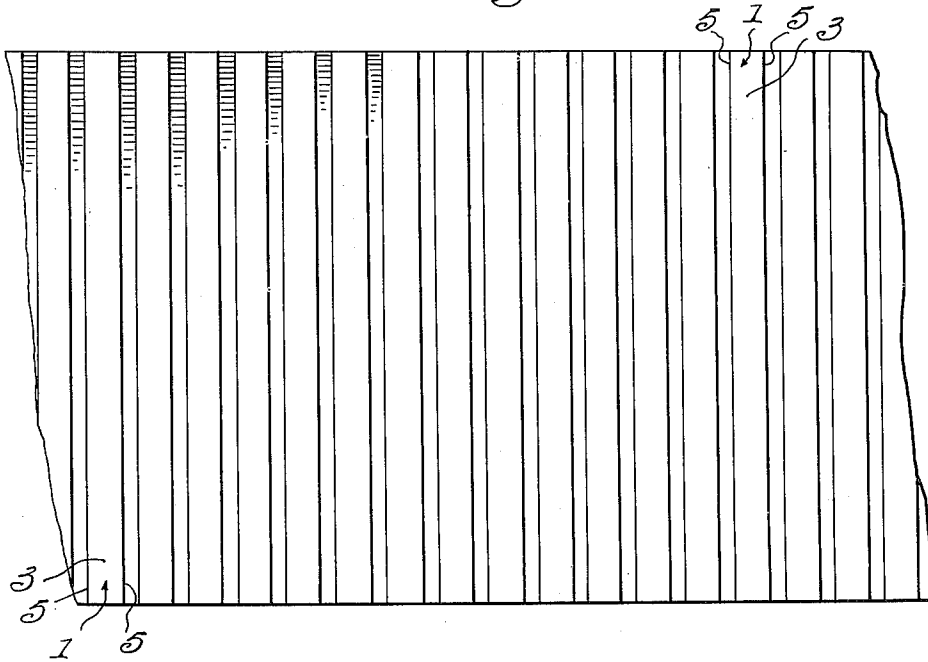


Fig. 2.

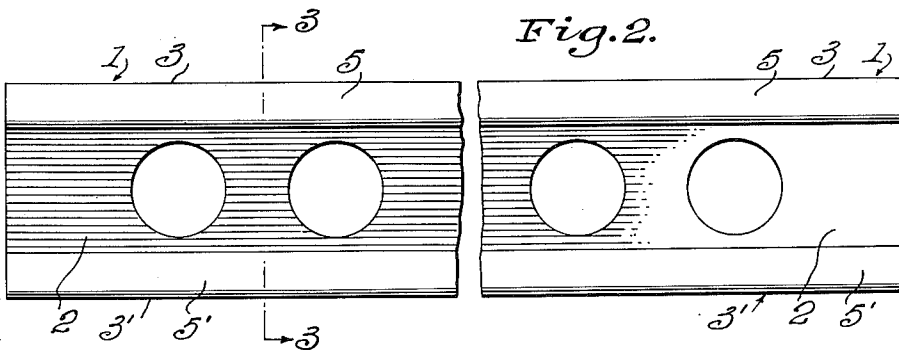
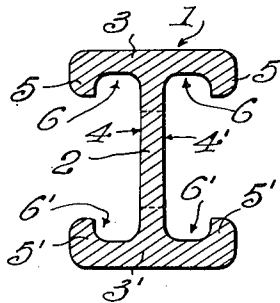


Fig. 3.



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2 SHEETS—SHEET 2

Fig. 4.

