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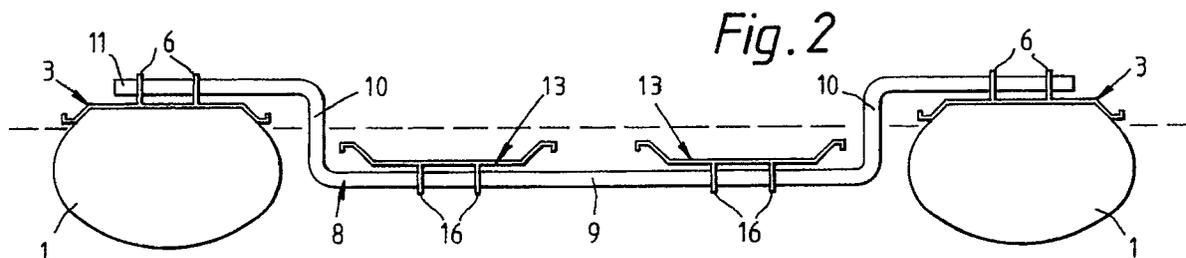
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54 Improved buoyant structure suitable for floating bridges.

57 A floating bridge structure consists of modules coupled together in a string either end to end or side by side depending on the nature of the stretch of water to be bridged. Each module comprises a spaced parallel pair of elongate internally compartmentalised inflatable floats (1) with respective elongate rigid platform members (3) attached along their tops and transverse connector members (8) extending between the floats (1) with their ends (11) releasably connected to the platform members (3). The connector members (8) are cranked so that their middle lengths (9) between the floats (1) lie submerged; and in the case where the modules are

coupled end to end with their floats (1) parallel to the length of the bridge structure, longitudinal track members (13) on which vehicles can run are mounted on the submerged middle lengths (9) of the connector members (8). In the case where the modules are coupled side by side with their floats (1) transverse to the length of the bridge structure, the track members (13) are mounted on the platform members (3) with their ends supported and located by arch members (27) in turn supported on the middle lengths (9) of the connector members (8).



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IMPROVED BUOYANT STRUCTURE SUITABLE FOR FLOATING BRIDGES

This invention relates to buoyant structures, and an object of the invention is to provide a form of structure which is both versatile in its use and capable of being readily assembled.

According to the invention in its broadest aspect, a buoyant structure comprises a pair of elongate floats, such as inflatable floats, and a plurality of transverse connector members the ends of which are releasably securable to the floats at spaced positions along the floats and which serve to maintain the floats in a parallel spaced relationship.

Such a structure may be used as a floating bridge module with the parts of the connector members between the floats providing supports for rigid track elements designed to carry vehicles across a river or other strip of water, or marshy of soft ground.

Preferably, each of the connectors has a central span which, when the assembled structure is floated on a body of water, is submerged beneath the surface of the water.

By arranging for the connector members and the track elements thereon to lie beneath the surface of the water the centre of gravity of the structure is lowered and its stability consequently improved. The construction of the connector members and the track elements should, of course, be such that the height of water above the track elements, in use of the structure, does not interfere with the passage of vehicles for which the bridge is to be used.

A plurality of individual modules, each carrying respective track elements, can readily be connected with the floats end-to-end, where necessary, to form a complete floating bridge.

Preferably, the module incorporates rigid platform members releasably securable along the tops of the floats so as to form walkways for foot personnel; and safety rails or grab ropes may then be fitted, if desired.

Alternatively, a plurality of individual modules may be connected in a row with the floats of consecutive modules side-by-side, instead of end-to-end, the track elements to carry vehicular and other traffic then extending transversely across the tops of the modules at right angles to the floats. Stability in such a case is provided by the fact that the end sections of the floats extend for an appreciable distance laterally beyond the track elements on each side of the bridge structure. Such an arrangement may be more suitable for providing a crossing over a fast flowing river, as the floats, being end on to the current, will be less subject to the force of the water and also the vehicle tracks

are out of the water.

However, it will be appreciated that the basic modules in accordance with the invention have a number of other uses besides being employed as bridges. For example, one or more basic modules may be arranged with a plurality of rigid elements extending transversely across the assembly to provide a continuous staging, for use as a floating jetty. Or a support for a winch may be mounted on the connecting members of one or more modules for lifting submerged objects.

One or more outboard motors may also be fitted to one or more basic modules to provide a floating transporter for objects and/or personnel.

The platform members, where provided, may be conveniently secured to the inflatable floats by means of straps with quick release connectors and, to connect the pairs of floats, the ends of the connecting members, which members may be made from aluminium tubing, are preferably arranged to be passed through holes in ribs extending longitudinally along the upper surfaces of the platform members, to be secured against withdrawal by swivel catches. It will therefore be seen that a structure in accordance with the invention can be assembled and dismantled extremely quickly without the use of nuts and bolts or separate tools.

