United States Patent

[11] **3,580,202**

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[45] Patented **May 25, 1971**
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[54] **FLOATING WHARF STRUCTURE**
9 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **114/0.5**
[51] **Int. Cl.** **B63b 35/00**
[50] **Field of Search** ..... 114/0.5, 0.5 (F); 61/48

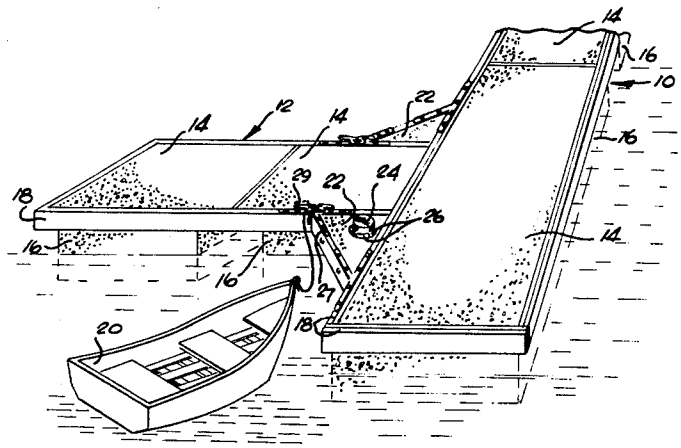
[56] **References Cited**

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Primary Examiner—Trygve M. Blix
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ABSTRACT: A floating wharf structure wherein interconnected walkways are provided spaced from the top surfaces of supporting pontoons. Each of the walkways comprises a flat sheet of wire mesh screen and spacing means are defined by reinforcing bars disposed downwardly from the sheet. The screen and bars are encased in concrete shaped to define the walkway and integral spacing means. The walkways are interconnected by flanges extending downwardly from the walkways to contralaterally flank underlying pontoons. Each pontoon comprises walls of concrete defining a chamber and polymer foam filling the chamber.