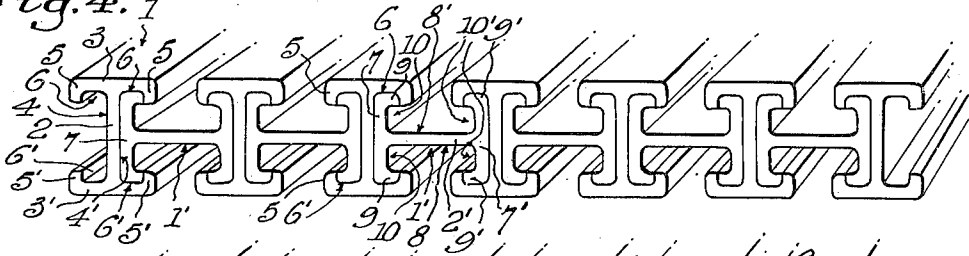


Fig. 5.

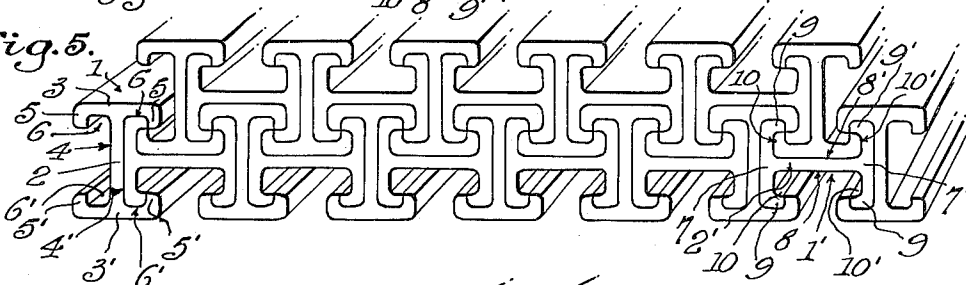


Fig. 6.

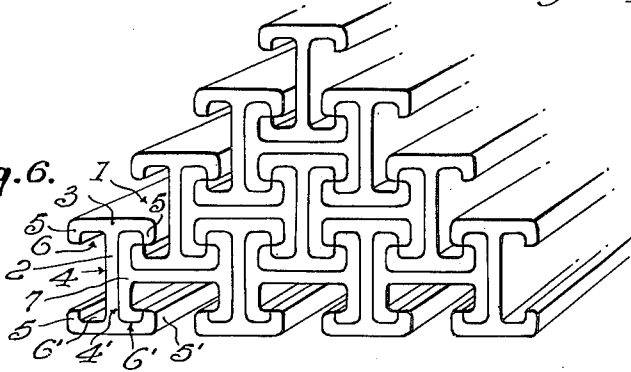
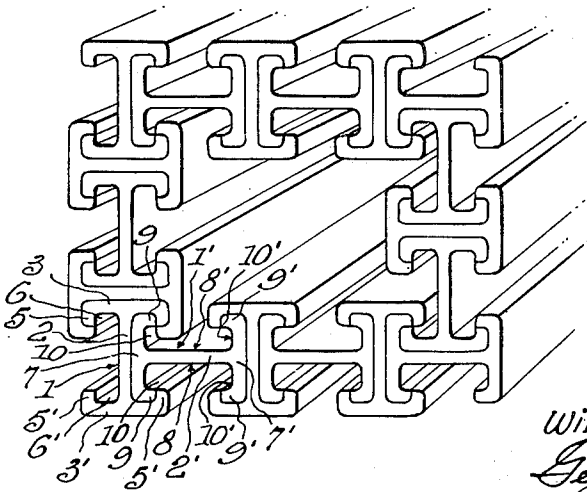


Fig. 7.



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2,589,304.

INTERLOCKING STRUCTURAL UNITS

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9 Claims. (Cl. 189—34)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without payment to me of any royalty thereon.

This invention relates to a knockdown construction which may be used for many different structural applications, including roadways, walls, box pillars, coffer-dams and the like, more particularly, it is directed to a portable roadway or runway or airplane landing mat construction.

One of the objects of the invention is to provide a structural unit substantially in the form of an I-beam, the cross-bars of which form recesses on opposite sides of the web of the I-beam, with the recesses being of such a shape as to be interchangeable with other similar units by receiving in such recesses either end of similar structural units.