Preferably, both the platform members and track elements are formed of pultruded glass fibre reinforced resin, this having the advantage of strength coupled with lightness. However, still stronger materials can be employed such as light alloys, steel, carbon-reinforced plastics and so forth. Both the platform members and the track elements may be formed with identical cross sections, and in some cases may be completely interchangeable.

The floats may be constructed with a number of interconnected compartments, inside an outer light-weight envelope, to be inflated from one end, non-return valves between adjacent compartments allowing this to be done whilst providing a degree of security against puncturing, for example due to sharp floating objects carried along by the water. In some cases security may be further increased by providing manually-operable valves between the compartments so as to enable any compartment to be completely isolated from the compartments on both sides of it.

Inflation of the floats may be conveniently achieved by means of a compressor or a compressed gas cylinder. In the latter case, the cylinder can be coupled to a float by means of an injector comprising a jet directed through a venturi

tube having a side opening through which atmospheric air is drawn and fed into the float along with the cylinder gas when the latter is being inflated. This enables the size of the cylinder required for inflating the float to be reduced.

Advantageously, the modules in accordance with the invention can be built of individual components that are light enough to be man-handled, and of dimensions such that the components for forming a number of modules can be readily transported in standard trucks, for quick assembly on site.

Arrangements according to the invention will now be described in more detail, by way of example, with reference to the accompanying schematic drawings, in which

Figures 1 and 2 are, in diagrammatic form, respectively a longitudinal section and a transverse section of one form of structure in accordance with the invention,

Figure 3 is an exploded view of the structure showing the various components more clearly,

Figure 4 shows, also diagrammatically, a series of elements assembled together to form a bridge,

Figures 5 and 6 illustrate a method of fitting a hand-or safety-rail to the bridge,

Figures 7 and 8 are, respectively, a longitudinal section and a transverse section of a unit modified to provide part of an alternative form of bridge, and

Figure 9 is a diagrammatic plan of that alternative form of bridge.

The structure illustrated in Figures 1 to 3 comprises a pair of elongated inflatable floats 1, of generally closed-ended tubular form provided at each side with a series of securing straps 2 (Fig 3) spaced apart along the length of the floats. Each float 1 is arranged to support on its upper surface a rigid elongate platform 3 of shallow inverted trough section, conveniently formed of glass-reinforced synthetic resin, extending the full length of the float 1 and provided at each side with a series of metal loops 4 at positions corresponding to those of the straps 2, the platform being secured to the float by passing one end of each strap through a respective loop and securing it to the other strap end by a quick release connector 5 of known kind.

On the upwardly-facing surface of each platform 3 there is provided a pair of parallel upstanding longitudinally-extending ribs 6 each having a plurality of holes 7 spaced along it, corresponding holes in each rib being disposed in alignment with each other.

The two float assemblies, each comprising the float 1 and associated platform 3, are secured together in spaced parallel relationship by a plurality of transverse tubular connecting members 8,

conveniently of aluminium, each having a middle length symmetrically bent to form substantially three sides of a rectangle comprising one long horizontal side 9 flanked by two shorter vertical sides 10, with two aligned end lengths 11 extending outwards horizontally from the tops of the two shorter sides 10 of the middle length, as shown in Figure 2. The end lengths 11 of the connecting members 8 extend through respective pairs of holes 7 in the ribs 6, and are secured against withdrawal by swivel catches 12 pivotally carried by the outer ends of the members 8 (Fig. 3). The inner lengths 9,10 of the connecting members 8 lie between the two floats 1 and serve to maintain the spacing between them, the length 9 lying at a level below the end lengths 11.

Such an arrangement forms a basic module, and a number of similar modules can be connected in a row in any convenient manner, with the floats of consecutive modules end to end, to form a temporary bridge across, for example a river, as shown in Figure 4, the platforms 3 providing walkways for foot personnel. If required, light planks (not shown) can be placed along the platforms 3 over the end lengths 11 of the connecting members 8 between the ribs 6 to form a smooth walking surface, which can then also be used by light wheeled traffic such as bicycles and motorcycles.

For heavier traffic, the assembled bridge structure is arranged to support elongate track elements 13 having a similar cross-section to the platforms 3, but laid with the troughs facing upwards. The ribs 16 of the track elements 13 are provided, in place of the holes 7, with a series of aligned pairs of notches or slots 17 which engage over the horizontal inner lengths 9 of the connecting members 8.

