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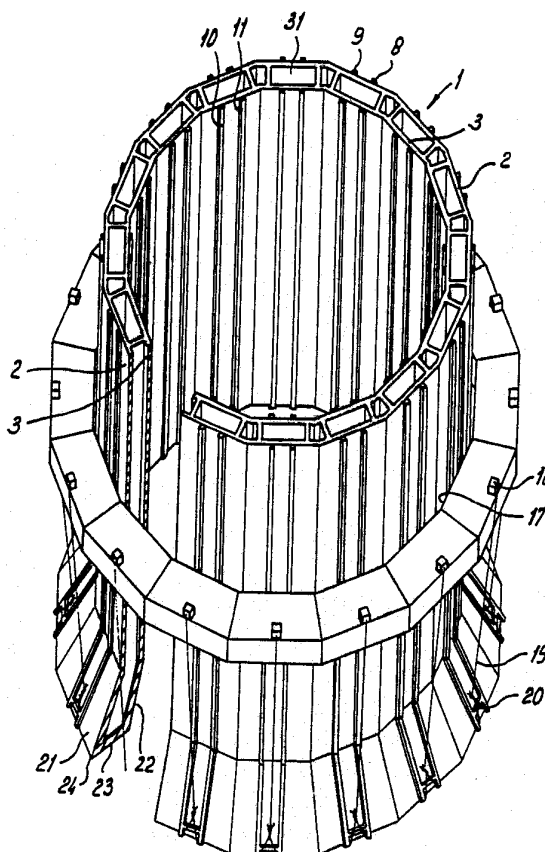
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(54) Title: METHOD AND APPARATUS FOR CONSTRUCTING AN ARTIFICIAL ISLAND AND CONSTRUCTION THUS OBTAINED

(57) Abstract

Method and device for manufacturing an artificial, in particular a column-shaped structure (1) on the bottom of a body of water by manufacturing first a part of the structure at a distance from its destination on a series of pontoons (16), which are placed on a working surface, which is dry but can be flooded, said part receiving its own buoyancy, and that after having made said part the pontoons are brought in floating condition, moved toward quite undep water, separated from the said part, which part is lowered on the bottom (26) of the water and further assembled by making use of the pontoons which are attached to outer wall (2) of the structure and that after further completion of the structure it is floated towards its destination with the aid of the said pontoons and lowered.



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METHOD AND APPARATUS FOR CONSTRUCTING AN ARTIFICIAL
ISLAND AND CONSTRUCTION THUS OBTAINED

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The invention in the first place relates to a method of manufacturing an artificial construction the bottom of a body of water, such as an
15 artificial island or the like, a column, a pile, a harbour etc., in which a large part of the construction is manufactured at a distance from the location in an area which is free of weather circumstances which are disadvantageous for the work, and in which said part of the construction, after completion, in floating condition is moved towards the
20 location and there is lowered upon the bottom of the body of water.

The term "artificial construction" covers arrangements, such as drilling platforms, platforms capable to withstand ice bergs, platforms for investigation or for military purposes.

A method of this type is known. E.g. one did manufacture in a
25 Norwegian harbour a very large artificial island construction from concrete, towed in floating condition towards the location in the so called Ecofisk area of the Northsea and lowered it there by ballasting upon the bottom of the sea and anchored it.

It is evident, that manufacturing and in particular transportation
30 of the entire island is cumbersome and expensive affair. Moreover one usually is bound to a place of manufacturing, which place of manufacturing, in view of the often large height of such a construction, has to have a dock, within which at least the lower portion can be manufactured and which allows, by sufficient depth, to bring the entire construction
35 in floating condition after completion.

Purpose of the invention is to provide a method which is more simple and accordingly more cheap and more flexible with respect to the area where the work has to be done.

This purpose is achieved in the first place in that primarily in

the dry a series is manufactured of interconnectable pontoons or floats, said series as interconnected series of pontoons is placed on a working surface which can be brought below water surface or can get below water surface,

5 on the upper surface of said series of pontoons a part of the construction is made at least comprising the lower portion of the construction to be manufactured and that

this lower part is made such that it has its own buoyancy,

subsequently the series of pontoons with upon it said portion is
10 brought into floating condition and thereafter moved towards a water depth which is such that the portion of the construction can float in it with between its lower edge and the bottom a distance which is larger than the height of the pontoons,

subsequently the pontoons are ballasted and removed,

15 after which the floating construction in quiet water is placed upon a bottom and there at least one further portion of the construction is made,

at least partly from which are placed close to the outer wall of the construction and coupled therewith,

20 that after completion of said further portion the construction with the aid of the buoyancy of the pontoons and/or its own buoyancy is moved towards the location.

