

"FLOATABLE SUPPORTS"**TECHNICAL FIELD OF THE INVENTION**

THIS INVENTION relates to floatable supports such as pontoons, floatable walkways, piers, jetties and the like and particularly to floatable supports suitable for use in the construction of a multiple berthing facility commonly known as a marina.

BACKGROUND ART

Floatable supports usually employ a deck and a float beneath the deck, the float supporting the deck above the water. The float can employ an air filled cavity or a suitable lighter than water material to give the required floatation. One known pontoon is formed from a block of expanded polystyrene encapsulated in concrete.

The known pontoon is generally rectangular in plan having a reinforced concrete deck formed integral with concrete side walls and a base. When the pontoon is being constructed the block of polystyrene is located in a mould and the deck, side walls and base are poured into the mould to encapsulate the block of polystyrene. The pontoon can be secured to adjacent similar pontoons to form a floating walkway. A major disadvantage of this pontoon construction is that with the passage of time the concrete side walls crack and can separate from the deck. Ultimately the concrete can separate from the block of polystyrene so that the side walls and base simply fall away from the rest of the pontoon. Cracks or fractures leave the polystyrene prone to infestation by marine fauna including burrowing crabs and other crustacea.

Another problem is that in order to cater for different shapes, individual moulds must be made.

The pontoon is also expensive to construct and is inconvenient to transport from the workshop.

OUTLINE OF THE INVENTION

It is an object of the present invention to alleviate

at least to some degree the problems associated with the prior art.

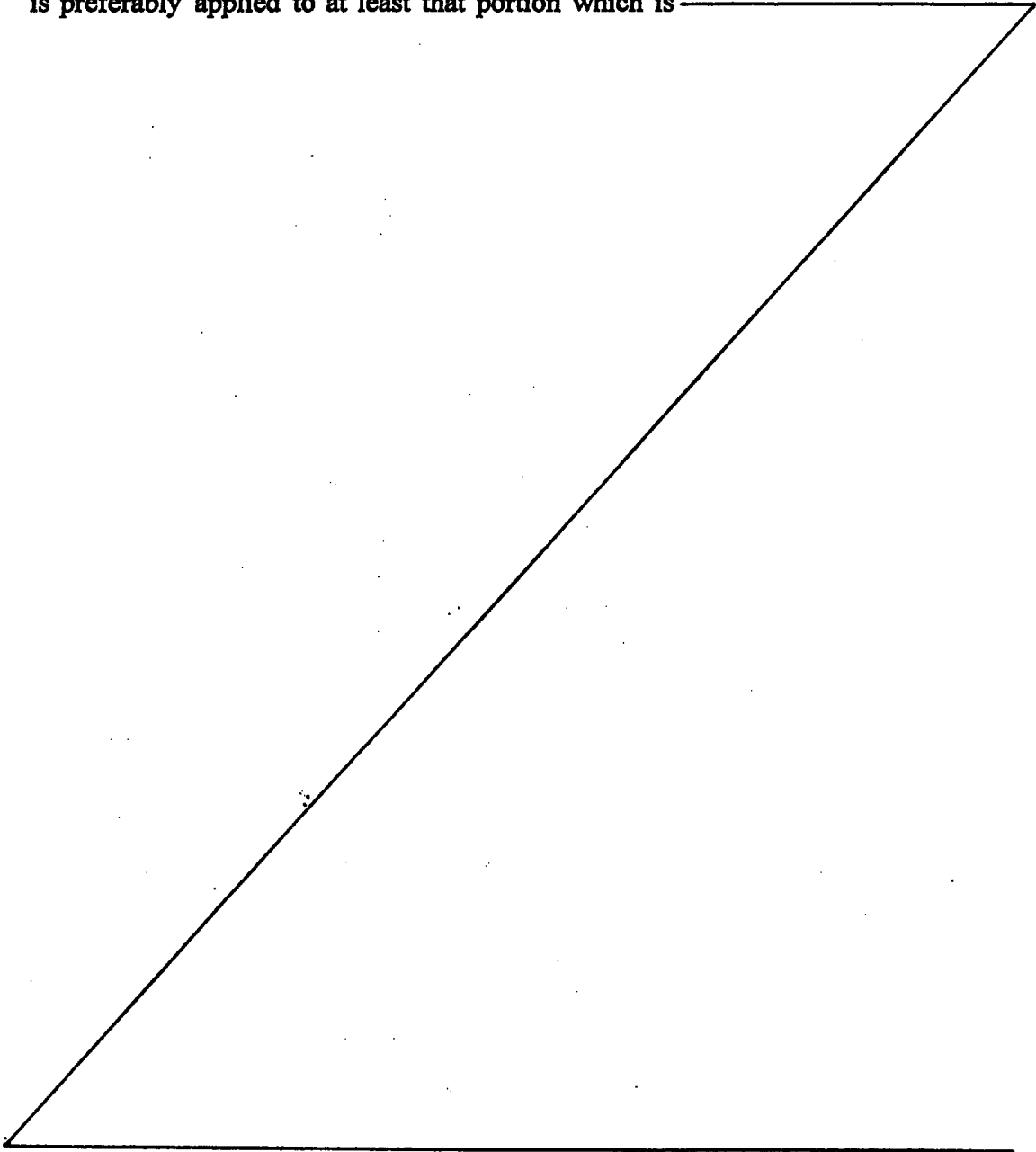
In one aspect therefore, the invention resides broadly in a floatable support including a deck, a float beneath the deck, the float being made of expanded polystyrene and supporting the deck, the float having an external surface having a protective coating applied after shaping the polystyrene and covering a major portion of the external surface of the float, the protective coating being so chosen and arranged that its thickness and character is selected to minimise material used in the coating by providing the coating as a thin layer which is also stable against infestation by burrowing marine fauna when tested in a marine environment, the deck comprising a prefabricated concrete slab or prefabricated timber deck having a float locating recess or protrusion in an underside surface of the slab or timber deck whereby the float is positively located beneath the deck.