Conveniently, two rows of track elements 13 are laid in spaced parallel relationship between the two rows of float assemblies of the bridge structure, the track elements in each row being secured to one another end to end. The lengths of the short vertical sections 10 of the connecting members 8 are such that, when the assembled structure is floated on water, the horizontal lengths 9 of the members 8 lie submerged and the track elements 13 thereon are slightly below the surface of the water, which is indicated by the chain line in Figure 2. This results in a suitably low centre of gravity and improves the stability of the structure in use.

It will be seen that the structure can be readily assembled from the basic components without the need for nuts, bolts or special tools, and can be quickly dismantled when no longer required. Moreover the individual components are of such dimensions and weight that they can be readily transported in standard 4- or 8-ton trucks depending upon the number required to be carried.

Inflation of the floats may be effected from one end by means of a compressor or a compressed gas cylinder, the floats being formed with a number of internal compartments interconnected by non-return valves, evacuation on dismantling being through the opposite end. Where a compressed gas cylinder is employed it is conveniently connected to a float through a coupling incorporating an injector that induces an additional flow of external atmospheric air to enter the float, thus reducing the size and weight of the cylinder needed.

If desired, a bridge structure as described may be fitted with a grab rope or safety rail at one or each side as shown in Figures 5 and 6. In such a case, the swivel catches 12 at the ends of the connecting members 8 are dispensed with, and plates 18, which are welded to the lower ends of metal posts 19, are fitted into horizontal slots 20 in the ends of the connecting members 8, the plates being secured to the connecting members 8 by pegs 21 passing through aligned holes in the connecting members and the plates. The plates 18 then serve to retain the float assemblies on the ends of the connecting members 8 as well as supporting the metal posts 19, which are arranged to carry the hand or safety rail 22. The latter is conveniently in the form of a rope of cable passing through eyelets 23 at the tops of the posts 19 and anchored at its ends to the end ones of the row of platforms 3.

An alternative form of bridge, which may be more suitable for providing a crossing of relatively fast flowing rivers, can be constructed from the same basic modules as described, with the provision of additional components as shown in Figures 7 and 8. In this case each individual module is turned in the horizontal plane through 90° so that the floats of consecutive modules are side-by-side, instead of end to end, with the float assemblies parallel to the flow direction as shown in Figure 9, so as to allow a relatively free passage for the water.

U-brackets 24 are located in the channel between the upwardly-directed ribs 6 of each of the platforms 3, being retained in position by the ends 11 of appropriate ones of the connecting members 8, and these brackets have holes to receive a horizontal aluminium tube 25 which extends parallel to the float and provides a cross support for a pair of track elements 13, the tube passing through the notches or slots in the downwardly directed ribs 16 of the track elements.

In addition, each module is fitted with a support frame 27 comprising a pair of elongate tubular members 28 each bent generally into the form of a bridge, the members having parallel horizontal top sections joined together, with legs 29 that diverge, both as regards the two legs of one member and

as regards the leg pairs of the two members, and terminate at their lower ends in bifurcated feet 30 engageable on the inner lengths 9 of respective connecting members 8. The top section of each bridge member 28 engages in slots 31 formed in the ends of the ribs 16 of a respective pair of track elements 13 and provides support and location for the ends of the track elements, the frame consisting of the two bridge members 28 thus serving to fix adjacent pairs of track elements 13 in end-to-end relationship. In this case the tracks 13, which provide for the passage of both vehicular and foot traffic, are carried above the level of the water, stability being provided by the float assemblies extending laterally for an appreciable distance on each side out beyond the tracks.

Where a basic module is fitted with such a support frame, a winch could alternatively be mounted on the frame for lifting submerged objects.

It will be seen that one or more of the modules described may carry a series of flat planks laid side by side over the platforms 3 and secured to them in any convenient manner, to provide a more extensive platform which may, for example, be used as a jetty, although other uses are obviously possible.

In addition a module may be fitted with an outboard motor and used as a floating transporter.

Many modifications of the structure described are possible within the scope of the invention. Thus, whereas the provision of vehicle-carrying tracks clear of the water has been described in the case in which the floats are aligned in the direction of the stream, when the structure is used to span a river, a vehicle track at the higher level can also be carried when the floats of successive modules are end to end. It may, for instance, be beneficial in certain situations to have more than two floats across the width of the bridge structure, and one or more floats, say two, intermediate those in the structure of Figures 1 to 4 can easily be fitted, either in singles or in rows, by providing straight, instead of cranked, connector members at the locations where these extra floats are to be included. This will result in the track elements running at or rising to the higher level over the stretch, or at the location, where such extra floats are situated.

Extra intermediate floats can, if desired, be included at positions staggered in the lengthwise direction in relation to the positions of the floats in the main rows of floats, thereby in effect spanning between the main floats of consecutive modules and giving the bridge structure greater stability and integrity, and greater load-carrying capacity, over its whole length or at a particular location or locations.