Patented May 25, 1971 3,580,202

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Fig-1

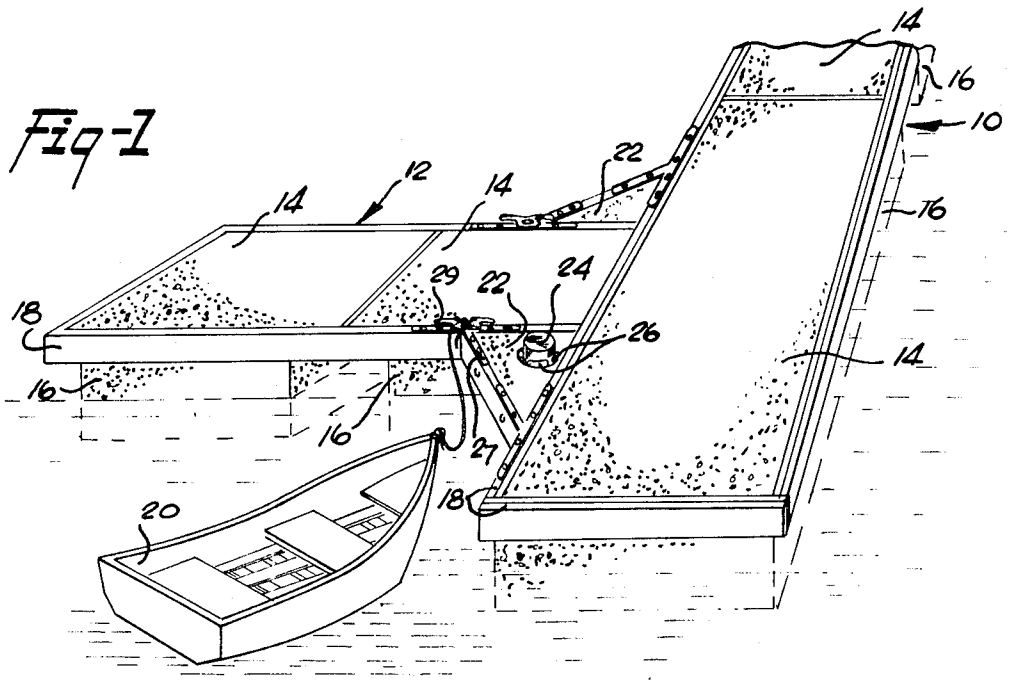
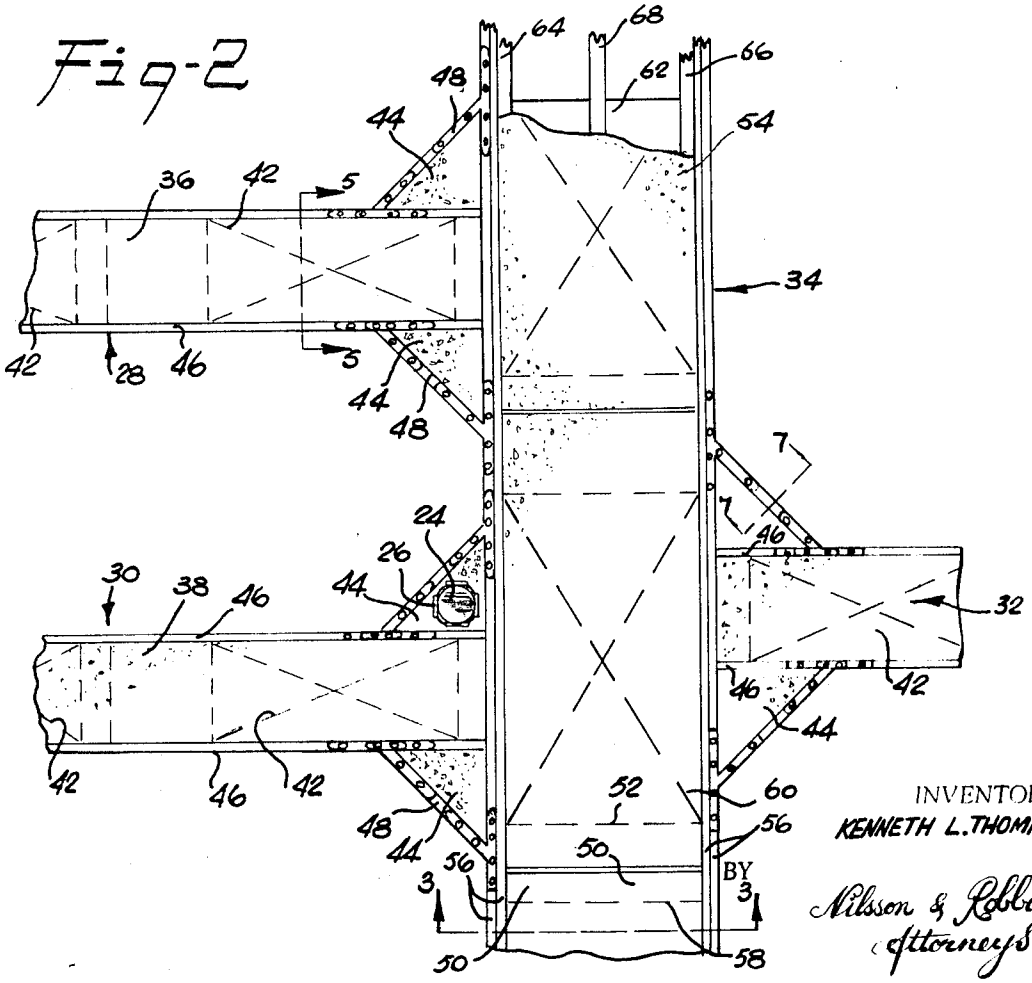


Fig-2



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Patented May 25, 1971 3,580,202

