

March 13, 1962

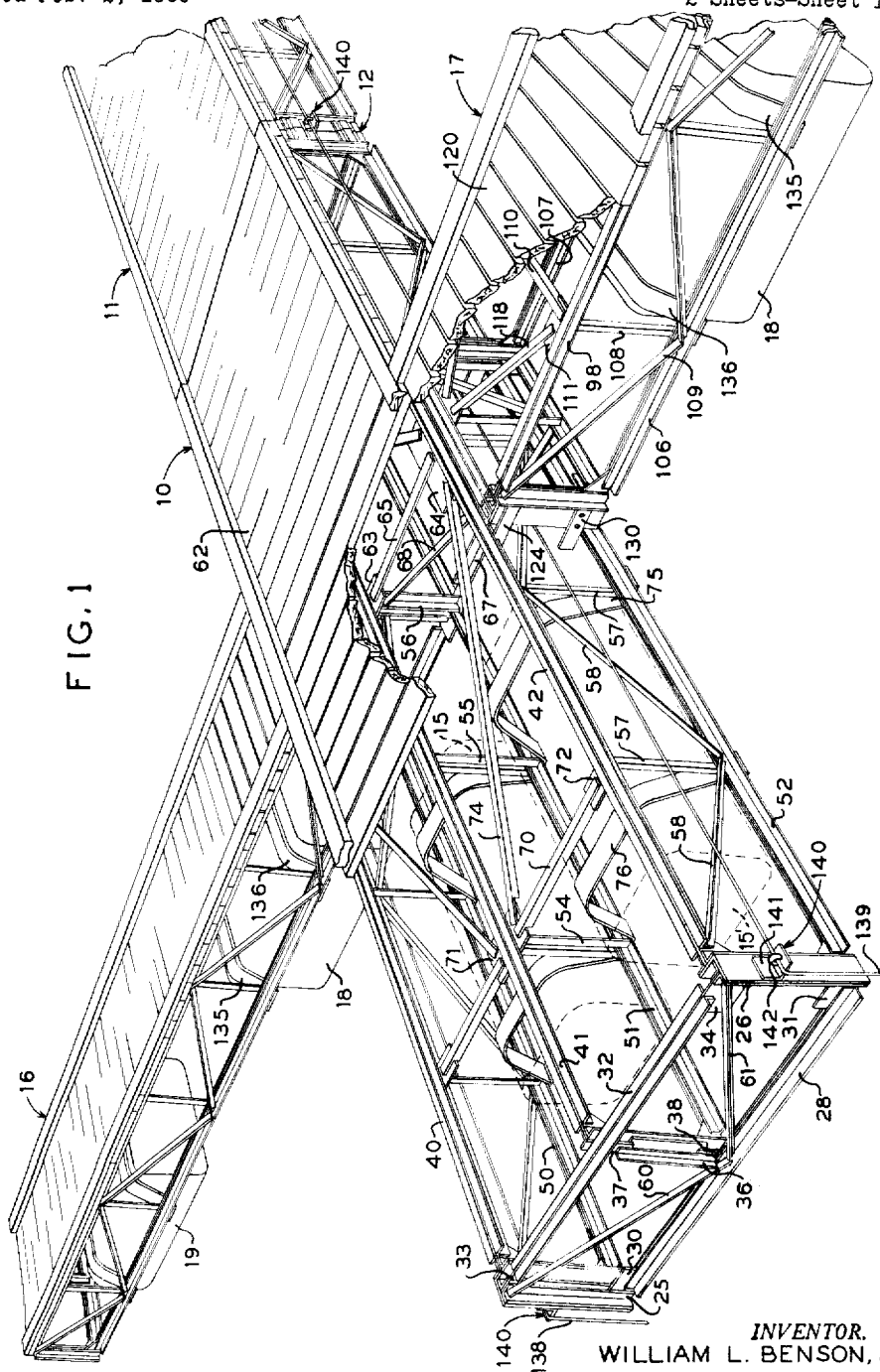
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3,024,753