Claims

1. A modular buoyant structure each module comprising at least a pair of elongate floats and a plurality of transverse connector members the end portions of which are releasably securable to the floats at spaced positions along the floats and which serve to maintain the floats in a spaced parallel relationship, a plurality of such modules being adapted to be coupled to one another to form a floating bridge or pontoon.

2. A structure according to claim 1, wherein the floats are inflatable and each has a substantially rigid elongate horizontal platform member secured along the top of it, the ends of the transverse connector members being releasably secured to the platform members.

3. A structure according to claim 2, wherein each platform member is of inverted trough shape with an upstanding pair of longitudinal spaced parallel ribs with holes through which the ends of the transverse connector members are passed.

4. A structure according to claim 2 or claim 3, wherein the platform members are secured to the floats by straps and quick release connectors.

5. A structure according to any preceding claim, wherein each transverse connector member is cranked so that it has a middle length between the floats that is at a lower level than its end portions connected to the floats, said middle length lying submerged below the water surface when the structure is in use.

6. A structure according to claim 5, wherein spaced parallel elongate horizontal track members upon which vehicles can travel are mounted on the submerged middle lengths of the transverse connector members, the modules of the structure being coupled together end to end with their floats and track members aligned in the direction of length of the modular structure.

7. A structure according to claims 3 and 6, wherein the track members are of generally the same trough configuration as the platform members but the other way up.

8. A structure according to any of claims 2 to 4 and 7, wherein upstanding support posts for a rope or cable handrail are dismountably attached at their lower ends to the ends of the transverse connector members, to assist foot personnel to cross the structure by walking on the platform members.

9. A structure according to any of claims 2 to 4, wherein the modules are coupled to one another side by side with the floats extending transverse to the direction of length of the modular structure, and elongate horizontal track members extending in the direction of length of the modular structure are mounted on platform members.

10. A structure according to claims 5 and 9,

wherein arch members are mounted each on two of the connector members extending between the pair of floats of a module to provide support and location for the ends of the track members at a position between the floats.

11. A structure according to claims 3 and 9, or claims 3 and 10, wherein the track members are of generally the same trough configuration as the platform members but the other way up.

12. A structure according to claim 7 or claim 11, wherein the platform members and the track members are of fibre-reinforced synthetic resin material.

13. A structure according to any preceding claim, wherein each float has an internally compartmentalised inflatable envelope that has an inflation connection at one end and a discharge valve at the opposite end, the internal compartments being interconnected via non-return valves.

14. A structure according to claim 13, wherein the inflation connection comprises an injector nozzle that induces an additional flow of external atmospheric air to enter the float along with compressed gas from a source of compressed gas when the float is being inflated.

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Fig. 1

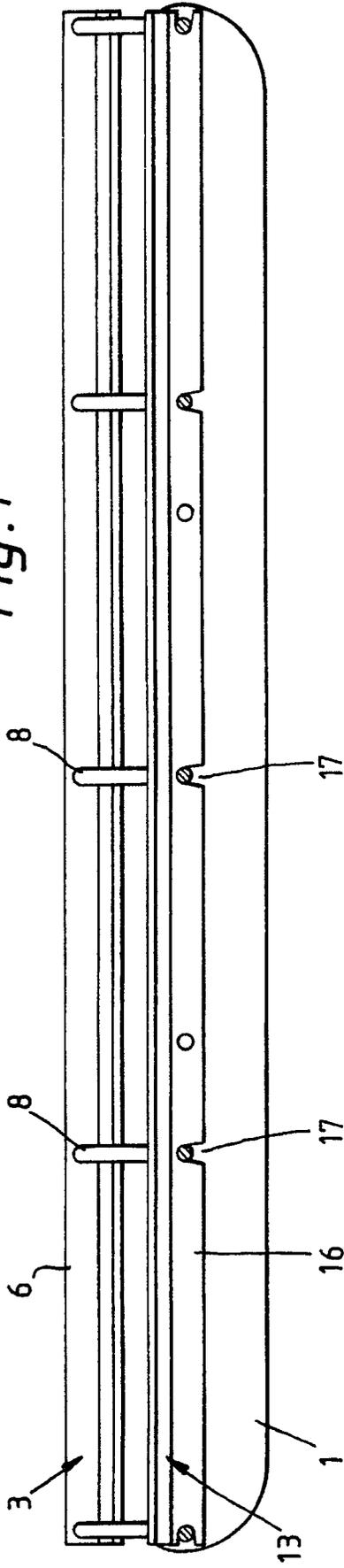
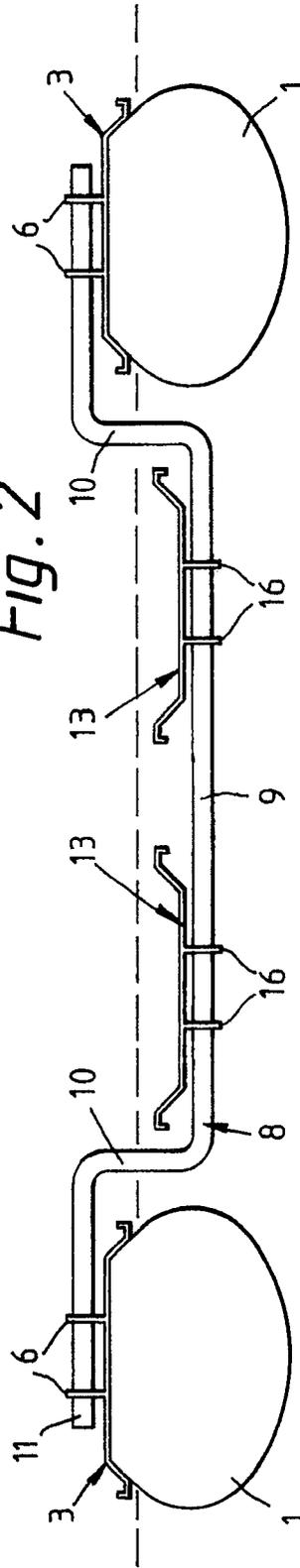