2 Sheets-Sheet 2

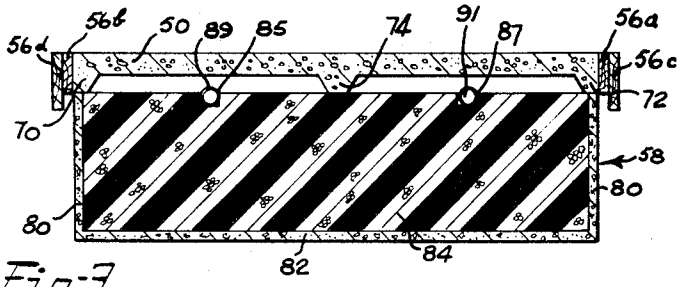


Fig-3

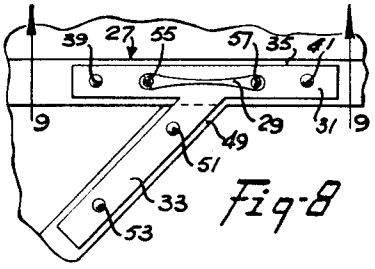


Fig-8

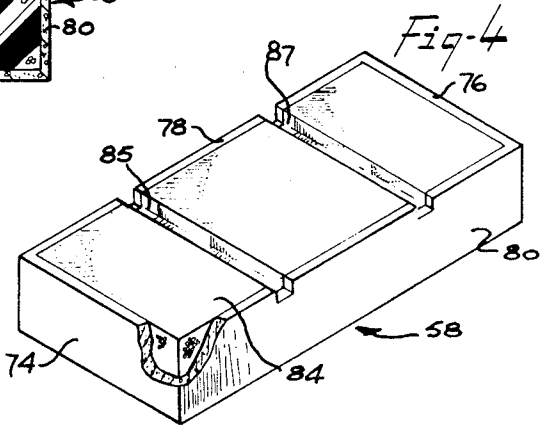


Fig-4

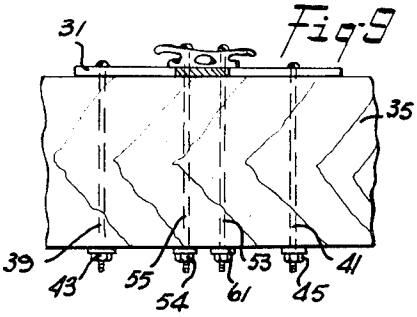


Fig-9

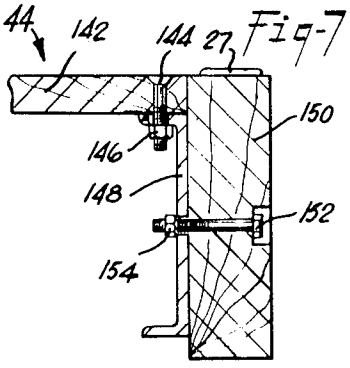


Fig-7

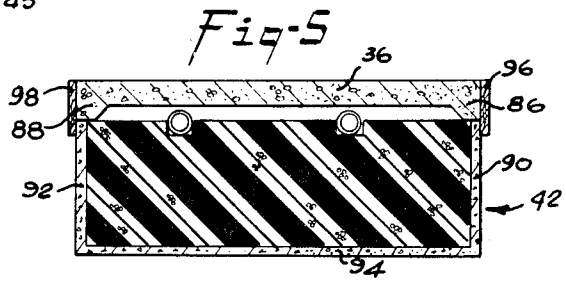


Fig-5

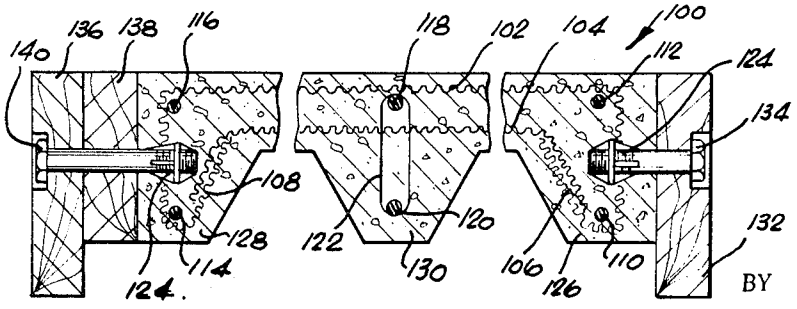


Fig-6

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FLOATING WHARF STRUCTURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The field of art to which the invention pertains includes the field of ships, particularly floating docks therefor.