The deck can be of any shape and can be fabricated from any suitable material such as concrete or timber. One preferred deck comprises a prefabricated concrete slab having float locating recesses or protrusions in an underside surface of the slab. In another preferred form, the deck can comprise a partly or wholly wooden frame where the locating recesses or protrusions are formed as part of the frame.

The float can be of any shape. The float can comprise a block of expanded polystyrene or other suitable floatation material. The float can be secured to the deck or can be held in place by the weight of the deck. The float can include a locating means co-operable with the float locating recesses or protrusions in order to positively locate the float beneath the deck.

The protective coating or membrane can be pervious, semi-pervious or impervious to water. For example, an open weave mesh fabric can be employed or

a fibreglass reinforced epoxy coating can be employed. Alternatively, a spray coating can be applied as a liquid or hardenable paste such as a spray concrete or plaster or the like. Suitable wetting agents or other additives may be employed in the coating material to improve its adhesion, flow characteristics and/or its reaction to a marine environment. Any other lightweight coating which can be applied in sheet form, sprayed, painted, rolled or otherwise applied can be employed. The coating or membrane can be applied to the entire external surface of the float but is preferably applied to at least that portion which is



to be submerged.

In normal use a floatable support according to the invention will be only partially submerged and therefore the submerged portion will be subjected in general, to different environmental damage than that portion which is normally above water level. For example, the submerged portion or that portion between high and low water levels is more likely to be damaged by marine fauna, such as burrowing crabs and other crustacea, than the portion above water level. By contrast, the portion above water level is likely to age quicker as a result of greater exposure to sunlight and is also more likely to be vandalised than the submerged portion.

It is therefore preferable that surface portions likely to be vandalised be provided with a coating which deters or resists acts of vandalism. The applicant has discovered that a rigid coating is more preferable in this regard and in particular a coating which generally simulates the external appearance and feel associated with solid concrete is particularly useful as a deterrent to vandals. Advantageously, those surface portions of the float which in normal use are accessible to vandals can be provided with a rigid coating whereas those surface portions of the float which are inaccessible to vandals can be provided with the same or a different coating. In one embodiment it is preferred for at least the uppermost surface portions or those surface portions normally above water level to be provided with a rigid concrete-like coating.