This means that one can operate with all pontoons, which in that case accordingly are again placed around the construction, but as well

25 that one provides the construction at the outer side with a ring guided upon it to which the pontoons can be connected or along which the pontoons can be moved according to the circumference of the ring, so that one only uses a part of the pontoons as working platform.

Herewith one in the first place achieves that the lower part or
30 foot portion of the construction is manufactured in shallow water or in the dry on top of a series of pontoons, which rest upon a horizontal surface or a surface which is made horizontal.

This can be a shore area, subjected to tides, in which case one places the pontoons during low tide and are floated when time comes at
35 high tide together with the already manufactured portion of the construction placed upon it.

Of course one can do this in dock as well, so that the work takes place completely in the dry, which dock lateron is filled with water. In that case the dock needs, however, not to have a exceptional water
40 depth.

It is possible as well, in particular the tide differences are small and one can speak about a practically constant level, to work in shallow water in which case the pontoons are placed upon a horizontal or horizontally made bottom by ballasting the pontoons, after which again
5 on top of the pontoons the lower portion of the construction is placed, be it in its entirety or in part.

After the manufacturing of said lower portion the assembly of pontoons and lower portion standing upon it, is brought in floating condition or in floating condition respectively towards deeper water,
10 where the pontoons are removed by ballasting and subsequently the floating lower portion, as far as still necessary, is moved towards a place in quiet water where this portion is placed upon the bottom and one continues the assembly of the construction. The removed pontoons then can again be placed around the already manufactured portion and can be
15 coupled therewith and due to this function as working platform.

In case the construction is completed at the last mentioned place, at least as far as reaching the desired height is concerned, then with the aid of the buoyancy of said construction and for the buoyancy of the pontoons coupled therewith, the construction can be towed towards the
20 location of destination and there by ballasting and with the aid of means controlling the lowering movement lowered upon the bottom of the sea and subsequently anchored thereto.

As soon as the pontoons no longer are necessary, they are removed and one can complete the construction for the purpose it is meant for.
25 If e.g. an artificial island is concerned filling, at least partly, with sand or the like, will take place, whilst moreover on top of it or inside the installations can be placed for which the construction is destined.

The present invention in particular is destined for very large
30 constructions. One should think therewith of diameters of 100 to 200 meter and heights of 100 to 200 meter more. Said dimensions, however, are in no way limitative, smaller or larger is possible as well.

If during manufacturing of said further portion of the construction one, e.g. by the height and the local circumstances with respect
35 to water depths, cannot go that far that the construction is completely completed and accordingly one only can complete it partly, then according to the invention one subsequently with the aid of the pontoons can move the construction towards deeper water, where the already manufactured portion is lowered upon the lower bottom of water and a next portion
40 of the construction is made on top of the already manufactured portion.

Said steps of floating, displacing, lowering and further completing then are repeated as often as necessary until the construction can move towards the location of destination or can be completed there respectively.

5 Most shores are bordered by an area having a width of tenth of kilometers with gradually increasing depths, due to which at many places one has the possibility to complete the construction, such as the artificial island step by step in height. The pontoons then are rigidly interconnected and form e.g. an endless series and the coupling of the
10 pontoons with the construction takes place such, that only a controllable relative vertical movement between construction and pontoons may be possible. With other words the pontoons are guided upon the construction for vertical guidance, which construction to this end has been provided with guiding members. Accordingly the pontoons only can move in a vertical
15 cal direction with respect to the construction and the reverse. Movements away from each other or towards each other are not possible.

A simple control of the relative position can be achieved according to the invention in that the coupling in the vertical sense is obtained between pontoons and construction by means of cables, one end
20 of which being connected to the foot of the construction and the other end to winches which are placed upon the pontoons and by means of which from the pontoons cable by cable a controllable tension can be performed.

Accordingly with the invention one has the possibility to manufacture
25 on a series of rigidly interconnected but disconnectable pontoons a first portion of a large construction to be placed in the sea. Subsequently, after placing of said construction on a working bottom, accordingly after removal of the pontoons, said construction by means of the pontoons now placed around it, which pontoons serve as working platform,
30 is completed, is displaced with the pontoons towards deeper water and, if this is done in steps, the construction is also completed step by step in height, and finally the construction with the aid of its own buoyancy and the buoyancy of the pontoons is moved towards the location of destination. There the pontoons finally once will be removed for
35 repeated use.