OPEN SLIP FACILITY

Filed Feb. 2, 1959

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

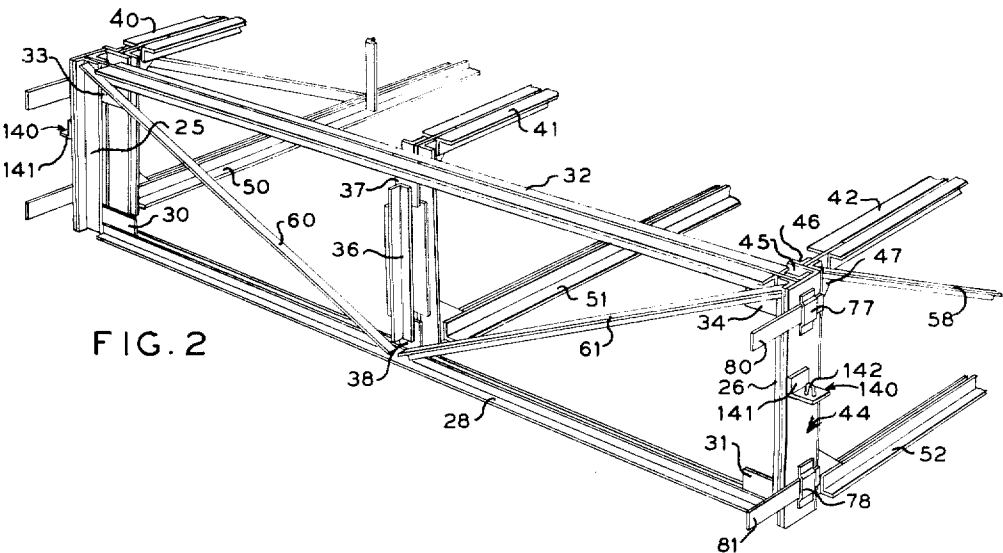


FIG. 2

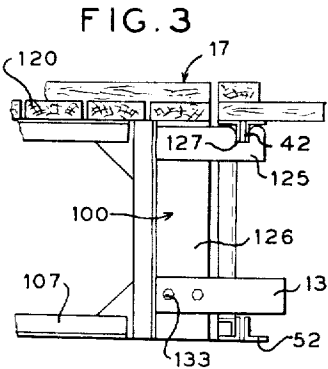


FIG. 3

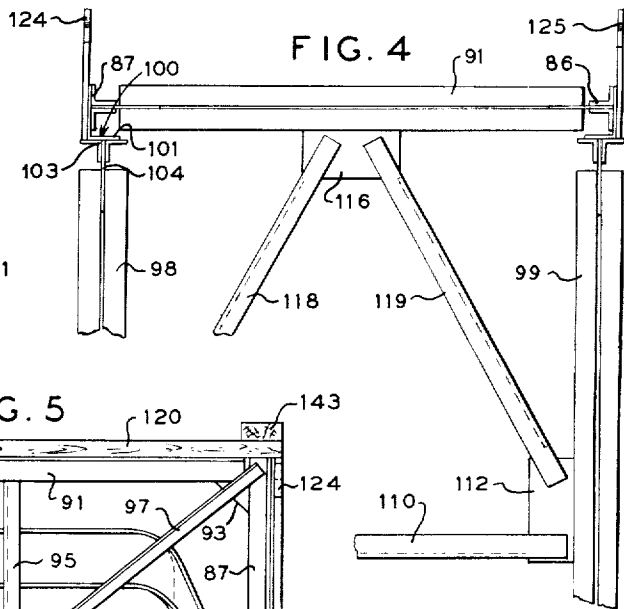


FIG. 4

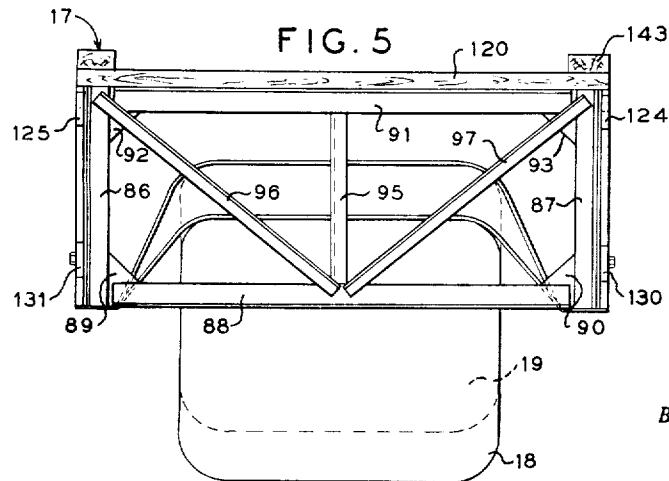


FIG. 5

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OPEN SLIP FACILITY

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Filed Feb. 2, 1959, Ser. No. 790,721

13 Claims. (Cl. 114—5)

This invention relates to an open slip facility, and more particularly concerns a floatable facility for the docking of boats.

In recent years there has been increased boating use of a large number of lakes created primarily for irrigation, power generation and flood control. Since such artificial lakes are subject to considerable "draw-down" to permit effecting of their primary purpose, the shore lines thereof are extensively variable, thereby precluding the use of conventional ground supported docking facilities which are now in general use with relatively fixed-level bodies of water. Such ground supported docking facilities have a further disadvantage in that the slipways thereof are of fixed dimension so as not to permit the most efficient utilization of the slipways for the number and types of boats to be accommodated.

It is one of the objects of the present invention, therefore, to overcome these and many other problems known to the prior art by the provision of a new and improved open slip facility that allows the use of a variable number of quays, each of which is readily positionable so as to permit accommodation of a maximum number of boats of various sizes.

An additional object of this invention is to provide a new and improved open slip facility which has flotation units arranged thereunder in such manner that no theoretical limitation is placed on the magnitude, angle of attack or frequency of wave action to which the facility may be subjected.

A further object of this invention is to provide a new and improved open slip facility which has no structural material located below the water line and, consequently, is not subject to corrosive action of the same, with the further advantage that it is readily available for inspection and maintenance.