Fig. 2



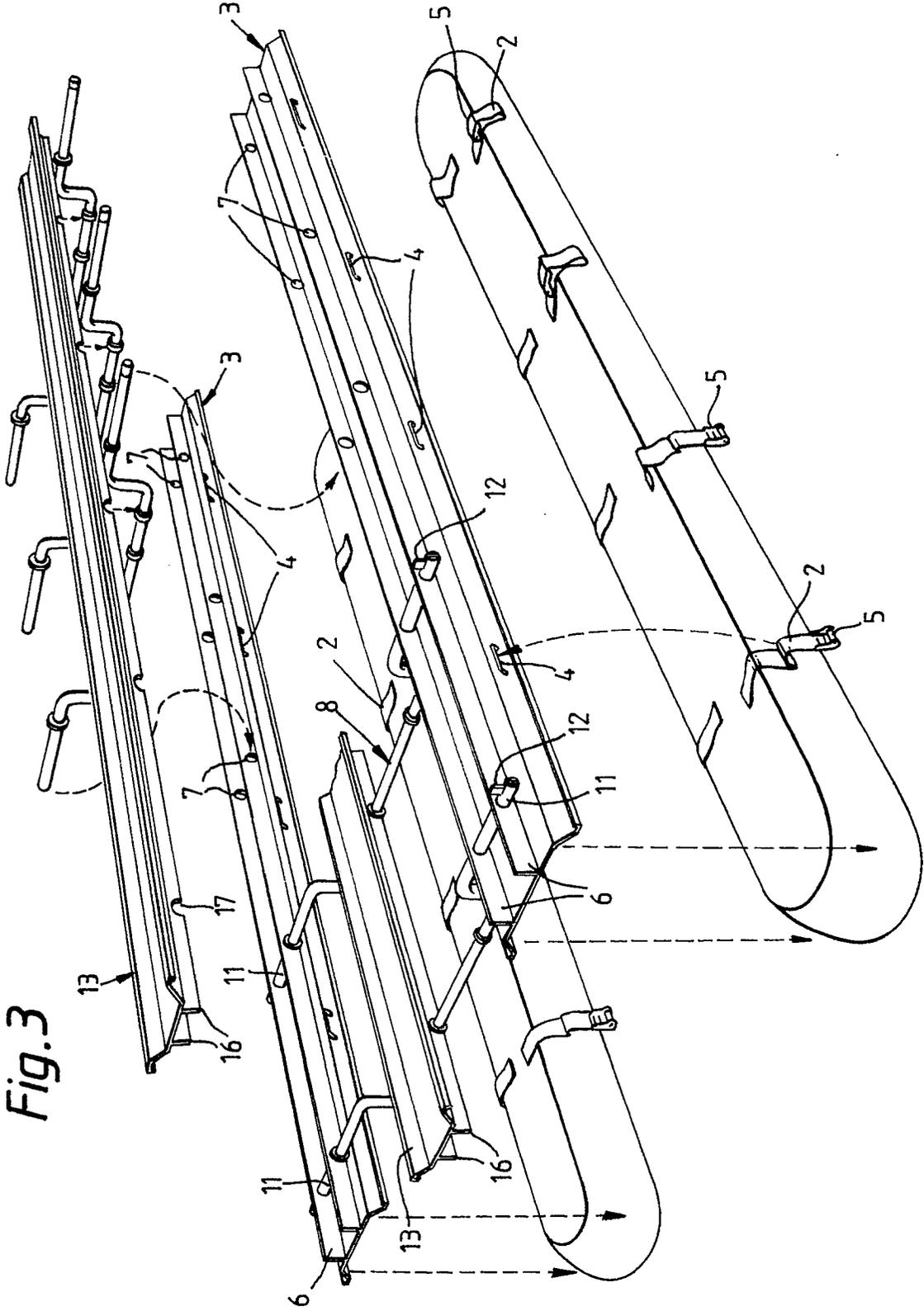
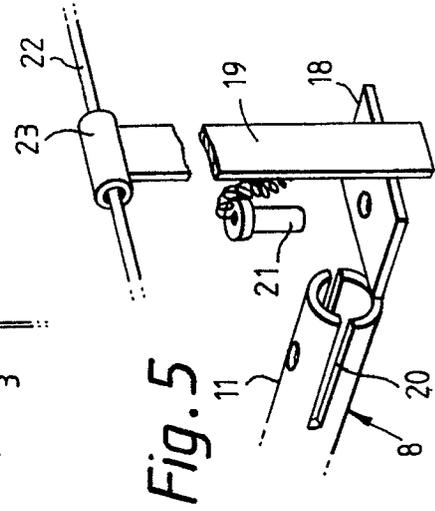