2. Description of the Prior Art

In constructing marina or small boat harbors it is desirable to utilize a floating wharf structure which is accessible to land and has one or more fingers extending out into the body of water. In the past, various types of pontoons and floats have been utilized and proposed for this purpose. For example, in U.S. Pat. No. 2,857,872 a floating wharf structure is disclosed made up of concrete float units and in which the walkway is provided by the surfaces of the float units themselves. Although most of these structures operates satisfactorily for the purpose intended, they are often unwieldy and expensive to construct. It can also be noted that prior art floating wharfs tend to buck against tides and currents when they are constructed so that the space between the floating units is insufficient to accommodate the passage of such water.

SUMMARY OF THE INVENTION

The present invention provides a floating wharf structure which can utilize any form of pontoon for floating thereof and which allows the placement of pontoons relatively spaced apart. The structure comprises interconnectable units which can be arranged in any of a variety of patterns and permanently fastened together in desired configuration. Walkways are provided which are separate from the underlying pontoons and which are spaced from the top surfaces of the pontoons to further reduce resistance to the passage of breaking waves. Specifically, each of the walkways is spaced from and supported by the top surfaces of the underlying pontoons by means of paired support members disposed lengthwise of each walkway under each side thereof. The wider walkways include an additional support member disposed lengthwise and substantially centrally thereof to extend downwardly from the walkway in the manner of the side support members. Flanges on the sides of the walkways serve to interconnect the walkways and extend downwardly therefrom to contralaterally flank underlying pontoons to limit lateral movement of the pontoons relative to the walkways.

With respect to specific structural details, each of the walkways comprises a flat sheet of wire mesh screen and the spacing members comprise reinforcing bars disposed downwardly from the sheet. The screen and bars are encased in concrete which is shaped to define the walkway and the integral spacing members. The pontoons can each comprise walls of concrete defining a chamber and polymer foam filling the chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of part of a floating wharf structure constructed in accordance with the present invention;

FIG. **2** is a plan view of part of another floating wharf structure in accordance with this invention;

FIG. **3** is a vertical section view taken on the line **3–3** of FIG. **2**, in the direction of the arrows;

FIG. **4** is a perspective view of a pontoon constructed in accordance with this invention;

FIG. **5** is a vertical section view taken on the line **5–5** of FIG. **2**, in the direction of the arrows;

FIG. **6** is a broken, enlarged vertical section view of a walkway structure of this invention;

FIG. **7** is a partial vertical section view taken on the line **7–7** of FIG. **2**, in the direction of the arrows; and

FIGS. **8** and **9** are plans on vertical section views, respectively, of a knee bracket utilized herein.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, there is illustrated a floating wharf structure, including a headwalk **10** and a finger section **12**, each including sectionalized walkways **14** supported on pontoons **16**. The pontoons **16** are spaced 3—4 feet apart to allow the water of breaking waves, currents and tides to pass through to thereby stabilize the wharf. Tie rails or facers **18** interconnect the walkway units **14** and also serve as flanges to buffer impacts from boats, as **20**, docked thereat. Corner sections of knees **22** and **24** are shown connecting the finger section **12** to the headwalk **10**. A wooden piling **24** extends through one of the corner sections **22** between rollers **26** thereon to anchor the floating wharf, but the piling can be located in other positions, e.g., on a finger section or on the headwalk. Knee brackets, **27**, which may have a cleat, **29** thereon, secure the finger sections **22** to the headwalk **10** as hereinafter described.