In one form the rigid coating is preferably a modified mortar or an acrylic cement the major components of which include cement, sand, acrylic, non-foam chemicals, wetting agent, and freeze/thaw ingredients. One particularly preferred coating material is available under the trade name "Aegis white fine multi-surface protector" available from Durus (Aust) Pty Ltd of 2 /19 Aranda Street, Slacks

Creek, Queensland, 4127, Australia. The Aegis multi-surface protector is a two part product being packaged as 25 kilograms (dry mix) and a 1.9 litre "chemical" mixture. The Aegis multi-surface protector can be applied directly to polystyrene without any surface preparation other than providing a clean dry surface prior to application. After the two part mixture is combined it is a simple matter to spray a layer of the mixture utilising a hopper gun to provide a coating between 1.5 to 3mm and preferably an average thickness of approximately 2mm. The type of coating afforded by this product is a concrete like finish which resists normal "finger pressure" but can be fractured by a high percussion or heavy impact such as may be provided by a hammer or the like.

While rigid coatings have the advantage of deterring vandals, they suffer from a number of disadvantages. For example a rigid coating is more likely to fracture or crack than a relatively more flexible coating. While cracks and fractures can be tolerated, that is small scale invasion by marine fauna is unlikely to severely effect the float, it would be preferable to, if possible reduce the incidence of cracks or fractures, particularly below water level or between tide levels. In some circumstances for example, on submerged portions of the float or where the float may be subjected to flexing during normal use a more flexible coating is preferred.

The applicant has spent much time and performed many trials in the marine environment testing various coating materials with varying degrees of success. The coating materials mentioned below are arrived at as preferred coatings from the experiment conducted by the applicant and have been found stable in the marine environment when applied as a thin layer.

One suitable coating is available from A V Syntec Pty Ltd of 15-21 Argon Street, Carole Park, Queensland, 4300, Australia, under the manufacturer's product numbers "SFC

789 A" (Styrofoam Coating 789) (Liquid) and "SFC 789 B" (Styrofoam Coating 789) (Powder). This product differs from the Aegis multi-surface protector insofar as it provides a more flexible and deformable membrane and in general can be applied as a thinner coat. Whereas it is preferred that the Aegis white fine be sprayed as a 1.5 - 3mm coating the A.V. Syntec Product can be applied as a 1 - 1.5mm coating. The type of coating afforded by this product is such that for a 1 - 2mm layer finger pressure can cause limited deformation of the underlying polystyrene without breaking the coating.

Another coating which is particularly suitable is a structural urethane spray such as INSTAMOLD available from Indmark Pty Ltd of 24 Sandgate Road, Breakfast Creek, Queensland, 4010, Australia. This product can be sprayed as a two part mixture to a thickness of 1.5mm to 3mm although thicknesses of up to 5mm or more can be used, although at greater expense. INSTAMOLD is a 100% solids, fast reacting system designed to produce high density rigid polyurethane. It is suitable for "spray up" applications usually in conjunction with an aliphatic in-mould coating and produces articles with similar properties to glass fibre reinforced polyester.

Typical properties of INSTAMOLD are as follows:

Typical Physical Properties of Cured Material

Tensile Strength:	60-65 MPa (ASTM D412, 50 mm/min)
Elongation:	6 - 7%
Flexural Modulus:	3200 MPa (ASTM D790)
Density:	1150 kg/m ³
Heat Distortion Temp:	86 - 87°C (ASTM D648 - 1820 kPa)
Surface Hardness:	75 - 80 Shore D

Typical Liquid Properties @ 21°C

	Part A (Isocyanate)	Part B (Resin)
Viscosity (Brookfield)	200-300 cP	950-1050 cP
Specific Gravity	1.22	1.18

Typical Reaction Data

Mixing Ration A:B by volume. 1:1

		Laboratory	Machine
	Reaction profile (@21°C)	Hand Mix	Mixed
5	Set Time (secs)	14-18	5-20

The applicant has found that when applied as a thin coating to polystyrene, INSTAMOLD is fairly flexible in a manner similar to the abovementioned A.V. Syntec product.