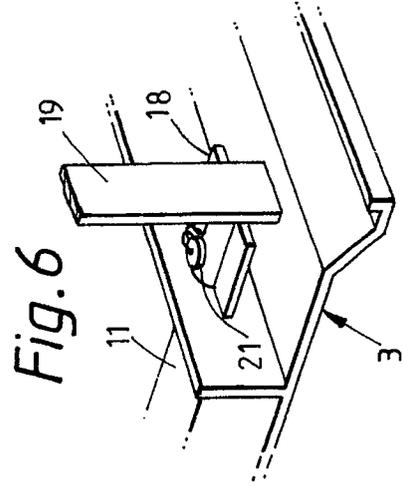
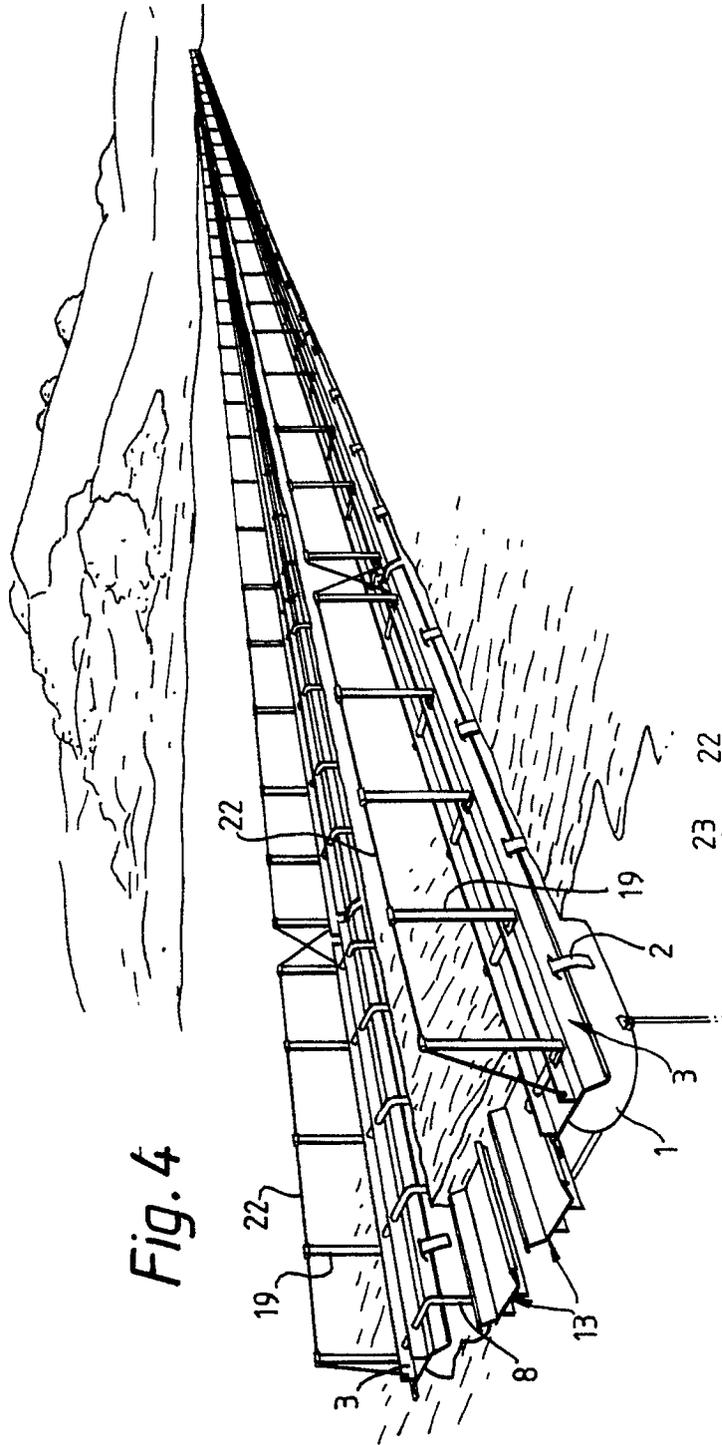