Referring to FIG. **2**, a floating wharf structure similar to that of FIG. **1** is shown in plan view, wherein finger sections **28, 30** and **32** project from a single headwalk **34**. Each finger section consists of one or more walkways **36, 38 40**, although only one walkway is shown in FIG. **2** for each finger section. One or more pontoons, shown in shadow **42**, underlie and support each finger section. Facers **46** and **48** are applied along each side of the finger sections and connecting corner sections **44**, respectively.

The headwalk includes a plurality of walkways **50, 52 54** which are interconnected by double-run tie rails **56** as will hereinafter be detailed. The walkways are supported on pontoons, shown in shadow at **58** and **60** and in partial section at **62**, and are spaced from the pontoons by supporting side beams **64** and **66** and centrally disposed beam **68**, each running lengthwise beneath the walkway and, as will be seen hereinafter, each is formed integrally with the walkway. Similar side support members are provided for the walkways **36, 38, 40** constituting the finger sections **28, 30, 32.**

Referring to FIG. **3**, a vertical section view of the headwalk of FIG. **2** is shown. The walkway **50** is constructed of reinforced concrete and is provided with side support members **70** and **72** which are similar to the side support members **64** and **66** referred to in FIG. **2**. The side support members **70** and **72** run the length of the walkway **50** and serve to space the walkway **50** from the top surface of the pontoon **58** thereunder. An additional support member **74** is formed extending downwardly from the walkway **50** and runs lengthwise and substantially centrally beneath the walkway **50**. It is particularly desirable to utilize a central support member **74** to additionally support the relatively wide walkways constituting the headwalk **34** (in comparison to the width of the walkways constituting the finger sections **28, 30, 32**). As shown in FIG. **3**, the support members **70, 72** and **74** have little horizontal extent relative to the horizontal extent of the walkway **50** whereby to define open spaces between support members.

Tie rails **56** are provided and connected to the walkway **50** as will hereinafter be detailed. In this particular structure, double-run tie rails are supported on each side of the walkways constituting the headwalk **34**. By utilizing double-run tie rails **56**, extra buffering strength is provided to the headwalk **34** to protect the walkways **50, 52, 54** from direct impacts from boats being docked. It will be seen that it is generally only necessary to provide a single tie rail on each side of the walkways constituting the finger sections **28, 30, 32** since the finger sections generally receive only glancing impacts from boats being docked. An additional reason for providing a double-run tie rail **56**, in effect an extended facer, is to protect the pontoons underlying the headwalk from being damaged by any protruding object such as, for example, the propeller of a boat. Thus, a pair of inner tie rails **56*a*** and **56*b*** are secured to the sides of the walkways **50** and are flanked by outer tie rails or facers **56*c*** and **56*d***.

Although, as indicated, any appropriately sized and shaped pontoon can be utilized to support the walkways described herein, particularly advantageous pontoon is shown in cross section in FIG. **3** and in perspective in FIG. **4**. The particular pontoon **58** shown in FIGS. **3** and **4** comprises a generally box-shaped structure having front and rear walls **74** and **76**,

sidewalls 78 and 80 and a bottom wall 82 of lightweight concrete as hereinafter described. The walls are each 1 inch thick, but shown disproportionately in the drawing, and the chamber defined thereby is entirely filled with a solid polymer foam 84, such as polystyrene or the like as hereinafter described. A pair of notches 85 and 87 are cut through the upper surface of the portion 58 to support utility lines 89 and 91, shown in cross secton, under the walkway 50. By utilizing the foam-cored pontoon, structural strength is obtained although the concrete walls utilized can be relatively thin compared to prior structures. Although the pontoons illustrated in FIGS. 3 and 4 are shown with the foam-core exposed and defining the top surface of the pontoon, the foam may be completely encased in the concrete. A significant advantage of the foam-cored pontoons herein is the fact that the pontoons are not hollow and therefore do not fill with water by seepage or otherwise. Accordingly, there is no need for periodic inspection of seepage water.

