April 6, 1965 B. G. E. STIFF 3,176,470

MODULAR FLOAT AND PIER STRUCTURE

Filed Oct. 4, 1962 2 Sheets-Sheet 1

FIG. 1

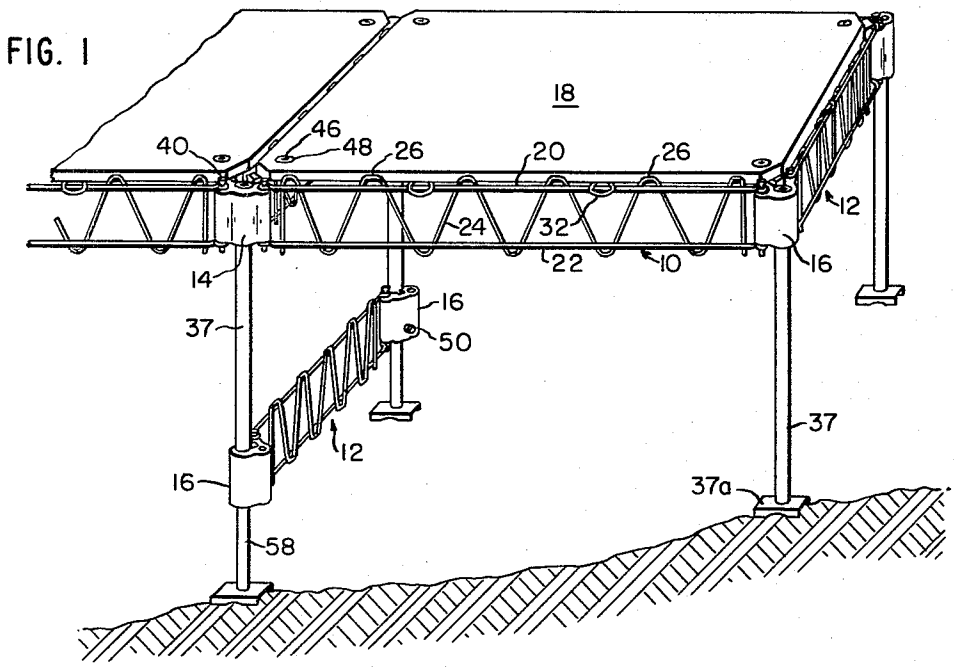


FIG. 2

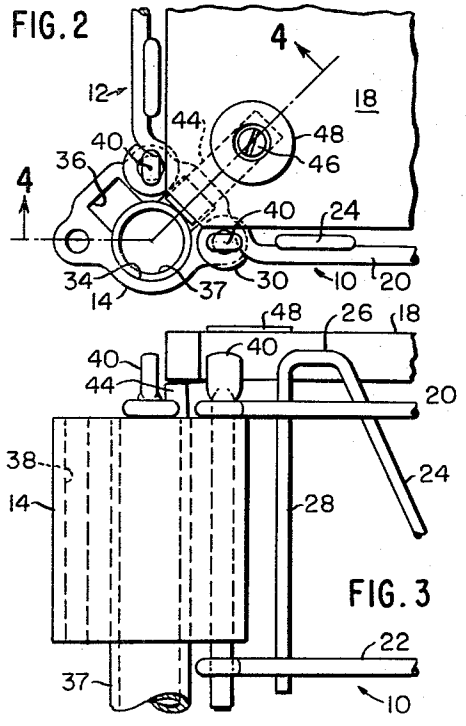


FIG. 3

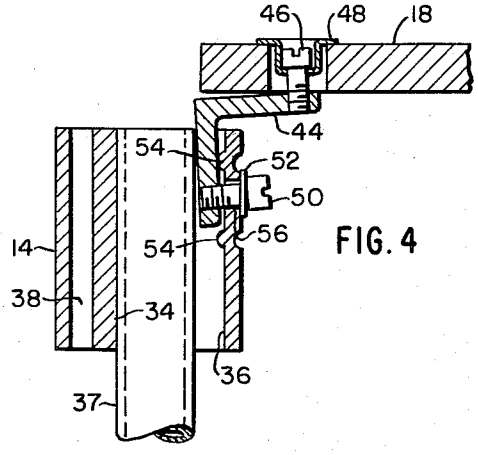


FIG. 4

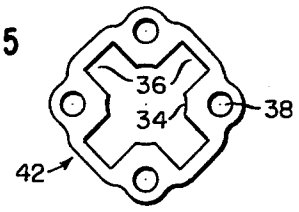
INVENTOR.
BERNARD G. E. STIFF
BY
Kenway, Jenney & Hildreth
ATTORNEYS