Still another object of this invention is to provide a new and improved open slip facility which is simple in construction and operation and well adapted to meet the demands of economic manufacture.

Many other features, advantages and objects of the present invention will become apparent from consideration of the following specification taken in conjunction with the accompanying drawings in which like designators refer to the same or similar parts throughout, and in which:

FIG. 1 is a perspective view, partly broken away, showing one form of open slip facility according to the present invention.

FIG. 2 is a perspective view, partly broken away, showing the coupling arrangement of one of the central sections.

FIG. 3 is a side elevation, partly broken away, showing the slidable coupling of one of the quays to a walkway section.

FIG. 4 is a top plan view, partly broken away, showing the inner end of one of the quays.

FIG. 5 is an end elevation showing the end of one of the quays adjacent the central walkway.

According to the invention, a central walkway leading from shore is comprised of one or more rigid walkway sections each consisting of a complex of trusses and webbing designed to render the unit completely rigid. To maximize stability, flotation bodies are placed under each walkway section preferably as far as possible from the center of gravity of the section so that the height of

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the center of gravity above the water line is negligible when compared with the gross horizontal projected area of the section. Where more than one walkway section is used, they may be rigidly secured together in a continuous extension arrangement without interfering with the basic stability of any one section. To each central walkway section may be slidably coupled a completely self-contained quay of narrower width which is supported on its major or longitudinal axis at right angles to the walkway section by two flotation bodies displaced as far as possible from its center of gravity. Each quay is stable in one direction only, that is, about its minor transverse axis, but is rendered fully stable by attachment to one of the stabilized central walkway sections.