Floatable supports according to the invention can be utilised singly or can be coupled together to form extended floatable supports such as walkways and the like and as a consequence of the present invention, assembly can be made on-site and transportation costs can be reduced considerably when compared to the prior art. Likewise, as a result of the simplicity of the present invention, construction times are significantly reduced. In order to facilitate connection to an adjacent support the deck of a floatable support preferably includes coupling means. The coupling means can comprise a hinge or part of a hinge secured to the deck so adjacent supports can be coupled for relative movement. Alternatively, the coupling means can be a bracket or rail secured to and bridging between adjacent floatable supports in order to secure the supports together. The bracket or rail can be made of material having high or low elasticity depending on whether a rigid or flexible coupling is required. One or more brackets or rails can be employed to couple adjacent supports together.

In long walkways where a flexible coupling is required wooden rails are preferred. The rails can be connected to the floatable supports using suitable fasteners. It is preferred that opposite sides of the deck be equipped with spaced holes or protruding bolts or rods so that rails can be fastened to the opposite sides of the deck. The holes are preferably through holes spaced along each of the opposite sides of the deck and extending the full width of the deck so that each through hole can accommodate a

threaded bolt which can be a common fastener for the rails of opposite sides of the deck.

5 In another aspect, the invention resides in a floating walkway including a plurality of adjoining pontoons, a finger coupled to and extending from the pontoons to enable access to respective boat moorings adjacent the finger, the pontoons and the finger comprising floatable supports as described above. The walkway can include a plurality of fingers located at spaced intervals along the pontoons.

10 Preferably, the walkway pontoons each have a concrete deck slab while the deck of each finger can be made from concrete or in part or wholly as a wooden framework. Each finger preferably comprises a unitary deck rigidly cantilevered to the walkway and supported adjacent its free
15 end by at least one float. The deck of each finger preferably includes an elongate upper panel, a lower frame member spaced from the panel and bridging members extending between the panel and the lower frame member. The frame preferably includes legs or side rails extending below the
20 lower frame member so that the float of the finger is positively located between the rails and beneath the deck.

Each walkway pontoon or each finger can be supported by a single float. Alternatively, each pontoon or finger can include spaced floats having a total surface area in
25 plan equal to between 50% to 70% of the total surface area in plan of the pontoon or finger as the case may be. Preferably, the surface area ratio in plan of float area to walkway area is approximately 2:3.

BRIEF DESCRIPTION OF THE DRAWINGS

30 In order that the invention can be more readily understood and be put into practical effect, reference will now be made to the accompanying drawings and wherein:

Figure 1 is a perspective view illustrating a floatable support constructed in accordance with the
35 present invention;

Figure 2 is a plan view illustrating in part a marina

having a walkway and fingers employing floatable supports according to the invention;

Figure 3 is a cross-section (not to scale) through 3-3 of Figure 2;

5 Figure 4 is a cross-section (not to scale) through 4-4 of Figure 2.

Figures 5 and 6 are respective plan and end views illustrating a further embodiment of the present invention; and

10 Figures 7 and 8 are respective plan and end views illustrating a still further embodiment of the present invention.

METHOD OF PERFORMANCE

Referring to the drawings and initially to Figure 1
15 there is illustrated a floatable support which in this case is a pontoon 10 including a deck 11 supported by a pair of spaced floats 12 positively located beneath deck 10, each float includes a thin protective outer coating or membrane 13 (see Figure 3) covering at least a portion of the
20 external surface of each float. In the illustrated embodiment the coating or membrane covers all exposed surfaces of each float. Thus the surface in contact with the deck is not covered. In some cases it may be preferable to cover the entire external surface of a float.

25 The float is preferably an expanded polystyrene block and the coating or membrane is preferably thin spray applied concrete, a watertight fibreglass reinforced epoxy, or spray urethane but the applicant has found that an open mesh fabric such as shade cloth is also effective to
30 provide protection and long life in a marine environment. In the illustrated embodiment the coating or membrane is approximately 3mm thick but can be thicker or thinner depending on the material employed for the coating.