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MODULAR FLOAT AND PIER STRUCTURE

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FIG. 5



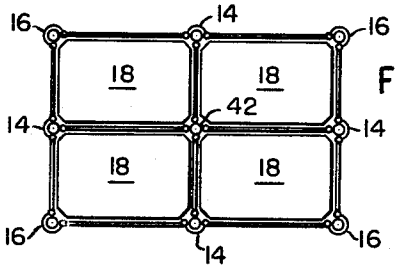


FIG. 6

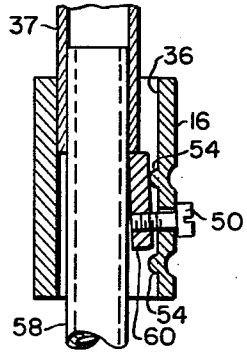


FIG. 7

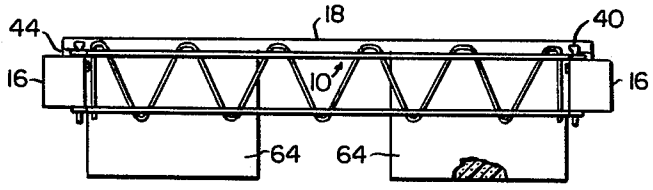


FIG. 8

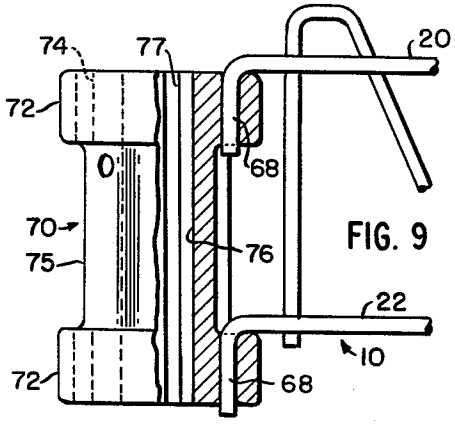


FIG. 9

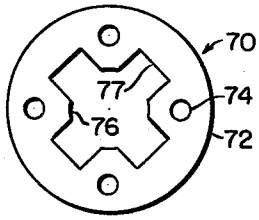


FIG. 10

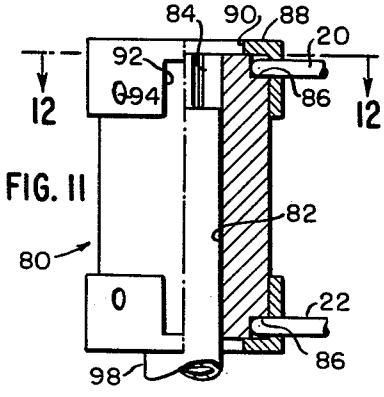


FIG. 11

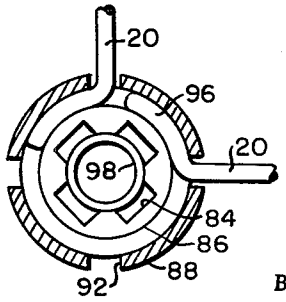


FIG. 12

INVENTOR.
BERNARD G. E. STIFF
BY
Kenway, Jenney & Hildreth
ATTORNEYS

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MODULAR FLOAT AND PIER STRUCTURE

Bernard G. E. Stiff, Lynnfield Center, Mass., assignor to William L. Ericson, Marblehead, Mass.

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4 Claims. (Cl. 61—46)

This invention pertains to an improved modular float and pier structure, and has as its primary objects the provision of an improved structure which can be assembled and disassembled very readily; which is portable; which includes only a small number of parts, of standardized size and types; and in which light parts combine to afford a strong and rigid structure.

Each module of my improved structure is made up of a series of girder sections, which are connected to form a polygonal (usually rectangular) framework by means of a single key located at each corner or apex of the polygon. A series of modules may be interconnected to the keys of adjacent modules, using the intervening girder sections in common, thus reducing the number of parts required in a multiple construction. The girders are readily connected in the keys by pin means, which may comprise separate pins, or may be integrally formed in the girders themselves.