Another object of the invention is to provide an improved portable roadway construction including a multiplicity of interchangeable and interlocking units which may be joined together readily without the necessity of employing bolts, rivets or any other extraneous fastening means.

Another object of the invention is to provide a roadway construction made up of independent duplicate units which are capable of interlocking with each other and which, when so interlocked, are also capable of withstanding any strain put upon them.

Another object of the invention is to provide a construction made up of a plurality of separate interlocking units which may be employed not only to provide a surface but also may be interlocked into a four-sided structure to form box beams, pillars, coffer-dams and the like.

Another object of the invention is to provide a portable knockdown construction in which a plurality of interchangeable and interlocking units are employed, possessing maximum strength when in position, and yet being capable of separation after use without distortion or modification, and reassembled for use in another location, with the original strength and the general usefulness of the individual units being unimpaired and capable of reassembly.

With the above and other objects and advantages in view, the invention consists of certain features of construction and operation of parts, which will hereinafter be described and shown in the accompanying drawings, in which:

Fig. 1 is a fragmentary top plan view of a plurality of interlocking, independent units joined together for forming a roadway or landing mat construction;

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Fig. 2 is a side elevation of a single unit employed in the construction of Fig. 1;

Fig. 3 is a cross-sectional view thereof taken on line 3—3 of Fig. 2;

Fig. 4 is a fragmentary perspective end view of a single layer of the interlocking units;

Fig. 5 is a fragmentary perspective end view of the interlocking units, illustrating another manner of joining the units together to provide a double layer thereof;

Fig. 6 is a fragmentary perspective end view illustrating a further manner of joining the interlocking units; and

Fig. 7 is a fragmentary perspective end view illustrating the manner in which the units may be interlocked into a four-sided structure to form box beams, pillars, coffer-dams or the like.

In general, the improved structural units of the present invention consist of a plurality of interlocking units substantially in the form of I-beams including webs having transverse flanges on the opposite longitudinal edges thereof. The transverse flanges extend at right angles to, and equal distances from, opposite sides of the webs and are provided with curved lateral hook flanges which depend inwardly relative to the web from the outer extremities of the flanges substantially at right angles to the flanges and parallel to the webs, whereby recesses are formed on the sections adjacent to opposite sides of and along the longitudinal edges of the webs. By providing the recesses on the units, the hook flanges on the transverse base flanges of similar sections may engage in the recesses of the other adjacent sections, whereby a series of the I-beam units may be detachably connected in interlocking relation to form a single layer roadway surface or mat, as illustrated in Fig. 4 of the drawings.

If the area over which the roadway extends requires greater strength, additional layers of the units may be added in interlocking relation as illustrated in Figs. 5 and 6 and, should it be desired to form a four-sided structure for use as box beams, pillars, coffer-dams or the like, the I-beam units may be interlocked with each other as illustrated in Fig. 7.

The single layer construction, shown in Fig. 4, consists of a plurality of units 1 held in spaced interlocking relation by means of a series of similar units 1'. The units 1, one of which is shown in detail in Figs. 2 and 3, include a web portion 2 having transverse flanges 3 and 3' provided on opposite, longitudinal edges thereof, which flanges 3 and 3' extend at right angles to

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the web 2 an equal distance from its opposite sides 4 and 4'. The transverse flanges 3 and 3' are formed adjacent to their longitudinal edges with curved lateral hook flanges 5 and 5', respectively, which depend inwardly from the outer extremities or edges thereof substantially at right angles to the transverse flanges 3 and 3' and parallel with the web 2, whereby recesses 6 and 6' are formed on the vertical units 1 adjacent to the opposite sides 4 and 4' of the web 2 and along the longitudinal edges thereof.