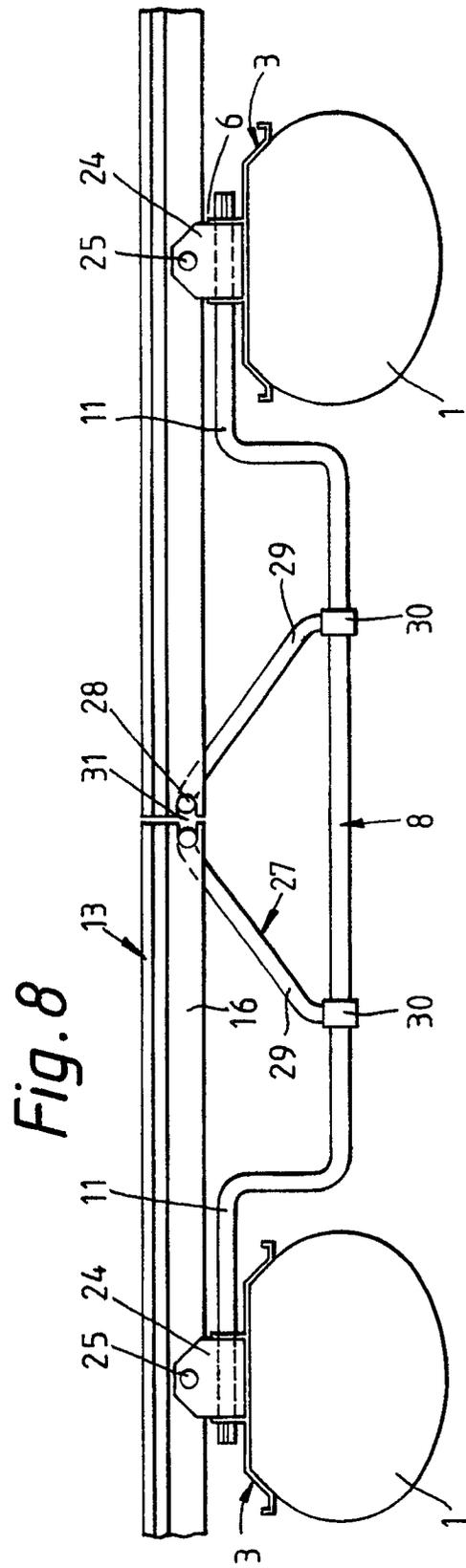
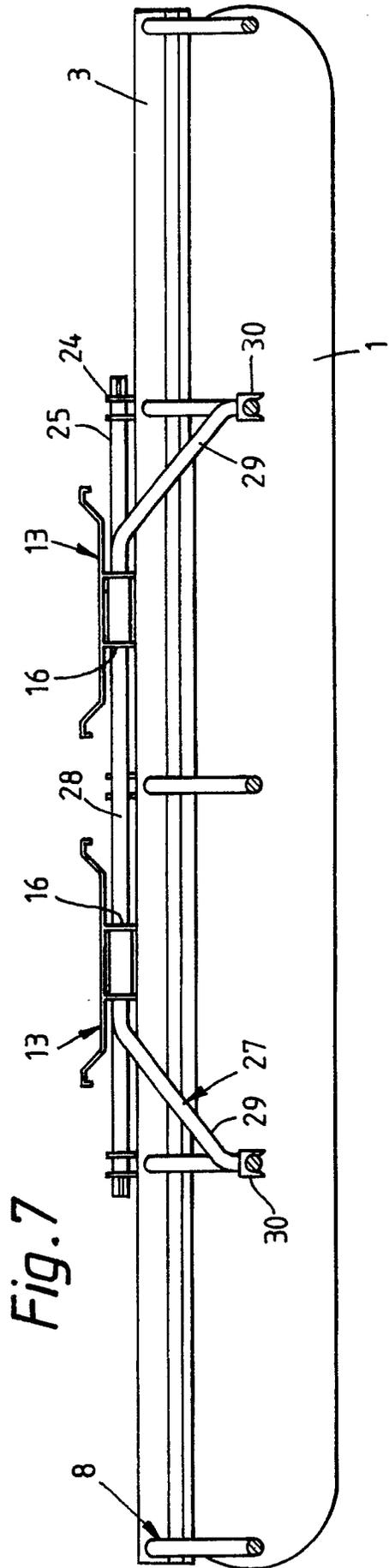