As a feature of the invention, each module includes a deck element whose edges abut the girders interiorly to give the polygonal structure a fixed form, and thereby support the girders transversely. The girders may therefore be light and relatively flexible transversely. The deck is also mounted upon the keys at the corners of the module, and the parts thus are secured by a common means which joins them into a sturdy unit of light weight.

A series of modules may be interconnected to form a complex pier or float structure of any desired form, and it is another feature of the invention that the second and succeeding modules utilize at least two of the keys and share at least one adjacent girder of the preceding modules. A girder shared in common by adjacent deck elements acts as a separator, and is transversely supported by both.

A further feature of the invention pertains to the special form of the keys and their manner of cooperation with the other elements, which permits the girders, floats or posts, and deck elements not only of a first, but also of adjacent modules, to be interconnected by means of a single key. These keys further permit any of the other elements to be individually attached or detached without disturbing the remainder of the structure. A single person is thus able to assemble and disassemble a pier or a float piece by piece, without inconvenience or any need to handle cumbersome sub-assemblies, and without having to remove one part in order to deal with another. To these ends, the keys comprise elongated members having a longitudinal bore for receiving a post, as in a pier construction. Pin-receiving openings and recesses are formed in circumferentially-spaced alternating array about the longitudinal bore; the latter preferably opening onto the bore, for receiving angles by means of which deck elements may be attached. The angles may also serve to secure the supporting post in an adjusted position in the key. The number of pin-receiving openings and angle-receiving recesses may vary, depending upon whether the particular key is intended to connect the parts of a single module, or to interconnect two, three, or four modules at a common locus.

While the specification concludes with claims particularly pointing out the subject matter which I regard as my invention, it is believed that a clearer understanding may be gained from the following detailed description of preferred embodiments thereof, referring to the accompanying drawings, in which:

FIGURE 1 is a fragmentary pictorial view of an assembled pier according to the invention, showing the manner of interconnecting modules;

FIGURE 2 is a fragmentary plan view of a corner portion of a module;

FIGURE 3 is a fragmentary view in elevation of the module of FIGURE 2;

FIGURE 4 is a sectional view taken along line 4—4 in FIGURE 2, looking in the direction of the arrows;

FIGURE 5 is a plan view of a key comprising one element of the assembly;

FIGURE 6 is a plan view showing the manner of connecting a number of modules;

FIGURE 7 is a sectional view showing the manner of interconnection of telescoping posts by means of a key;

FIGURE 8 is a view in elevation showing the incorporation of a module in a float structure;

FIGURE 9 is a fragmentary view in elevation showing a modified key and pin means;

FIGURE 10 is a plan view of the key of FIGURE 9;

FIGURE 11 is a view in elevation and partially in section of another form of key and pin means; and

FIGURE 12 is a sectional plan view taken along line 12—12 in FIGURE 11, looking in the direction of the arrows.

Referring to FIGURES 1–7, a preferred construction of my modular structure is made up of pairs of prefabricated girders 10 and 12, interconnected to form rectangular frames by means of keys 14 and 16, and deck members 18 which are also mounted on the keys. It is desirable, though not necessary, that the decks 18 be approximately 32 inches wide along the girders 10, and approximately 4 feet in length along the girders 12, so that the modules may be assembled endwise to form a pier of conventional dimensions. Further, elements of this moderate size are conveniently portable, and three decks may be cut from a standard 4 by 8 foot sheet of plywood.

Each of the girders 10 or 12 is made up of a pair of longitudinal stringers 20 and 22, and a sinuous brace 24, which is spot-welded or otherwise firmly secured to the stringers at the points of contact. The return bends of the brace extend above the upper stringer 20 to form protrusions 26, which abut the deck 18 about its periphery. This engagement serves not only to give the module a fixed form, but the girders are supported against transverse deflection by virtue of their abutment with the deck.

Each terminus of the brace 24 extends vertically as at 28, to provide rigid support to the ends of the stringers, which are formed with eyes 30. It is important to note that the center of each eye coincides with the centerline of the brace 24 (see FIG. 2) rather than with the centerlines of the stringers; this is desirable in order to allow the brace to extend between adjacent decks to act as a separator (see FIG. 1), and to provide support by the deck of the girders. Spaced along each upper stringer 20, a pair of rings 32 are spot-welded or otherwise secured to provide an additional support, upon which the deck rests. The centers of these rings also coincide with the centerline of the brace 24.

