Nov. 18, 1969 J. W. BETHUREM 3,478,710

FLOATING DOCK STRUCTURE

Filed July 31, 1968 2 Sheets-Sheet 1

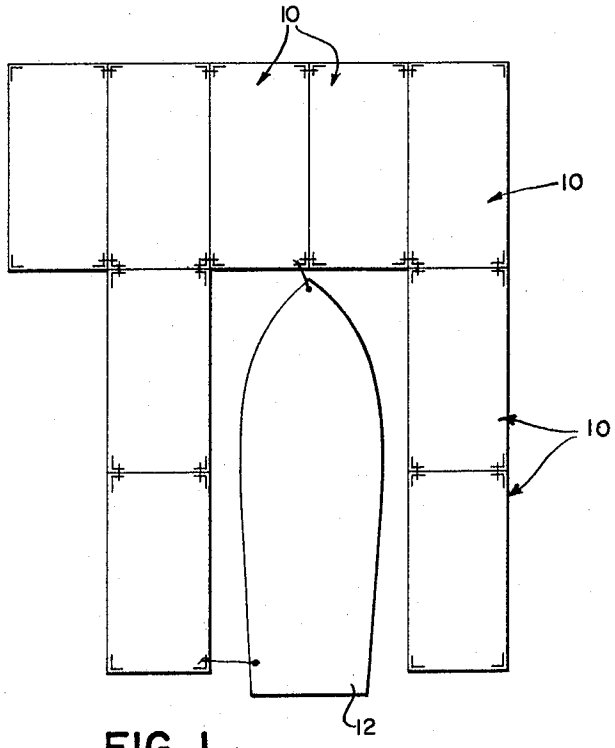


FIG. 1

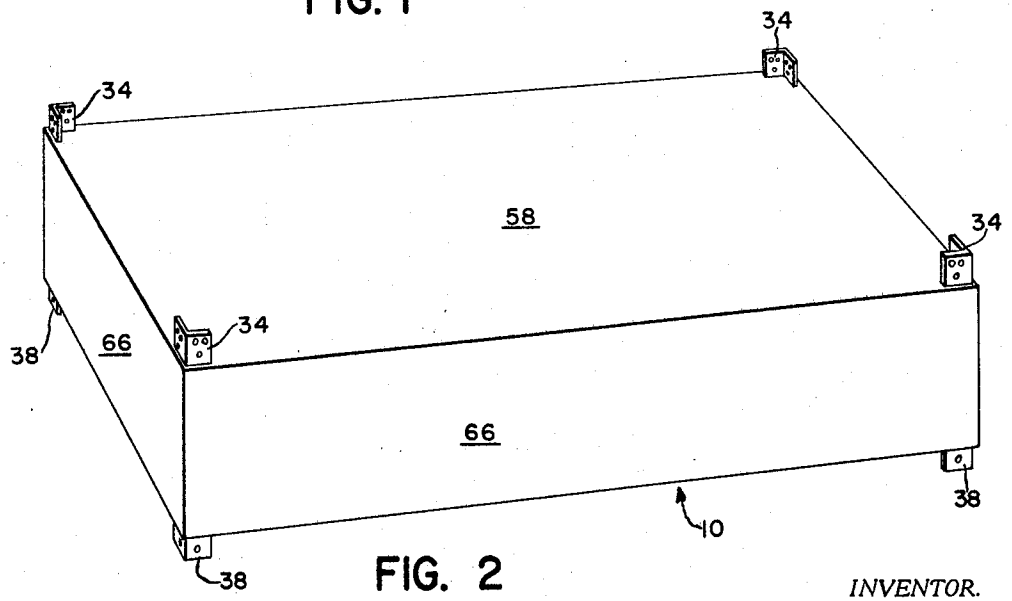


FIG. 2

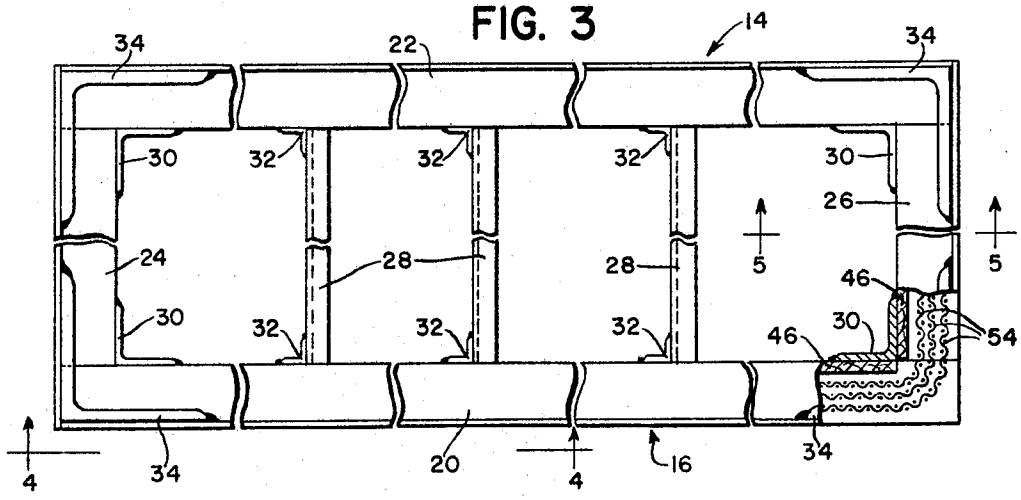
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FIG. 3



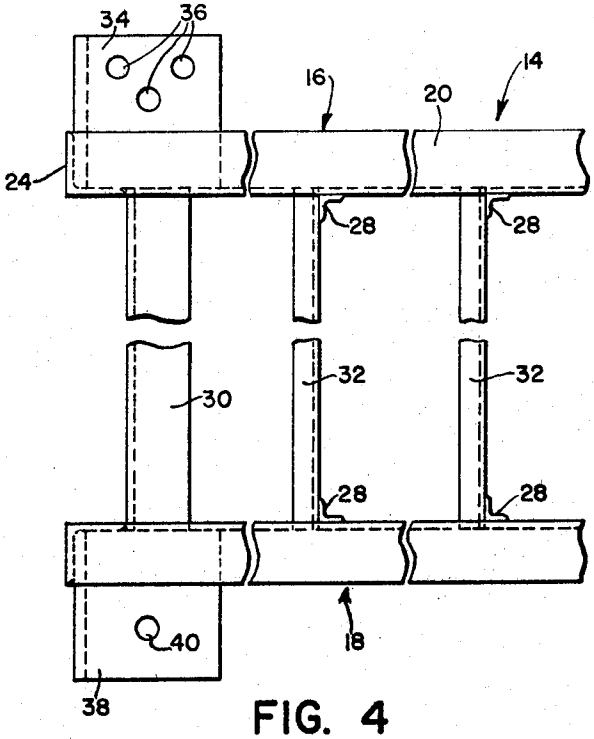


FIG. 4

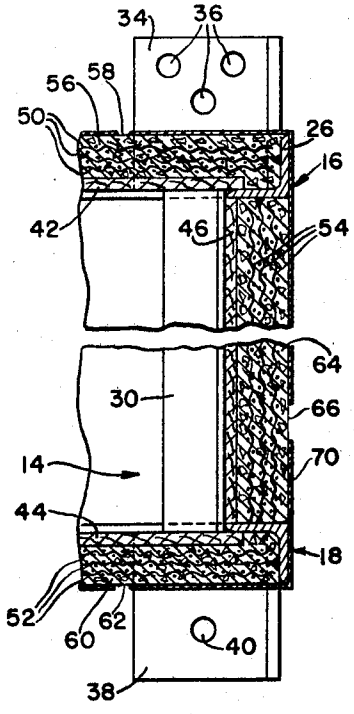


FIG. 5

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FLOATING DOCK STRUCTURE

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ABSTRACT OF THE DISCLOSURE

A floating concrete dock is formed by connecting a number of identical, hollow, box-like concrete structures in the desired pattern. The individual structures are formed by providing a rigid welded steel frame having rectangular top, bottom and sides, securing panels to the frame interior to form a core, placing reinforcing wire around the core, and pouring high density concrete around the core, while utilizing the frame elements as the concrete forms.