Each quay unit is provided with coupling means in the form of two notched bars projecting from the inner end thereof to engage a portion of the framework of a central walkway section. In addition, at the same end of the quay but along the lower edge thereof, two retainer bars project along the quay against the lower portion of the central section framework. A flotation unit located under the quay at its inner end is so arranged as to cause the two notched bars to bear upwardly against the framework of the central walkway section to effect a latching action therewith. By properly arranging the framework of the central walkway section, a quay may be attached at any point and be slidably adjustable after installation. The coupling arrangement of the quay to the central walkway section permits limited vertical movement in the coupling; however, since each quay is unstable by itself, one or both of its coupling projections will bear at all times against the framework of the central walkway section. In this manner, sufficient frictional contact is provided at all times to prevent any lateral movement of the quay along the walkway, other than that deliberately intended.

Referring now more particularly to the drawings, FIG. 1 shows the open slip facility of my invention as being characterized by rigid central walkway sections 10 and 11 secured in tandem by coupling 12, the arrangement being such that each walkway section is floatably supported on water by a plurality of flotation units as at 13 and 15'. Attached to and extending normal from the walkway sections are quays 16 and 17, with each quay being selectively positionable along the walkway so as to provide for slips of determinable width, the arrangement being such that each quay is supported on the water by a pair of flotation units, as at 18 and 19, as will hereinafter be seen in more detail.

Considering now one half of the framework of one of the rigid central walkway sections, it being understood that the other half is identical, the corner columns 25 and 26 are each built up from a pair of angle irons to form the main structural members of the end frame, as shown most clearly in FIG. 2. A lower built-up beam 28 is horizontally secured to the lower ends of the corner columns 25 and 26 by gusset plates 30 and 31, respectively, the arrangement being such that gusset plate 30 is welded between the adjacent flanges of column 25 and beam 28, and gusset plate 31 is welded between the adjacent flanges of column 26 and beam 28. In like manner, an upper built-up beam 32 is horizontally secured between the upper ends of columns 25 and 26 by gusset plates 33 and 34, respectively, which are welded between the adjacent flanges of each member. Centrally between corner columns 25 and 26 is the L-shaped column 36 which is secured to upper beam 32 and lower beam 28 by gusset plates 37 and 38, respectively.

Extending longitudinally along the top side of the central walkway section are spaced girders 40, 41 and

42 secured, respectively, to corner column 25, center column 36 and corner column 26. To illustrate the manner of securement of each of these girders to their respective columns, reference is made to column 26 and girder 42 where it can be seen that corner column 26 has welded to its coplanar flanges a right angle adapter 44 so as to present the flange 45 thereof confronting the end of girder 42. Built-up stub coupler 46 has its base portion welded along flange 45 of adapter 44, the arrangement being such that girder 42 is secured to the upper end of stub coupler 44 by way of connecting plate 47 which is welded between adjacent flanges of each member. In like manner, girder 41 is secured to center column 36 of the end frame, and girder 40 is secured to end column 25.

Extending longitudinally along the bottom portion of the central walkway section and spaced downwardly from girders 40, 41 and 42 are the built-up girders 50, 51 and 52, secured in like manner to the lower ends of columns 25, 36 and 26, respectively. Between the upper central girder 41 and lower central girder 51 are provided a plurality of built-up bracing columns, as at 54, 55 and 56. Bracing is also provided along each side of the central walkway section by truss framing, including L-beam columns 57 and L-beam diagonals 58. Referring to the near side of the walkway section, it can be seen that columns 57 are each welded to the inside flanges between the upper girder 42 and the lower girder 52, and diagonals 58 are each welded to the outside flanges between the upper girder 42 and lower girder 52. Additional bracing at each end frame of the walkway section is provided by the L-shaped diagonals 60 and 61, which are welded at their lower ends to a central position on the lower beam 28. The upper end of diagonal 60 is welded to the upper end of corner column 25, and the diagonal 61 is welded at its upper end to the upper end of corner column 26.