Each of the horizontally extending units 1', which units are duplicates of the vertically extending units 1, consists of a web 2' having transverse flanges 7 and 7' provided on opposite longitudinal edges of the web and extending at right angles to the web an equal distance from its opposite sides 8 and 8'. The transverse flanges 7 and 7' are provided with curved lateral hook flanges 9 and 9', respectively, which depend inwardly from the outer extremities or edges of the transverse flanges 7 and 7' substantially at right angles thereto and parallel with the web 2', whereby recesses 10 and 10' are formed on the horizontally extending sections 1' adjacent to the opposite sides 8 and 8' of the web 2' and along the longitudinal edges thereof.

In forming the portable roadway or mat construction using a single layer of the interchangeable interlocking units 1 and 1', respectively, as illustrated in Fig. 4, a plurality of the units 1 are arranged and held in suitably spaced interlocked relation by means of a series of the similar units 1' having the transverse flanges 7 and 7' of the units abutting against the sides 4 and 4', respectively, of the webs 2 of the vertically extending units, with the lateral hook flanges 9 and 9' on the flanges 7 and 7' of the units 1' engaging in the recesses 6 and 6' of adjacent units 1 and abutting against the hook flanges 5 and 5' of the units.

Should it be required to have a roadway, landing mat or bridge flooring construction with a greater strength than provided by a single layer of the interlocking units as illustrated in Fig. 4, additional layers of the units may be interlocked with each other as shown in Figs. 5 and 6. In Fig. 5, a plurality of interchangeable units are interlocked with each other to provide a one and one-half or two layer construction in which additional vertically and horizontally extending units 1 and 1', respectively, are provided, with the transverse flanges 3' of the additional units 1 abutting against the upper sides 8' of the webs 2' on the first layer of units 1' and the hook flanges 5' of the additional units engaging in a recess 10 and a recess 10' adjacent to the sides 8' of the webs 2' on the units 1' of the first layer of units. The webs 2' of the units 1', employed in forming the second layer of the roadway construction, abut against the upper transverse flanges 3 of the vertically extending units 1 used in providing the first layer of the roadway construction and the hook flanges 9 and 9' provided on the transverse flanges 7 and 7', respectively, of the last-mentioned units 1' engage in the recesses 6 and 6' of the units 1.

Having thus described my invention, what I claim as new and wish to secure by Letters Patent is:

1. A structural assembly comprising a plurality of interlocked, universally interchangeable, identical, elongated units interlocked together with their major transverse axes at right angles to each other and being substantially in the form of

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I-beams and including web portions, elongated transverse flanges formed on opposite longitudinal edges of said web portions terminating in curved lateral hook flanges extending along outer longitudinal extremities of the said transverse flanges, the said curved hook flanges depending inwardly from the said transverse flanges and providing oppositely curved, oppositely disposed recesses on opposite sides of the said web portions at the said longitudinal edges thereof, the interior surfaces of each pair of the said recesses with the surface of the web connecting the two recesses being identical in configuration to the exterior surfaces of each of the said transverse flanges including the curved lateral hook flanges thereon, said units being identical in size and shape and in interlocked relation with each other, with the curved hook flanges of certain of said units engaged in and interlocked with the said curved recesses in contiguous units of the assembly.

2. A structural assembly comprising a plurality of interlocked, universally interchangeable, identical, elongated units interlocked together in an assembly at least one unit in thickness in each direction with their major transverse axes at right angles to each other and being substantially in the form of I-beams and including web portions, elongated transverse flanges formed on opposite longitudinal edges of the said web portions terminating in curved lateral hook flanges extending along outer longitudinal extremities of the said transverse flanges, the said curved hook flanges depending inwardly from the said transverse flanges and providing curved, oppositely disposed recesses on opposite sides of the said web portions at the said longitudinal edges thereof, the outside dimension of the unit along each said transverse flange from hook flange to hook flange being equal to the inside dimension between the transverse flanges on the same side of the said web portions, the interior surfaces of each pair of the said recesses with the surface of the web connecting the two recesses being identical in configuration to the exterior surfaces of each of the said transverse flanges including the curved lateral hook flanges thereon, said units being identical in size and shape and in interlocked relation with each other, with the curved hook flanges of certain of said units engaged in and interlocked with the curved recesses in contiguous units of the assembly.