Background of the invention

This invention relates to an improved concrete floating dock structure.

While concrete floating dock structures have not attained widespread use, they are known. Such docks offer obvious advantages, since they are impervious to various corrosive factors, which affect wood or metal docks. Also, concrete itself is a relatively inexpensive material and can provide a strong and durable structure.

However, the weight of the concrete presents a serious drawback, and if sufficient concrete were to be used to provide a strong and durable structure, the dock would be extremely heavy and difficult to transport and move, and also it would draw too much water. While some attempts have been made to overcome the problems associated with concrete docks, the solutions have resulted in docks which are difficult and expensive to manufacture, excessively heavy, or of insufficient strength and durability.

Summary of the invention

According to the present invention, a relatively lightweight, very strong concrete floating dock structure is provided which is relatively easy and inexpensive to manufacture and is easily attachable to similar structures to form a flexible and durable boat dock.

More specifically, the dock structure is provided with a strong, rigid frame to which a relatively thin outer shell of reinforced concrete is attached to provide a relatively lightweight hollow structure.

Another feature of the invention resides in the fact that the frame forms a portion of the dock exterior and is used both as a portion of the forms for pouring the concrete and as a means for supporting the remainder of the forms during the pouring operation.

Still another feature of the invention resides in the provision of posts for mooring boats to the dock or for connecting the dock units to one another, the post being rigidly attached to the frame.

Brief description of the drawings

FIGURE 1 is schematic plan view of a dock formed by connecting a number of the individual dock structures.

FIGURE 2 is a perspective view of the floating dock structure.

FIGURE 3 is a top plan view of the dock structure frame with intermediate portions of the frame removed and showing a corner of the frame in section with the side panels of the core and side reinforcing means also shown in section.

FIGURE 4 is a partial side elevation view of one corner of the frame, with intermediate portions of the frame members removed, as seen along the line 4—4 of FIGURE 3.

FIGURE 5 is a partial vertical section through the completed dock structure as viewed along the line 5—5 of FIGURE 3.

Description of the preferred embodiment

In the drawings, each individual floating dock unit is indicated generally by the numeral **10**. As best seen in FIGURE 1, a number of the individual units can be connected to form a floating dock to which a boat **12** may be tied. As is apparent, the individual units can be connected in a wide variety of relationships to form a dock of almost any configuration with almost any desired number of individual slips of variable sizes.

Each box-like dock structure **10** has a rigid metal frame, indicated generally by the numeral **14**, including horizontal rectangular top and bottom portions **16** and **18** respectively, formed by conventional steel angle irons. The top portion **16** has opposite side members **20** and **22**, which are preferably 8 feet in length, and opposite end members **24** and **26**, which are preferably 4 feet in length, and the members are welded to one another at their ends to form an approximate 4 foot by 8 foot rectangle with the vertical leg of each member at the outside of the frame portion and the horizontal leg of each member extending from the lower end of the vertical legs. The bottom frame portion **18** is identical to the top portion **16** except that it faces downwardly so that the horizontal legs of the angle iron members extend from the top of the vertical legs. The frame portions **16** and **18** also include three horizontal braces **28** rigidly interconnecting the side frame members **20** and **22** at approximately equal intervals.

Four upright corner members **30** rigidly connect the top and bottom frame portions at their four corners, the members **30** being formed by the same size angle iron as the members **20**, **22**, **24** and **26** and being welded to the interior edges of the horizontal legs of the frame members with their opposite ends flush with said horizontal legs. As best seen in FIGURE 3, the corners of the upright members **30** face outwardly and fit into the corners formed by the intersecting frame members **20**, **22**, **24** and **26**. Upright braces **32** also rigidly interconnect the top and bottom frame portions adjacent to the connection of the horizontal braces **28** with the frame member **20** and **22**.