An artificial construction of the type meant here and of the dimensions which can be large, may have any desirable circumferential shape, seen in the horizontal plane. This can be a circular circumference, a polygonal circumference, a rectangular circumference, an oval
40 circumference or even the circumference of a harbour having two jetties

and an interconnecting portion (U-shape).

The pontoons form the apparatus for manufacturing the column or similar construction upon the bottom of a body of water and known is an apparatus comprising at least two pontoons which can be coupled with
5 each other and define a space within which the construction can be made and can be displaced in vertical direction with respect to the pontoons. Such an apparatus has been described in the published patent application NL-A-8800664.

With said known apparatus a portion of a column is made as well by
10 making use of two pontoons whilst the pontoons are supported upon the bottom of the body of water, however, with the column portion still extending above the pontoons and one manufactured a further portion, which one in this way completes step by step by repeating the operations.

15 During the first step the pontoons rest upon the bottom of the body of water and are displaced as well by increasing their buoyancy, but they have their working surface above water. With very large constructions of the magnitude of the above indicated diameters it makes no sense to operate with two pontoons which together, which means by their
20 abutting surfaces, define a hollow space within which the construction has to be made. The two pontoons would together have dimensions in transverse direction which have to be larger than the outer diameter of the construction to be made and accordingly themselves would obtain unmanageable dimensions.

25 According to the invention now an apparatus is provided which comprises a plurality of pontoons which in coupled condition together form an endless closed series the inner circumference of which corresponds to the contours of the outer circumference of the construction to be manufactured. If e.g. a construction is meant having a circular
30 circumference then a circular ring is made from pontoons and said pontoons then have a curved inner surface, side faces in radial planes and an outer surface which can be curved, but need not to be.

If a polygonal is concerned then the most suitable form of the pontoons is the one of an equal sided trapezium of which the small one
35 of the two parallel sides lies against a side surface of the polygonal circumference of which the large parallel side forms the outer surface.

Since the construction to be manufactured may have any circumferential shape, it of course is feasible, that the pontoons have other shapes, which in top view may be square, triangular, unequally sided
40 trapezium, rectangular trapezium, with or without straight or curved

surfaces.

According to the invention each of the pontoons have been provided with guiding means, which cooperate with guiding members on the construction and closed by the pontoons and which only allow relative
5 movement in vertical direction.

Each of the pontoons moreover can be provided with means by means of which a relative displacement upwardly as well as downwardly can be performed and by means of which the pontoons can be locked with respect to the construction.

10 In its most simple form said means comprise cables, which with their free end are connected to the foot of the construction and with their other end to a winch and that each pontoon has at least one winch with cable.

It, however, is feasible as well that said means comprise a climb-
15 ing mechanism having a toothed rod or the like at the outer side of the construction and a drivable and lockable gear wheel mechanism upon or in each pontoon respectively, or that said means comprise a climbing mechanism of the type having locking beams and displacement cylinders by means of which a stepwise relative displacement can be performed. The
20 climbing mechanism mentioned above with toothed rod and gear wheels which preferably are driven by hydraulic motors, or the climbing mechanism comprising cylinders and locking beams is known in itself with artificial islands of the "jack-up" type, comprising a pontoon and at least three legs, which with the aid of said climbing mechanism can be
25 moved in vertical direction with respect to the pontoon and can be locked.

Said means can be applied with the present invention, but are relatively expensive as compared to winches with cables.

The pontoons in coupled condition have to form a rigid entity. To
30 this end they are mutually interconnected by means of flanges at the end faces or side faces and by means of tension anchors at the location of at least the top surface, which anchors bridge the flange connection.

Under the influence of wave forces the rigid ring of pontoons will be subjected to bending forces, which result in tension forces and
35 pressure forces at the location of upper and bottom surface. The tension anchors do support here the taking up of the occurring forces.

The method described before as well as the apparatus composed out of pontoons can be used for placing constructions of different design. Possible is an enlarged version of the columns described in EP-A-0 245
40 407.