Providing strength to the top portion of the central walkway section and additional support for the walkway planking 62 is the horizontal truss framing between girders 40, 41 and 42. Considering the truss framing between girders 41 and 42, it being understood that the truss framing between girders 40 and 41 is symmetrical, central girder 41 is provided halfway along its length with an inwardly extending gusset plate 63 welded to the underside of the horizontal flange of the inner section of the girder. In like manner, gusset plate 64 is welded onto the horizontal flange of the confronting section of outer girder 42 halfway along its length. L-beam 65 is secured between gusset plates 63 and 64 normal to the girders 41 and 42, the arrangement being such that the vertical flange at each end of the L-beam is cut away so as to permit the horizontal flanges thereof to be welded to the top side of each gusset plate, thereby providing a substantially even surface for the support of walkway planking 62. Spaced downwardly from the L-beam 65 is a second L-beam 67 secured in like manner between the lower central girder 51 and a lower outer girder 52. Diagonal 68 is secured between the upper end of center column 56 and the lower end of one of the side columns 57 in the same vertical plane as L-beam 65. Outwardly of L-beam 65 is a similar L-beam 70, being secured between the upper central girder 41 and the upper outer girder 42 as by gusset plates 71 and 72, respectively. Welded between gusset plate 71 on center girder 41 and gusset plate 64 on outer girder 42 is an L-shaped counter 74, the securing thereof being similar to the manner of securement of L-beam 65.

In that embodiment of the invention here shown by way of example, four flotation units are employed to floatably support each central walkway section. The combined buoyancy of these units is such as to maintain all the structural members above the water line so as to avoid the corrosive action of the water and to permit convenient inspection and maintenance. Referring now

to the manner of securement of one of these flotation units, it being understood that the manner of securement of the other units is identical, it can be seen that flotation unit 15' is retained between the outer lower girder 52 and the center girder 51 by straps 75 and 76 which are secured therebetween. This arrangement is such that the straps merely pass over the flotation unit, being flexed upwardly by the buoyant force of the latter so as to effectively retain the unit in its proper position under the framework. These flotation units may, of course, be of any type, such as hermetically sealed tanks or containers arranged for controlled flooding. It is preferable, however, that expanded polystyrene be utilized, since this material provides maximum water displacement for the weight of the displacing media and is relatively inert to normal corrosive agents likely to be encountered. In addition, it requires no maintenance when used in fresh water.

The manner of securing central walkway sections together in tandem by the coupling 12 is best seen in FIG. 2. For this purpose the right angle adapter 44 on each corner column is provided with upper and lower U-brackets 77 and 78, respectively. A connecting bar 80 passes between upper brackets 77 on adjacent walkway sections, being bolted or otherwise suitably secured therein. In like manner, a connecting bar 81 is secured between the lower brackets 78, the arrangement being such that when the walkway sections are in end-to-end relation, the connecting bars 80 and 81 on each side will provide for rigid securement of the sections.

Considering now the construction of the rigid quays, as best seen in FIGS. 1, 3 and 4, each is of generally rectangular configuration, but being of somewhat narrower width than the central walkway sections. The end frames of each quay are substantially identical except that the inner end frame of each has a coupling thereon to provide for selective securement to the side framing of the walkway section. As most clearly shown in FIG. 5, the end frame corner columns 86 and 87 of quay 17 are each built-up from a pair of angle irons. A lower built-up beam 88 is horizontally secured between the lower ends of the corner columns by gusset plates 89 and 90, the arrangement being such that gusset plate 89 is welded between the adjacent flanges of column 86 and beam 88, and gusset plate 90 is welded between the adjacent flanges of column 87 and beam 88. In like manner, an upper built-up beam 91 is horizontally secured between the upper ends of corner columns 86 and 87 by gusset plates 92 and 93, respectively. An L-shaped column 95 is welded between the inside flanges of the upper beam 91 and lower beam 88, being parallel to the corner columns and centrally spaced therebetween. Additional bracing is provided by the counter 96 which is welded between the outside flange at the upper end of corner column 86 and a center position on the outside flange of the lower beam 88. Being secured in a similar manner, the counter 97 extends between the upper end of corner column 87 and a center position on the lower beam 88.