Fig. 3





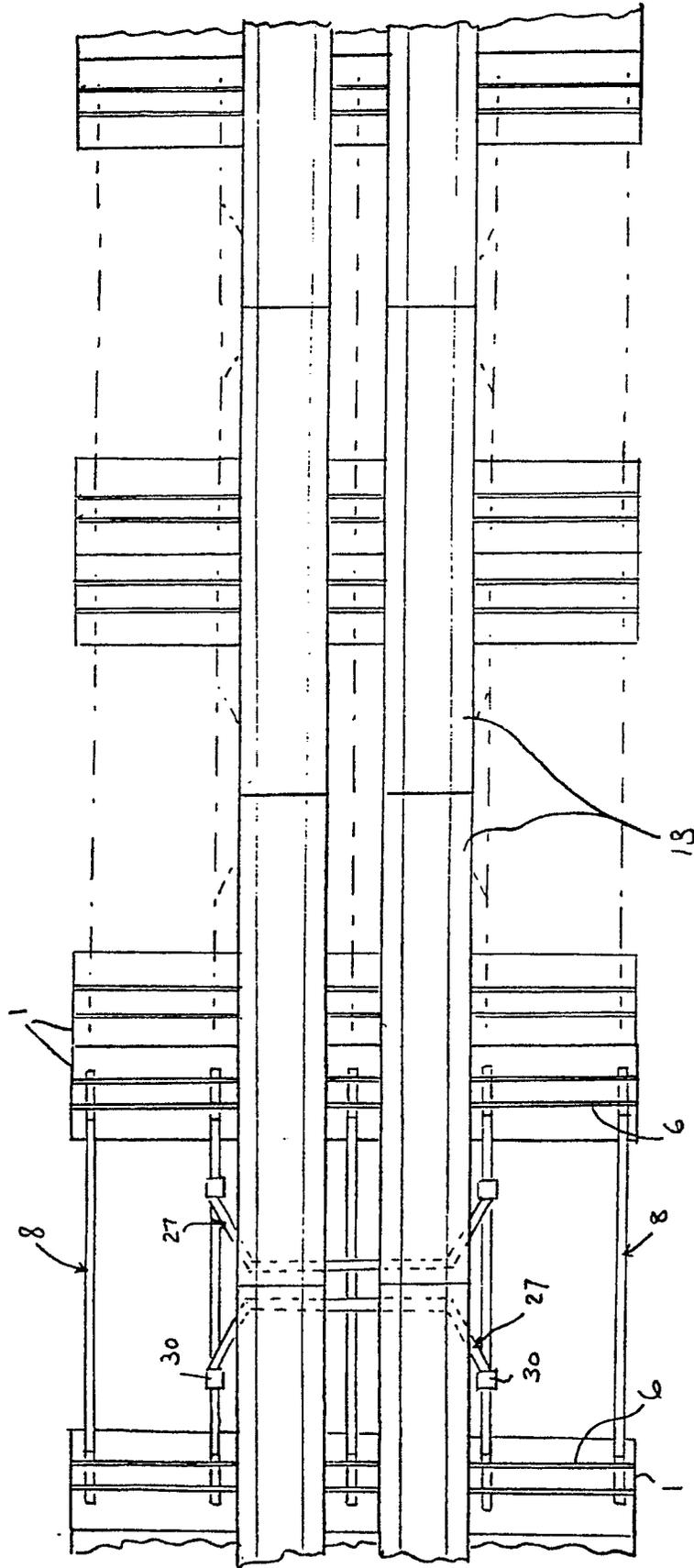


FIG 9.



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-2 423 832 (GEARON) * Whole document * - - - -	1,9	E 01 D 15/14 E 02 B 3/06 B 63 B 7/08
Y		2,4,8	
Y	DE-U-8 813 453 (CHANG) * Figures * - - - -	2	
A		1	
Y	FR-A-2 586 395 (SALMON) * Figures * - - - -	4,8	
A		1	
X	CA-A-8 868 79 (LEWICKI) * Whole document * - - - -	1	
A		2,8,9	
A	FR-A-1 294 566 (PEYTRAUD) * Whole document * - - - -	1,5	
A	ENGINEERING, vol. 206, no. 5341, 30th August 1968, page 325; "Bridges of glass-fibre" - - - - -	12	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E 01 D E 02 B B 63 B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 16 November 90	Examiner DIJKSTRA G.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention</p> <p>E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			