Since the present invention deals with very large constructions the construction to be manufactured with the method of the invention which is suitable in particular and which has a hollow wall closed at the bottom and open at the top and with a sharp lower edge. This construction now according to the invention can be performed such that each inner wall and each outer wall of the double wall is a double wall itself, said last mentioned double wall at least in vertical direction being locally interconnected by double transverse walls and that the walls of the double walls of outer wall, inner wall and transverse wall are interconnected by anchors, said last mentioned double walls provided with anchors being fillable with a hardening material, such as concrete. Said inner wall and outer wall respectively, made as double walls, then form spaces which, as need may be, one fills with concrete whereas the remaining free spaces are ballasting spaces which as desired can be filled with water or emptied by pumping to control buoyancy or, in the exceptional case that one wants to regain the construction.

There where the risk of freezing exists said free spaces can be ballasted as well with sand or the like material.

In this way one obtains a very strong entity, which moreover can be reinforced further by the measures to be described hereinafter.

Thus the outer wall of the construction for coupling with a pontoon may be provided with at least one hollow profile having guiding edges externally for cooperation with the guiding means which grip around it of the respective pontoons. Preferably two hollow profiles are provided for each pontoon to obtain the best possible guidance which prevents jamming. The hollow profile not only guides but is a reinforcement rib as well upon the outer surface of of the respective surfaces of the construction. Of course the construction is made from plates which provide tight walls.

Of course said profiles at the outer side can at a suitable moment be provided with a reinforcement and/or filling with concrete.

Furthermore it is possible according to the invention to provide the inner wall of the construction with spaced apart hollow profiles as well which extend from top to bottom and are open from top to bottom. These are continuously open profiles which apart from the function of reinforcing the inner wall may be used for other purposes.

If one imagines, that the construction has a diameter of e.g. 100 meter then it will be clear, that the inner and outer wall are at a mutual distance in the magnitude of 15 to 20 meter and that each inner wall or outer wall respectively, made as double wall, has a thickness of

1.5 to 2 meter.

Hollow profiles which then may be used for reinforcement soon will have dimensions of 50 to 100 cm square and this opens the possibility for the following purposes.

5 Thus one may use said hollow profiles at the innerside of the construction after its placing on the bottom for guiding a suction conduit or for guiding a pressure conduit. The construction does have a sharp lower edge and upon placing it upon the bottom of the body of water will partly penetrate into said bottom. It, however, will be
10 necessary to take care that the axis of the construction is correctly vertical. This may involve the need of treating the bottom but since this has to take place at large depth this hardly can be done previously. However, if one has placed the construction with its sharp edge upon the bottom water and said construction did partly penetrate into it then
15 one can, where necessary, by means of said hollow profiles with suction conduits remove sand, or by means of pressure conduits apply sand or hardening substances. Said substances then are applied below the inclined inner surface of the sharp lower edge and accordingly enlarge the foot. Through said channels one also can inject hardening substances
20 into the underground.

After completion of the construction said hollow profiles may still be used for performing drillings and if necessary for extending through it a riser or production conduit. This of course depends from the destination of the construction.

25 After placing one of course will also on top of the construction perform further completions by means of the required upper structure in dependence of the purpose.

It therewith is possible to make use of transverse beams which bridge the space between opposite walls, in particular the inner walls
30 and accordingly may form a working platform or support in the center of which a construction crane may be provided.

The invention now will be further elucidated with reference to the drawings.

Figure 1 is a diagrammatic view in perspective of a construction
35 obtained with the method according to the invention and to be manufactured with the apparatus according to the invention, in which for clearness sake part of the wall is taken away.

Figure 2 shows the construction of figure 1 in a perspective view from the underside.

40 Figure 3 shows diagrammatically a first step of the method according to the invention.

ding to the invention.

Figure 4 shows diagrammatically a second step of the method according to the invention.

Figure 5 shows in top view different shapes, not limitative, of 5 pontoons to be applied.

Figure 6 shows in top view, non limitative, circumferential shapes of constructions to be made.

Figure 7 shows possible cross sections in the vertical plane, in particular of the lower portion, non limitative as well.

10 Figure 8 shows in side view a step of the method.

Figure 9 shows in the same way as figure 8 a further step of the method.

Figure 10 shows in the same way as figures 8 and 9 still a further step of the method.

15 Figure 11 shows in perspective a possible coupling of pontoons.

Figure 12 shows in horizontal cross section a possible guiding of the pontoons upon guiding profiles of the construction.

Figure 13 shows as larger scale than figure 1 a horizontal cross section through a part of the wall of the construction to be made.