3. A structural assembly comprising a plurality of interlocked, universally interchangeable, identical, elongated units interlocked together with their major transverse axes at right angles to each other and being substantially in the form of I-beams and including web portions, elongated transverse flanges formed on opposite longitudinal edges of the said web portions terminating in curved lateral hook flanges extending along outer longitudinal extremities of the said transverse flanges, the exterior surfaces of the said transverse flanges being planar between the said curved hook flanges and perpendicular to the said web portions, the said curved hook flanges depending inwardly from the said transverse flanges and providing curved, oppositely disposed recesses on opposite sides of the said web portions at the said longitudinal edges thereof, the interior surfaces of each pair of said recesses with the surface of the web connecting the two recesses being identical in configuration to the exterior surfaces of each of the said transverse flanges including the curved lateral hook

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flanges thereon, said units being identical in size and shape and in interlocked relation with each other, with the curved hook flanges of certain of said units engaged in and interlocked with the curved recesses in contiguous units of the assembly.

4. A structural assembly comprising a plurality of interlocked, universally interchangeable, identical, elongated units interlocked together with their major transverse axes at right angles to each other and being substantially in the form of I-beams and including web portions, elongated transverse flanges formed on opposite longitudinal edges of the said web portions terminating in curved lateral hook flanges extending along outer longitudinal extremities of the said transverse flanges, the exterior surfaces of said transverse flanges being planar between the said curved hook flanges and perpendicular to the web portions, the said curved hook flanges depending inwardly from said transverse flanges and providing curved, oppositely disposed recesses on opposite sides of said web portions at the said longitudinal edges thereof, the exterior surfaces of the said curved hook flanges on the same side of the web being in planar alignment and parallel to the said web, the interior surfaces of each pair of the said recesses with the surface of the web connecting the two recesses being identical in configuration to the exterior surfaces of each of the said transverse flanges including the curved lateral hook flanges thereon, said units being identical in size and shape and in interlocked relation with each other, with the curved hook flanges of certain of said units engaged in and interlocked with the curved recesses in contiguous units of the assembly.

5. A structural assembly comprising a plurality of interlocked, universally interchangeable, identical units interlocked together in layers with their major transverse axes at right angles to each other and being substantially in the form of I-beams and including web portions, elongated transverse flanges formed on opposite longitudinal edges of the said web portions terminating in curved lateral hook flanges extending along outer longitudinal extremities of the said transverse flanges, the exterior surfaces of the said transverse flanges being planar between the said curved hook flanges and perpendicular to the web portions, the said curved hook flanges depending inwardly from the said transverse flanges and providing curved, oppositely disposed recesses on opposite sides of the said web portions at the said longitudinal edges thereof, the interior surfaces of each pair of the said recesses with the surface of the web connecting the two recesses being identical in configuration to the exterior surfaces of each of the said transverse flanges including the curved lateral hook flanges thereon, said units being identical in size and shape and in interlocked relation with each other, with the curved hook flanges of certain of said units engaged in and interlocked with the curved recesses in contiguous units of the assembly.