The girders are interconnected to form a rectangular structure by means of the keys 14 and 16, each of which has a central bore 34 for receiving a supporting post 37 therethrough. Each key is provided with circumferentially-spaced recesses 36 about the bore 34. The keys 14 and 16 also are provided with pin-receiving openings 38, alternating in circumferential array with the recesses 36; and differ in the number of these openings as well as of the recesses 36, but are otherwise similar. It will be apparent by reference to FIG. 1 that a key 16 having only two openings 38 may be used at the terminal corners of the pier, whereas a key 14 having three openings 38

is necessary for interconnecting two adjacent modules. As shown in FIG. 6, a longer and wider structure may be prepared by assembling modules laterally and longitudinally, utilizing keys 16 at the corners, keys 14 at the centers of each edge, and a key 42, having four pin-receiving openings 38, at the center of the structure. The key 42 is shown in enlarged scale in FIG. 5; in this case, four recesses 36 are also provided, for connection of the decks of four adjacent modules.

The girders are connected to the keys by means of pins 40, each of which is dropped downwardly through the eye 30 of a stringer 20, through a bore 33, and through the eye 30 of a lower stringer 22.

The recesses 36 receive L-shaped angles 44, of which one leg is received within the recess and the other overlies the key for attachment to the lower surface of the deck 18 by means of a machine screw 46. The screw 46 is preferably recessed into the deck surface, being received in a cup 48, so that a flush surface results. The angle 44 is secured in the recess 36 by means of a machine screw 50 and washer 52, and serves also, if desired, to lock a post 37 in an adjusted position through a jamming action. This is achieved by means of one of a pair of indentations 54 in the bracket wall, above and below an opening 56 for the screw 50. The indentations might alternatively take the form of a protrusion in the angle itself. As the screw 50 is drawn up in threaded engagement with the angle 44, the latter pivots about the indentation 54 and jams with the upper end of the post 37. One such angle 44 is provided at each corner of the deck 18, and in this manner adjacent decks may be secured to the same keys interconnecting the girders. It should be noted that each pair of angles form a trapezoidal linkage with a girder and the deck, and thus increases the rigidity of the polygonal form.

Where the pier is used in shallow water, single lengths of piping may suffice for the posts 37, but where deeper water is encountered, I prefer to provide a telescoping post arrangement, as indicated in FIG. 1 and illustrated in a detailed cross-section in FIG. 7. A second post section 58 is telescoped within the first section 37, and secured in an adjusted telescoped relation by means of an inverted key 16, which may be identical with the keys utilized in the deck support. A machine screw 50 is in this case threaded into a rectangular wedging block 60, which is received in a recess 36 of the key and wedged against an indentation 54. As the screw 50 is drawn up, the block 60 cants about the indentation, and jams into the side of the post 58. The upper post 37 rests against the block 60, and thus transmits the supported load to the post 58.

Preferably, an additional girder 12 extends transversely of the pier between two telescoping post structures to prevent side-sway, being secured in the keys 16 just as in the deck-supporting assembly.

The basic module structure may be used to construct floats instead of the piers which have been described. Such a float module is shown in FIG. 8, in which parts similar to those of the preceding embodiment are similarly numbered. An assembled module comprising a deck section 18, a plurality of girders 10 and four keys 16, is mounted on floats 64, which may be secured to the deck by through-bolts (not shown). The floats may be of any desired material, such as plastic foam or wood, or may be a bouyant tank. It will be apparent that a float of larger size may be assembled from a number of these modules, substituting keys 14 or 42 where needed.

A modified girder and key construction is shown in FIGS. 9 and 10, in which the pin means for interconnecting these members are formed integrally in the ends of the girders, comprising downwardly bent hooks 68 formed in the stringers 20 and 22 of a girder 10. A key 70 is formed with a pair of enlarged circular portions 72, each having four circumferentially-spaced holes 74 extending therethrough, to receive the hooks 68 of the girders. The

cups are interconnected by a central reduced portion 75, permitting the hooks to enter the holes 74. A central bore 76 is provided to receive a supporting post, and recesses 77 are formed in circumferential array, alternating with the holes 74, for receiving angles 44 (not shown).