Extending longitudinally along the top side of quay 17 are the spaced girders 98 and 99 supported, respectively, from corner columns 86 and 87. For this purpose, the corner column 86 has welded to its coplanar flanges a right angle adapter 100 so as to present the flange 101 thereof confronting the end of girder 98. Built-up stub-coupler 103 has its base portion welded along flange 101, the arrangement being such that girder 98 is secured to the upper end of stub-coupler 103 by way of connecting plate 104 which is welded between the adjacent flanges of each member. In like manner, the girder 99 is supported from the upper end of corner column 86.

As shown most clearly in FIG. 1, extending longitudinally along the bottom portion of the quay 17 are the built-up girders 106 and 107, which are similarly supported from the lower ends of corner columns 86 and 87, respectively. Bracing is provided along each side of the

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quay by truss framing, including L-beam columns 108 and L-beam diagonals 109. Columns 108 are welded between the upper girder 98 and the lower girder 106 on the inside flanges thereof; whereas, the diagonals 109 are secured between the outer flanges. To strengthen the top portion of the quay, horizontal truss framing is provided between girders 98 and 99. Referring to the inner end of the quay, it being understood that the strengthening arrangement for the outer end is identical, spaced outwardly from but parallel to the upper beam 91 is the L-shaped crossbeam 110 which is secured between the upper girders 98 and 99, as by gusset plates 111 and 112. This arrangement is such that the vertical flange at each end of the crossbeam is cut away so as to permit the corresponding horizontal end flanges thereof to be welded to the top side of the gusset plates which, in turn, are welded to the underside of the girder flanges. Welded to the underside of the outer horizontal flange of the upper end frame beam 91 is a gusset plate 116. Secured between gusset plate 116 and gusset plate 111 is an L-shaped counter 118, and secured between gusset plate 116 and gusset plate 112 is a counter 119, the manner of securing these counters being similar to the manner of securing of the crossbeam 110 so as to provide an even support for the quay planking 120.

To provide for coupling of each quay to the side of the walkway section, the projection bars 124 and 125 extend inwardly from the upper end of each of the corner columns 86 and 87, respectively, with the outer end of each bar being welded to the side flange 126 of one of the right angle adapters 100. Each of bars 124 and 125 is notched, as at 127, so that the adjacent vertical flanges of girder 42 are freely receivable therein, with the planking 120 of the quay being substantially coplanar with the walkway planking 62. Extending inwardly from the lower ends of the corner columns 86 and 87 are the retaining bars 130 and 131, each being removably secured by bolts 133 to the lower end of side flange 126 of one of the right angle adapters 100. Retaining bars 130 and 131 are so positioned as to extend over the lower girder 52 in the walkway section so as to preclude accidental release of the notched bars 124 and 125 from the upper walkway girder.

The flotation arrangement for each of the quays can more readily be seen by an inspection of quay 16 in FIG. 1. As shown, under the inner end of quay 16 is secured a flotation unit 18 by the straps 135 and 136 which are suitably secured between the lower quay girders 106 and 107. This arrangement is such that the straps merely pass over the flotation unit, being flexed upwardly by the buoyant force of the latter so as to retain it in proper position. Outwardly of flotation unit 18, a second flotation unit 19 is secured under the rigid quay framework, the arrangement being such that inner flotation unit 18 is positioned lower in the water than unit 19 so as to cause the notched bars 124 and 125 to bear upwardly in latching relation against the upper walkway girder 42.

In the practice of the invention each quay is preferably secured to the walkway section with the notched bars 124 and 125 on opposite sides of one of the truss framing columns 57. This permits the quay to be slidably positionable over a range of approximately its own width, with the frictional contact being sufficient to retain the quay wherever positioned. It will be noted, then, that the distance between adjacent quays may be varied approximately twice the width of each quay, so as to be readily adjustable to changing requirements. More extensive positioning of each quay may be obtained by removal of the lower retaining bars 130 and 131 so as to permit the upper notched bars 124 and 125 to be unlatched from the upper walkway girder 42 and repositioned straddling another walkway side frame column 57. Rebolting of the retaining bars 130 and 131 in such new position along the side of the walkway section thereafter permits additional slidable positioning over a limited range with a

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minimum of effort, as above described. It will be recognized that this arrangement allows use of any number of quays, each of which can be readily positioned to permit accommodation of a maximum number of boats of various sizes.