Referring to FIG. 5, there is shown a vertical section view of a walkway 36 and underlying pontoon 42 constituting a finger section 28 of FIG. 2. The walkway 36 has two integral beams or support members 86 and 88 extending downwardly from the sides thereof to support the walkway 36 spaced from the top surface of the pontoon 42. The pontoon 42 is constructed in a manner similar to the pontoon 58 illustrated in FIG. 4 and the sidewalls 90 and 92 and bottom wall 94 are also shown disproportionately thick for clarity of illustration.

The walkways constituting the finger sections are sufficiently narrow so as to be adequately supported by only two support beams, such as 86 and 88. Furthermore, it is adequate to provide only single thicknesses of tie rails or facers 96 and 98. The tie rails 96 and 98 extend downwardly from the walkway 36 to contralaterally flank the underlying pontoon 42 to thereby limit its lateral movement relative to the walkway 36.

Referring to FIG. 6, there is illustrated in broken vertical section a walkway 100 such as may be utilized in constructing a headwalk, but wherein it is desired to have a double-run facer on only one side thereof. The walkway 100 is initially defined by a pair of flat sheets of galvanized wire mesh screen extending two-ply the length of the walkway and deformed downwardly at the sides 106 and 108 thereof to initially define the side support members. Steel reinforcement bars 110, 112, 114 and 116 are inserted within the screening defining the side support members and extend the length of the walkway 100. Additional steel reinforcement bars are disposed along the length of the walkway centrally of the sheeting and downwardly therefrom, respectively, and are held in place by loops of wire, such as 122, to initially define the central support member. A plurality of inserts 124 enclosing threaded nuts are inmeshed in the wire legs 106 and 108 that define the support members to provide rows of threaded nuts along the sides of the walkways to enable fastening thereat of the tie rails. The subassembly is cast in concrete so as to form the walkway 100, integral side support beams 126 and 128 and central support beam 130. The walkway is formed about 2½ inches thick.

Referring to the right-hand side of the drawing in FIG. 6, the single wooden facer 132 thereat is secured to the right-side supporting beam 126 by means of bolts 134 that are threaded into the encased inserts 124. Referring to the left-hand side of the drawing in FIG. 6, an outer wooden facer or tie rail 136 and left-side support beam 128 sandwich an inner wooden tie rail 138 therebetween and the tie rails are connected to the side support beam by means of galvanized bolts 140 that are threaded into the inserts 124 thereat.

FIG. 7 shows a detail of construction of a corner section 44 of FIG. 2. The top surface 142 of the corner section is defined by 1 inch plywood which is secured at its outer edge by one-quarter inch bolts 144 and nuts 146 to one leg of a galvanized steel U-beam 148. A wooden facer 150 is secured centrally to the U-beam 148 by means of one-half inch galvanized bolt 152 and nut 154 therefor so that the top surface of the facer 150 is flush with the top surface of the plywood 142.

FIGS. 8 and 9 show details of construction of a knee bracket 27, and cleat 29 thereon, which is utilized to secure the knee facers, such as 150 of FIG. 7, to the facers along the sides of the headwalk and finger sections to thereby join the finger sections to the headwalk. Each bracket 27 consists of a one-quarter inch plate stock runner portion 31, which in this case is about 2½ inches wide, and an extending portion 33, extending at an appropriate angle, and also about 2½ inches wide. It is convenient to utilize 45° as an extension angle so that any bracket 29 can be utilized on either side thereof to secure the fingerwalks to the headwalk and define unilateral corner sections. Other extension angles are similarly convenient, e.g., 30° and 60° which can be inverted for use in different positions; however, any angle can be utilized. The bracket 27 is secured along the runner portion 31 of the edge of a walkway faceboard 35 on the side of a walkway 37 by means of a pair of bolts 39 and 41 through the runner portion 31 land width of the faceboard 35 and secured by nuts 43 and 45, respectively. The angled extension portion 33 is similarly secured to the edge of a faceboard 47 on the side of a corner section 49 by a pair of bolts 51 and 53 and nuts (not shown). A cleat 29 can be conveniently secured to an edge of the walkway or corner section by means of bolts 55 and 57 through the bracket 27 and secured by nuts 59 and 61 to the faceboard thereat. By utilization of knee bracket 27 as described, the cost of construction of the floating wharf is drastically reduced, yet the structure is strong and rigid.