A further modification of the key construction is shown in FIGURES 11 and 12, in which a key 80 is provided with a central bore 82 for receiving a post 98, and with recesses 84 in circumferential array about the bore to receive deck-supporting angles (not shown) as in the preceding embodiments. The key terminates at its upper and lower ends in circumferential grooves 86, and a pair of covers 88 are positioned over the ends to secure the stringers 20 and 22 of adjacent girders upon the key. Each stringer terminates in an arcuate hook 96 comprising integral pin means. The hooks 96 extend somewhat less than 90 degrees about the grooves 86, thus permitting four intersecting girders to be secured in the key. The caps 88 are provided with pin-receiving openings 92 spaced at 90 degree intervals thereabout, in alternating circumferential array with the recesses 84, to receive the hooks 96. A central opening 90 is formed in each cap to permit the post 82 to be received in the key. The hooks 96 first being positioned in the grooves, the assembly is secured by means of threaded fasteners (not shown) which pass through openings 94 in the covers 88 and into threaded engagement with the key. In order that the same threaded fasteners may be used to secure the angles in the recesses 84, the openings 94 are circumferentially aligned with these recesses.

It will be apparent from the foregoing description that I have provided a modular structure for floats and piers which comprises only three essential groups of interchangeable parts, including girders, keys, and deck members. Pin means for interconnecting these parts may be formed integrally in the girders, or furnished separately. These elements are easily assembled into a sturdy composite structure, and can be quickly disassembled and stored compactly. Because of the multiple utility of the parts, they may be conveniently packaged and sold in kit form, and distributors are relieved of the need to stock a great variety of different parts and sizes. While I have illustrated and described preferred embodiments of the invention by way of illustration, it will be apparent that various changes and modifications will occur to those skilled in the art without departing from the true spirit and scope of the invention, which I therefore intend to define in the appended claims without limitation to the specific details of the described embodiments.

What I claim is:

1. A modular structure for piers and floats, comprising, in combination; a plurality of girders, keys, and pin means, said keys being provided with spaced-apart openings for receiving said pin means, said pin means being attached to said girders and received in said key openings to secure ends of said girders thereto to form a polygonal framework in which a key forms each apex and a planar polygonal deck element receivable in said framework for support thereby in a direction normal to said deck, the edges of said deck element abutting said girders interiorly of said framework for transverse support thereof, said keys further being provided with recesses located intermediate adjacent ones of said pin-receiving openings, a plurality of angles secured in said recesses and securing the apices of said deck element thereto, whereby said girders and said deck element are independently secured to said keys, a plurality of supporting posts, each of said keys being formed with a central bore receiving one of said supporting posts, said recesses in each key communicating with said bore thereof to receive said angles in abutting relation against said post, and means for jamming said angles into gripping engagement with said posts to secure said modular structure thereon.

2. A structure for piers and floats, comprising a series of connected modules, each of said modules comprising

a plurality of girders, keys, and pin means, each of said keys being provided with a plurality of openings for receiving said pin means, said pin means being attached to said girders and received in said key openings to secure ends of a plurality of girders thereto to form connected polygonal frameworks in which a key forms each apex, and a plurality of planar polygonal decks, each receivable in one of said frameworks for support thereby in a direction normal to said deck, the edges of said decks abutting the girders interiorly of the frameworks for transverse support thereof, said keys further being provided with recesses located intermediate adjacent ones of said pin-receiving openings, a plurality of angles secured in said recesses and securing the apices of said decks thereto, said openings and said recesses being located in circumferentially-spaced alternating array about each of said keys, whereby a number of girders and decks of adjacent modules may be secured in common to each of said keys.

3. A structure as recited in claim 2, adjacent pairs of connected modules sharing two of said keys and one of said girders in common.

4. A modular structure for piers and floats comprising, in combination; a plurality of girders having integral arcuate hooks, a plurality of keys, each of said keys

being provided with at least one cap attached thereon, said caps being formed with openings and said keys being formed with arcuate grooves communicating with said openings and receiving said hooks therethrough to secure ends of said girders thereto to form a polygonal framework in which a key forms each apex, and a planar polygonal deck receivable in said framework for support thereby in a direction normal to said deck, the edges of said deck abutting said girders interiorly of said framework for transverse support thereof, said keys further being provided with independent means for securing the apices of said deck thereto.

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HARRISON R. MOSELEY, *Primary Examiner.*