To maintain the walkway properly positioned with respect to the shore from which it extends, anchor cables 138 and 139 are supported along opposite sides of the walkway, being secured by clamps 140 at the outer end of each walkway section. Referring more particularly to the clamps 140 on the near side of FIGS. 1 and 2, it can be seen that the side of the right angle adapter 44 on the outer end of walkway section 10 has welded thereto a bracket 141 to which the clamping U-bolt 142 is secured. Cable 139 is suitably secured at its inner end to the shore, passing through the clamps 140 on each section. At its outer end cable 139 passes through the outermost clamp 140 and downwardly into the water for securement to a suitable sea anchor on the bottom of the lake. In the practice of the invention, it may also be desirable to provide curbing beams, as at 143, at the outer ends of the quay and walkway planking, with each beam being suitably bolted to the colinear framework girder thereunder so as to retain the planking in position.

From the foregoing construction it can be seen that in each walkway section the height of the center of gravity above the water line is negligible when compared with the gross horizontal projected area of the section so as to provide for relatively high stability. It will further be recognized that several walkway sections may be connected together without interfering with the basic stability of any one section. In addition to this advantage of high stability, the arrangement for positioning of the quays greatly increases the versatility of the docking facility since the slips may be readily adjusted to provide docking for the maximum number of boats by properly grouping the boats according to size. Furthermore, while the structure provides an immediate answer to the docking of boats, it may be adapted to any use where a floatable load bearing structure which partially encloses water is required.

From the foregoing it will be apparent that I have provided a new and improved open slip facility which is well adapted to fulfill the aforesaid objects of the invention. Moreover, whereas the invention has been disclosed with respect to a certain embodiment which gives satisfactory results, it will be understood by those skilled in the art to which the invention most nearly appertains, that other embodiments and variations thereof may be provided within the spirit or scope of the invention as defined by the appended claims.

I claim:

1. In an open slip facility, a floatable walkway section, a floatable quay, and means on said quay for selectively coupling said quay normal to said walkway and engaging one side thereof, said means including a latch member so constructed and arranged as to prevent appreciable movement of said quay in the normal direction while permitting relocation of the position of said quay along said side.

2. In an open slip facility, a walkway section, a floatable quay section arranged normal to said walkway section in end-to-side relationship, and a coupling member joining said end of said quay section to said side of said walkway section, said coupling member including a horizontal straight rigid side member disposed longitudinally of said walkway and carried by one of the aforesaid sections, a latch member arranged normal to said side member and carried by the other section, said latch member being engageable with said side member for preventing appreciable movement of said quay section toward and away from the side of said walkway section, said latch member being movable along said side member to a plurality of positions.

3. In an open slip facility, a walkway section, a float-

able quay section arranged normal to said walkway section in end-to-side relationship, a coupling member joining said end of said quay section to said side of said walkway section, said coupling member including a horizontal straight rigid side member disposed longitudinally of said walkway and carried by one of the aforesaid sections, a latch member arranged normal to said side member and carried by the other section, said latch member being engageable with said side member for preventing appreciable movement of said quay section toward and away from the side of said walkway section, said latch member being movable along said side member to a plurality of positions, and means for urging said latch member into engagement with said side member in all positions of said side member.

4. In an open slip facility, a floatable walkway section having a side member, a floatable quay, and means selectively coupling said quay normal to said walkway section, said coupling means including spaced projections extending from said quay slidably engaging said side member so as to be movable therealong, said projections being so constructed and arranged as to prevent appreciable movement of said quay toward and away from said walkway section, said projections being disengageable from said side member upon downward movement of said quay, said quay having a flotation unit adjacent said coupling means, said flotation unit being of such buoyancy in water as to urge said projections upwardly into engagement against said side member.

5. In an open slip facility, a floatable walkway section having upper and lower elongate side members, a floatable quay, and means on said quay selectively coupling said quay normal to said walkway section, said coupling means including spaced latching bars slidably engaging said upper side member, said coupling means further including a set of spaced retaining bars cooperating with said lower side member so as to maintain said latching bars in engagement with said upper side member.