In order for the pontoon to be coupled to similar
35 adjacent pontoons or other floatable supports the deck 11 is provided with spaced holes 14 in opposed sides 15 so

that a bridging rail or bracket can be secured to the deck using suitable fasteners.

Referring to Figure 2 there is illustrated in plan view a marina 16 which employs a plurality of floatable supports coupled together. A floating walkway 17 includes a plurality of pontoons 10 (of the type illustrated in Figure 1) coupled together using wooden rails 18 secured to and bridging between decks 11.

As can be seen more clearly in Figure 3 each deck 11 includes a locating recess 19 (shown in phantom in Figure 2) which includes inclined walls 20 co-operable with a locating chamfer 21 on a respective float 12 in order to positively locate each float 12 beneath the respective decks 11. In the illustrated embodiment a single recess is employed but a separate recess can be employed for each float 12.

In the illustrated embodiment the decks 11 are readily detachable from the floats 12 and are retained in position by virtue of the locating recesses 19, chamfers 21 and the weight of the concrete decks. This arrangement simplifies transportation and lends itself to on-site construction. As a number of deck sections can be coupled together and stacked on the bed of a truck the overall transportation costs are less and the load safer than was the case with prior art supports which had to be preassembled in total prior to transportation.

A plurality of fingers 22, which are each also floatable supports according to the invention, extend from the walkway at spaced intervals to enable access to respective boat moorings 23 adjacent each finger. The fingers 22 are rigidly secured to the walkway by corner brackets 24 so as to cantilever from the pontoons. As can be seen more clearly in Figure 4 each finger includes a deck 11' and spaced floats 12' located beneath the deck, the floats 12' having a protective coating or membrane 13' covering their respective exposed surfaces. The coating or

membrane 13' is similar to coating or membrane 13 of floats 12.

5 The deck 11' is made in part or wholly as a wooden framework including spaced panels which are preferably plywood panels 25 secured in spaced relationship by bridging frame members or beams 26 and side rails 27 to form a box-like structure. The framework of the deck 11' can be made from other materials or combinations of materials including metals, plastics, fibreglass reinforced epoxy, timber or concrete.

10 The rails 27 extend below the lower panel 25 to form a locating recess 28 so floats 12' can be positively located beneath deck 11'.

15 The floats 12' can be detachable from deck 11 or can be secured thereto by fasteners or by a suitable adhesive.

In the preferred embodiment the marina is made using decks 11 of steel reinforced concrete and decks 11' wholly of timber as a most economic construction having substantial advantages over the prior art.

20 A major advantage of the present invention is its flexibility. For example, in high flow environments by using the present invention, it is a simple matter to contour a block of polystyrene to any shape which will enhance stability of the pontoon and simply apply the coating as a spray. This gives unlimited variations on the possible float shapes and configurations of decks and fingers that can be employed. For example, Figures 5 and 6 illustrate a walkway pontoon 29 having a deck 30 beneath which are two floats 31 and 32. The floats 31 and 32 are spaced beneath the deck 30 and include respective contoured ends 33 and 34. The ends 33 and 34 include a tapered nose portion to promote laminar flow about the floats and thereby improve stability.

35 Figures 7 and 8 illustrate another embodiment wherein a walkway pontoon 35 including a deck 36 has a float 37 positioned therebeneath. The float has an inverted "V"

cut-out 38 to improve stability.

5 The float of Figures 7 and 8 has been found particularly suitable for use on figures whereas the float arrangement of Figures 5 and 6 has its major application to walkway pontoons.

10 Whilst the above has been given by way of illustrative example of the present invention many variations and modifications thereto will be apparent to those skilled in the art without departing from the broad ambit and scope of the invention as set forth in the appended claims.