With respect to materials of construction, the concrete utilized should be lightweight and is advantageously waterproof. Waterproof concrete having a cast weight of 100 pounds per cubic foot can be utilized. As the foamed-core, a material which forms a closed cell foam should be utilized. Other materials that can be utilized include closed cell urethene foams, foamed polyethylene, foamed vinyl plastics, and foamed phenolics, epoxy foams, and the like.

With respect to the design parameters for the headwalks and finger sections, headwalks 8 feet wide and finger sections 4 feet wide can be provided. With respect to the headwalk, walkways of about 15—20 feet in length, 8 feet wide and constructed as described of lightweight concrete, weigh about 200 pounds per linear foot. In order to obtain an 18 inch freeboard, and utilizing a pontoon about 24 inches in height and 8 feet in width, one need utilize 1 linear foot of such pontoon for every 1.6 linear feet of walkway. With respect to the finger sections, a 4 feet wide finger section weights about 110 pounds per linear foot. In order to obtain an 18 inch freeboard, and utilizing a pontoon of about 25 inches in height and 4 feet in width, one should utilize about 1 linear foot of pontoon for every 1.3 linear feet of walkway.

I claim:

1. A floating wharf structure, comprising:

a plurality of pontoons; and

a plurality of interconnected walkways overlying said pontoons, each walkway integrally formed with concrete support members lengthwise under each side of said walkway and extending downwardly therefrom to about the top surface of an underlying pontoon whereby to support said walkway spaced from said pontoon top surface.

2. The structure of claim 1 including an additional support member of concrete formed integrally with said walkway lengthwise and substantially centrally thereof to abut the top surface of said underlying pontoon whereby to support said walkway spaced from said pontoon top surface.

3. The structure of claim 1 wherein said interconnecting means comprises flanges extending downwardly from said walkway to contralaterally flank an underlying pontoon for limiting lateral movement of said flanked pontoon relative to said walkway.

4. The structure of claim 1 wherein each of said walkways comprises a flat sheet of wire mesh screen and said support members are formed about reinforcement bars disposed downwardly from said sheet, said screen and bars being encased in concrete shaped to define said walkway and said integral support members.

5. The structure of claim 1 wherein each of said pontoons comprises walls of concrete defining a chamber and rigid foam filling said chamber.

6. A walkway unit, comprising:

a sheet of wire mesh screen;

reinforcement bars spaced downwardly from the longitudinal sides of said sheet and extending lengthwise therewith; and

concrete encasing said screen and bars and shaped to define a walkway and integral elongate side members, respectively, said side members each extending substantially a predetermined distance downwardly from said walkway and having little horizontal extent relative to the horizontal extent of said walkway whereby to define open spaces between support members.

7. The unit of claim 6 including at least one reinforcement bar disposed lengthwise and substantially centrally of said sheet and spaced downwardly therefrom, said concrete encasing said bar and shaped thereat to define an integral elongate central member extending substantially said predetermined distance downwardly from said walkway and having little horizontal extent relative to the horizontal extent of said walkway whereby to define open spaces between support members.

8. The unit of claim 6 including a plurality of fastening members spaced apart along the sides thereof and embedded in said concrete.

9. A floating wharf structure, comprising:

a first walkway;

a second walkway laterally of said first walkway;

a corner section between an edge of said first walkway and an edge of said second walkway, said corner section having an outer edge defining with said first walkway an acute angle facing said second walkway, said corner section outer edge defining with said second walkway an acute angle facing said first walkway; and

a one-piece bracket connecting in a single plane the top surface of said corner section outer edge to the top surface of at least one of said first and second walkways.