6. In an open slip facility, a floatable walkway section having upper and lower elongate side members, a floatable quay, and means on said quay selectively coupling said quay normal to said walkway section, said coupling means including a set of spaced latching bars slidably engaging said upper side member, said coupling means further including a set of spaced retaining bars cooperating with said lower side member so as to maintain said latching bars in engagement with said upper side member, said quay having a flotation unit adjacent said coupling means, said flotation unit being of such buoyancy in water as to urge said latching bars upwardly against said upper side member.

7. Apparatus as set forth in claim 6 including means for removably securing said retaining bars to said quay so as to permit said latching bars to be disengaged from said upper side member.

8. In an open slip facility, a floatable walkway section having a generally rectangular rigid framework, said framework including upper and lower side frame members, a floatable quay having a generally rectangular rigid framework, and means on one end of said quay framework selectively coupling said quay to said walkway section, said coupling means including a set of spaced latching bars slidably engaging said upper side frame member, said coupling means further including a set of spaced retaining bars cooperating with said lower side frame member so as to maintain said latching bars in engagement with said upper side member, said quay having a first flotation unit under one end of said quay framework, said quay having a second flotation unit under said framework spaced outwardly from said first unit, said first and second flotation units being such that said first flotation unit exerts a greater buoyant force in water than said second flotation unit so as to urge said latching bars upwardly against said upper side frame member.

9. Apparatus as set forth in claim 8 including means for removably securing said retaining bars to said quay so as to permit said latching bars to be disengaged from said upper side member.

10. In an open slip facility, a walkway having a plurality of floatable walkway sections secured rigidly together in end-to-end configuration, a plurality of floatable quays, and means on each of said quays for coupling with said walkway, said coupling means including a latching member selectively engaging one of said walkway sections so that adjacent quays on the same side of said walkway may be positioned with respect to each other to determine the size of the open slip formed therebetween, said coupling members being so constructed and arranged as to prevent appreciable movement of said quays toward and away from the side of said walkway while permitting adjustment of the position of said quays longitudinally of said walkway.

11. In an open slip facility, a walkway having a plurality of floatable walkway sections secured rigidly together in end-to-end configuration, a plurality of floatable quays, and means for selectively coupling each of said quays to said walkway, said coupling means including spaced latching bars slidably engaging one of said walkway sections so that adjacent quays on the same side of said walkway may be selectively positioned with respect to each other to vary the size of the open slip formed therebetween, said coupling members being so constructed and arranged as to prevent appreciable movement of said quays toward and away from the side of said walkway while permitting adjustment of the position of said quays longitudinally of said walkway.

12. In an open slip facility, a walkway having a plurality of floatable walkway sections rigidly secured together in end-to-end fashion, each of said walkway sections having a plurality of flotation units secured thereunder in such manner as to render each of said sections stable in water about both its longitudinal and transverse horizontal axes, a plurality of floatable quays each having a plurality of flotation units thereunder arranged to render each of said quays stable in water only about its transverse horizontal axis, and means on one end of each of said quays releasably coupling said quays to said walkway sections so as to render each of said quays stable in water about its longitudinal horizontal axis, said coupling means having a latching member in longitudinally slidable engagement with one of said walkway sections, said coupling means being so constructed and arranged as to prevent appreciable movement of said quays toward and away from said walkway while permitting relocation of said quay longitudinally of said walkway.

13. In an open slip facility, a generally rectangular floatable walkway section having flotation units thereunder arranged to make said section stable in water about both its longitudinal and transverse horizontal axes, a generally rectangular floatable quay having flotation units thereunder arranged to make said quay stable in water only about its transverse horizontal axis, and means on said quay selectively coupling said quay to said walkway section so as to render said quay stable in water about its longitudinal horizontal axis, said means being so constructed and arranged as to prevent appreciable movement of said quays toward and away from said walkway while permitting relocation of said quay longitudinally of said walkway.

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