6. A structural assembly comprising a plurality of interlocked, universally interchangeable, identical units interlocked together in layers with their major transverse axes at right angles to each other and being substantially in the form of I-beams and including web portions, elongated transverse flanges formed on opposite longitudinal edges of the said web portions terminating in curved lateral hook flanges extending along

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outer longitudinal extremities of the said transverse flanges, the exterior surfaces of the said transverse flanges being planar between the said curved hook flanges and perpendicular to the said web portions, the said curved hook flanges depending inwardly from the said transverse flanges and providing curved, oppositely disposed recesses on opposite sides of the said web portions at the said longitudinal edges thereof, the interior surfaces of each pair of said recesses with the surface of the web connecting the two recesses being identical in configuration to the exterior surfaces of each of the said transverse flanges including the curved lateral hook flanges thereon, said units being identical in size and shape and in interlocked relation with each other, with the curved hook flanges of certain of said units in one layer thereof engaged in and interlocked with the curved recesses in others of said units of the same layer, and with the curved hook flanges on some of said others of the said units of the same layer engaged in the curved recesses of other units not in the same layer.

7. A structural assembly comprising a plurality of interlocked, universally interchangeable identical elongated units interlocked together in at least two layers with their transverse axes at right angles to each other and being substantially in the form of I-beams and including web portions, elongated transverse flanges formed on opposite longitudinal edges of the said web portions terminating in curved lateral hook flanges extending along outer longitudinal extremities of the said transverse flanges, the exterior surfaces of the said transverse flanges being planar between the said curved hook flanges and perpendicular to the said web portions, the said curved hook flanges depending inwardly from the said transverse flanges and providing curved, oppositely disposed recesses on opposite sides of the said web portions at the said longitudinal edges thereof, the interior surfaces of each pair of said recesses with the surface of the web connecting the two recesses being identical in configuration to the exterior surfaces of each of the said transverse flanges including the curved lateral hook flanges thereon, said units being identical in size and shape and in interlocked relation with each other, with the curved hook flanges of certain of the said units in each layer thereof engaged in and interlocked with the curved recesses in others of the said units of the same layer, and with the curved hook flanges on the said others of the said units of the same layer engaged in and interlocked with the curved recesses in certain of the units of another layer whereby an extensive planar bearing surface is formed.

8. A structural assembly comprising a plurality of interlocked, universally interchangeable, identical, elongated units interlocked together in separated layers in a hollow rectangular formation with their major transverse axes at right angles to each other and being substantially in the form of I-beams and including web portions, elongated transverse flanges formed on opposite longitudinal edges of the said web portions terminating in curved lateral hook flanges extending along outer longitudinal extremities of the said transverse flanges, the exterior surfaces of the said transverse flanges being planar between the said curved hook flanges and perpendicular to the said web portions, the said curved hook flanges depending inwardly from the said transverse flanges and providing curved, oppositely

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disposed recesses on opposite sides of the said web portions at the said longitudinal edges thereof, the interior surfaces of each pair of said recesses with the surface of the web connecting the two recesses being identical in configuration to the exterior surfaces of each of the said transverse flanges including the curved lateral hook flanges thereon, said units being identical in size and shape and in interlocked relation with each other, with the curved hook flanges of certain of the said units engaged in and interlocked with the curved recesses in contiguous units of the assembly.

9. A structural assembly comprising a plurality of parallel, elongated, identical, individually interchangeable units with alternate units rotated 90° about their longitudinal axes, each of which units is substantially in the form of an I-beam including a web portion, terminating in a planar transverse flange on each opposite longitudinal edge of said web portion, and a curved lateral hook flange formed on each outer longitudinal extremity of each of the said transverse flanges, each of the said curved hook flanges depending inwardly from its transverse flange

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and being in planar relationship with the other curved hook flange on the same side of the web portion and defining with the said web portion recesses on each side of the said web portion, said units being in interlocked relation with each other, with curved hook flanges on at least one half of the units minus one engaged in recesses of contiguous units.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
645,800	Furness -----	Mar. 20, 1900
1,030,761	Archer -----	June 25, 1912
1,037,099	York -----	Aug. 27, 1912
1,585,003	Wilson et al. -----	May 18, 1926
2,020,562	Miller -----	Nov. 12, 1935
2,302,586	Thelen -----	Nov. 17, 1942
2,407,927	Hayden -----	Sept. 17, 1946