A corner post **34** is welded to and extends upwardly from each of the four corners of the top frame portion **16**. Each corner post **34** is formed by an upright, relatively short piece of angle iron, the corner of which fits into the corner formed by the intersecting vertical legs of the angle iron frame members **20**, **22**, **24** and **26** and the bottom of which rest on the top of the horizontal legs of said members. Both legs of each corner post are provided with three triangularly arranged holes **36**, which accommodate suitable fasteners for securing the individual dock structures **10** to one another.

Similarly a bottom corner post **38** is attached to and projects downwardly from each corner of the bottom frame portion **18**, the bottom posts **38** being identical to the posts **34** except that they are provided with a single hole **40** in each leg.

A 4 foot by 8 foot panel **42** is disposed within the recess of the top frame portion **16** and is supported by the horizontal legs of the frame members **20**, **22**, **24** and **26** and the horizontal braces **28**. The panel **42** is preferably formed by a standard 4 by 8 foot sheet of relatively inexpensive building material such as ¼ inch ply-

wood, fiberboard, plasterboard or the like, and is spaced a short distance from the upright legs of the frame members, the frame being slightly larger than 4 by 8 feet. A bottom panel **44** is similarly disposed in the recess of the bottom frame portion **18**, and four upright side panels **46** of the same material as the panels **42** and **44** extend between the top and bottom frame portions exteriorly adjacent to the corner members **30** and the vertical braces **32**, so that the top and bottom panels **42** and **44**, and the side panels **46**, in conjunction with the frame members form a closed, hollow, box-like structure or core. Preferably the upright members **30** are 1⅓ foot long so that each side panel **46** is 1⅓ foot high, whereby the two 4 foot by 1⅓ foot side panels and the two 8 foot by 1⅓ foot panels can be made from a single standard 4 x 8 foot sheet of material.

Three layers of reinforcing wire mesh or screen **50** are disposed within the recess formed by the top frame portion **16** on top of panel **42**, each layer of wire mesh substantially spanning the length and width of the frame. In the illustrated embodiment the middle layer of wire mesh is welded to the top frame portion **16** to anchor the reinforcing wire mesh. Similarly, three layers of wire mesh **52** are disposed within the recess formed by the bottom frame portion **18**, the middle layer again being anchored to the frame. Also, three similar layers of reinforcing wire mesh **54** are wrapped around the four upright sides of the box-like core exteriorly of the side panels **46** but interiorly of the exterior sides of the top and bottom frame portions, the middle layer of wire mesh **54** again being welded to the top and bottom frame portions.

The recess formed by the top panel **42** and the top frame portion **16** is then filled with a layer of high density concrete **56**, the concrete **56** being poured into the recess while the frame is resting on the four bottom posts **38**, and filling the interstices between the reinforcing screens **50**, which become imbedded in the contract. Thus, the panel **42** and the top frame portion function as a form for the concrete **56**, which is finished off so that its top surface **58** is flush with the upper edge of the top frame portion **16**, which provides a striking surface for the concrete. As is apparent, the top corner post **34** projects upwardly thru the concrete, which seals against the corner posts and the vertical legs of the frame members. A sealing material can be provided on the frame member to assure adequate sealing.

After the concrete **56** is sufficiently set, the frame is turned over, and the above procedure is repeated, filling the recess in the bottom frame portion **18** with a layer of concrete **60** having an outer surface **62** flush with the ends of the vertical legs of the frame members.

After the concrete bottom is sufficiently set, an integral layer of concrete **64** is poured around the four upright sides exteriorly of the side panels **46** and between the top and bottom frame portions **16** and **18**. The concrete sides **64** are imbedded in the reinforcing screens **54** and have outer surfaces **66** flush with the exterior vertical legs of the frame members. The sides **64** are preferably poured in one operation without drying intervals for the individual sides to provide an integral concrete structure. This is accomplished by securing flat retainer panels (not shown) against the exterior of the frame portion to hold the concrete against the side panel **46** before the particular side is turned from a horizontal position. The retainer panel is conveniently secured to the frame by means of bolts extending through the holes **36** and **40** in the corner post members. After the retainer panel is bolted to the frame, the structure is rotated 90° and the procedure is repeated, until all four upright sides are poured.