CLAIMS

1. A floatable support including a deck, a float beneath the deck, the float being made of expanded polystyrene and supporting the deck, the float having an external surface having a protective coating applied after shaping the polystyrene and covering a major portion of the external surface of the float, the protective coating being so chosen and arranged that its thickness and character is selected to minimise material used in the coating by providing the coating as a thin layer which is also stable against infestation by burrowing marine fauna when tested in a marine environment, the deck comprising a prefabricated concrete slab or prefabricated timber deck having a float locating recess or protrusion in an underside surface of the slab or timber deck whereby the float is positively located beneath the deck.
2. A floatable support as claimed in claim 1 wherein the coating is selected from the following:-
 - (i) an open weave mesh fabric;
 - (ii) a glass fibre reinforced polyester;
 - (iii) an acrylic cement;
 - (iv) a flexible deformable membrane; or
 - (v) a spray urethane.
3. A floatable support as claimed in claims 1 or 2 wherein the float is partially submerged and the coating covers a submerged surface of the float.
4. A floatable support as claimed in any one of claims 1 to 3 wherein the float is contoured to enhance laminar flow of water about the submerged portion of the float.
5. A floatable support as claimed in claim 4 wherein the float has a tapered nose section at an end thereof.
6. A floatable support as claimed in claim 4 wherein the float has an inverted generally V-shaped cut-out extending along its undersurface to enhance the laminar flow about the float and to improve stability.
7. A floating walkway including a plurality of adjoining pontoons, a finger coupled to and extending from the pontoons to enable access to a boat mooring adjacent the finger, the pontoons and fingers each comprising a respective deck and floats made of expanded polystyrene supporting the respective decks, each float



having an external surface having a protective coating applied after shaping the polystyrene and covering a major portion of the external surface of the float, the protective coating being so chosen and arranged that its thickness and character is selected to minimise material used in the coating by providing the coating as a thin layer which is also stable against infestation by burrowing marine fauna when tested in a marine environment, the deck of each pontoon comprising a prefabricated concrete slab having a float locating recess or protrusion in an underside surface of the slab whereby the float of each pontoon is positively located beneath the deck, the deck of the finger comprising a partly or wholly wooden frame, the frame including float locating recesses or protrusions adjacent an underside thereof whereby the float of the finger is positively located beneath the deck of the finger.

8. A floating walkway as claimed in claim 7 wherein the coating is selected from the following:-

- (i) an open weave mesh fabric;
- (ii) a glass fibre reinforced polyester;
- (iii) an acrylic cement;
- (iv) a flexible deformable membrane; or
- (v) a spray urethane.

9. A floating walkway as claimed in claim 7 or claim 8 wherein each float is partially submerged and the coating covers a submerged surface of each float.

10. A floating walkway as claimed in claim 7 or claim 8 wherein the deck of the finger is rigidly cantilevered to the pontoons and supported adjacent its free end by its float, the deck of the finger comprises an elongate upper panel, at least one lower frame member spaced from the panel and bridging members extending between the panel and the lower frame member, legs or rails extending below the lower frame member, the float of the finger being located between the legs or rails and beneath the lower frame member.

11. A floating walkway as claimed in claim 7 or claim 8 wherein the floats have a total surface area in plan projection equal to between 50% to 70% of the total surface area in plan projection of the pontoons and finger.

12. A floating walkway as claimed in claim 7 or claim 8 wherein the ratio in plan of float area to walkway area is about 2:3.



13. A floating walkway as claimed in claim 7 to claim 8 wherein the deck of the finger is supported on a single float extending along a substantial portion of the length of the deck.
14. A floating walkway as claimed in claim 7, claim 8 or claim 13 wherein the decks of adjacent pontoons are coupled together by side rails bridging between the pontoons and the finger is coupled to one of said pontoons using rigid corner brackets bridging between the finger and the said one pontoon.
15. A floating walkway as claimed in claim 7 or claim 10 or claim 14 wherein one of said floats is contoured to enhance laminar flow of water about the submerged portion of the said one float.
16. A floating walkway as claimed in claim 15 wherein the contoured float has a tapered nose section at an end thereof.
17. A floating walkway as claimed in claim 15 wherein the contoured float has an inverted generally V-shaped cut-out extending along its undersurface to enhance laminar flow about the float and to improve stability.
18. A floatable support according to any one of claims 1 to 6 wherein the coating is 2mm-5mm thick.
19. A floating walkway according to any one of claims 7 to 17 wherein the coating is 2mm-5mm thick.



20. A floatable support substantially as herein described with reference to the accompanying drawings.

21. A floating walkway substantially as herein described with reference to the accompanying drawings.