When the concrete sides **64** are sufficiently set, the side retainer panels are removed and the concrete is cured. After the concrete is cured, the entire outer surface of the dock structure, which includes the outer surface **58** of the concrete top layer **56**, the outer surface **62** of the bottom concrete layer **60**, the outer surface **66** of the concrete sides **64**, and the exterior sides of the top and bottom frame portions, is coated with a layer **70** of moisture imprevious material. In the preferred embodiment, an epoxy paint is applied to the exteiror and provides a moisture resistant, tough, and durable finish. Preferably, at least the upper surface **58** is provided with a textured finish to minimize individuals slipping on the dock structure when it is wet.

The individual dock units **10** can be fastened to one another by means of conventional bolts extending through the holes **36** and **40** in adjacent units to provide an overall dock of almost any desired configuration with 4 and 8 foot increments in size. The upright corner posts **34** also provide convenient means for securing boats to the dock or for the attachment of a canopy or other structure to the dock. Since the connection between the individual units or between the dock and other objects is accomplished through the corner posts, which form an integral part of the frame, the stresses on the dock unit are all taken by the strong and rigid frame. Thus, since the concrete does not receive substantial stress, it need not be excessively thick, so that the dock units are relatively light weight. As is apparent from the above, commercially available, relatively inexpensive materials are used to construct the dock units, so that the units are relatively inexpensive despite their high strength, light weight, and durable construction.

I claim:

1. A floating dock structure comprising: a rigid metal frame including similar, polygonal, generally horizontal and parallel top and bottom portions and a plurality of upright members rigidly connecting the top and bottom portions; panel means connected to the frame and forming a substantially closed, hollow core in conjunction therewith and a concrete, outer shell disposed around said core, and connected to the frame to form in conjunction with the frame a closed hollow structure having an outer surface with parallel horizontal top and bottom walls and upright side walls connecting the top and bottom walls, said structure forming an interior closed chamber adapted to provide sufficient buoyancy in water to float said structure with the top wall above the water.

2. The invention defined in claim **1** and including a plurality of post members rigidly attached to the frame and projecting outwardly therefrom beyond the outer surface of the outer shell.

3. The invention defined in claim **1** and including reinforcing means imbedded in the concrete outer shell and connected to the frame.

4. The invention defined in claim **1** wherein at least a portion of the frame is flush with the outer surface of the concrete shell, so that the frame and the concrete outer shell conjunctively form the outer surface of said closed hollow structure.

5. The invention defined in claim **4** wherein the upper frame portion is rectangular and includes four members joined at their ends, the members having L-shaped cross sections with upright and horizontal legs, the upright legs forming a portion of said outer surface side walls and the horizontal legs being spaced interiorly from the outer surface of top wall.

6. The invention defined in claim **5** and including a plurality of upright post members rigidly attached to and extending upwardly from the upper portion frame members and projecting upwardly above the outer surface of the outer shell top wall.

7. The invention defined in claim **5** wherein the bottom frame portion has the same configuration as the top frame portion and includes four frame members joined at the ends and having L-shaped cross sections with upright legs extending downwardly from the horizontal legs and forming a portion of the outer surface of the side walls, and the upright members connect the top and bottom frame portions at the four corners and are spaced inwardly from the outer surface of the outer shell.

8. The invention defined in claim 7 wherein the panel means includes top and bottom panels respectively supported on the horizontal portions of the top and bottom frame members and four upright side panels supported on the upright frame members.

9. The invention defined in claim 8 and including at least one layer of reinforcing wire outwardly adjacent to the top and bottom panels respectively and imbedded in the concrete outer shell and at least one layer of reinforcing wire wrapped around the four upright side panels exteriorily thereof and imbedded in the concrete outer shell.

10. The invention defined in claim 9 and including a relatively thin coating of moisture impervious material applied to the outer surface of the outer shell.

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TRYGVE M. BLIX, Primary Examiner