20 Figure 14 is a perspective view of a part of the inner wall of the construction shown in figures 1 and figure 13.

Figure 1 in general shows the construction to be manufactured with reference 1, which construction has to be placed upon the bottom of a body of water, not shown. Said construction has a polygonal circumferen- 25 ce with an outer wall 2 and an inner wall 3. Said outer wall and inner wall respectively are, as clearly shown in figure 13, made as double wall with an inner plate 4 and an outer plate 5. Said outer wall and inner wall respectively are interconnected by transverse walls 6, which are performed as double walls as well and lie in planes, which are 30 perpendicular to the inner and outer surface respectively. Said perpendicular position of course is not necessary. Said transverse walls 6 moreover need not to extend over the entire height. Feasible is to interrupt them locally.

Said double walls are destined to be filled with concrete in the 35 course of the manufacturing procedure. The degree of filling and the moment of filling depends on the need for buoyancy of ballasting respectively.

Between the walls of the double walls anchors 7 are present of which only a few are shown.

40 Upon the outer wall at the location of each flat surface, which

forms part of the polygonal circumference two hollow profiles 1 and 9 are provided the cross sectional shape of which is shown in a simplified way in figures 1 and 13, but of which a possible more precise cross sectional shape is found in figure 12.

5 The inner wall 3 has also been provided with hollow profiles 10 and 11 which need not to have a guiding function.

As may be seen from figure 14 said profiles 10 and 11 respectively extend vertically downwardly with the inwardly turned surface 12 extending vertically at the location of the inclined inner side 13 of the foot
10 of the construction, so that below said foot an enlargement of the profile is formed in the form of a hollow casing 14.

Through said hollow profiles 10,11 and the casings, such as 14, a suction conduit can be guided, not shown, or a pressure conduit, not shown, by means of which sand can be withdrawn from below the inner
15 surface 15 of the inclined foot or by means of which filling substances, like sand or the like, can be introduced below the foot or by means of which hardening substances can be supplied or injected.

As figure 1 shows, the construction is surrounded by an annulose of pontoons 16, which in top view have the shape of an equally sided
20 trapezium the short parallel sides 17 of which having a length which corresponds to the plain surface 2 of the outer wall of the polygonal circumference of the construction.

Said pontoons are rigidly coupled with each other in a manner shown in figure 11 and are guided upon the profiles shown in figure 12
25 by means of guiding means shown in more in detail in figure 12 as well.

Each pontoon supports at least one winch 18, which by means of a cable 19 is connected with the lower part or foot 20 of the construction.

By means of said cables the pontoons can support the construction
30 with or with no help of the own buoyancy of the construction. Said pontoons may have different shapes, a number of examples of which are shown in top view in figures 5a to 5e inclusive.

Said shapes depend from the circumference of the construction to be made of which a number of examples are given in figures 6a to 6e
35 inclusive, such as circular, polygonal, rectangular, oval, U-shaped.

Figure 1 shows, there where a part of the wall is taken away, in vertical cross section the profile of the construction with an outer wall 2 performed as double wall and an inner wall 3 performed as double wall.

40 The construction shown in figure 1 has in the upper portion paral-

1el extending vertical inner and outer walls which in the lower portion merge into an inclined downwardly extending outer surface 21, a slightly less inclined inner surface 22 which further downwardly merges into an inclined surface 23, which forms a sharp lower edge 24 with the surface 21.

Figure 7 shows possible cross sectional shapes of the lower portion each having a sharp lower edge 24a to 24e inclusive and with side walls in the upper portion, which extend vertically and parallel to each other, as shown in figures 7a to 7c incl., or extending inclined towards each other as shown in figures 7d and 7e respectively.

With respect to the method according to the invention figure 3 shows a first step. According to said first step an annulose of pontoons, such as the pontoons 16 of figure 1, is placed upon a horizontally made surface of e.g. a shore area subjected to tides. Said pontoons are manufactured in the dry and during low tide one takes care that the bottom upon which the pontoons have to be placed is flattened, which annulose of pontoons is placed during low tide and one takes care that during high tide the annulose of pontoons remains in place by ballasting, such as filling with water or placing weights upon it.

During another period of low tide or high tide upon said annulose of pontoons one places the already manufactured lower portion. This is shown in figure 4 in which for the lower portion one has chosen a shape which is similar to the shape shown in figure 7c. The diameter at the location of the sharp lower edge is larger than the inner diameter of the annulose of pontoons such and smaller than the outer diameter of said annulose of pontoons such that said lower portion can stand upon it. The outer diameter of the outer wall of the upper portion preferably is such that said outer diameter in principle corresponds to the inner diameter of the annulose of pontoons, so that said annulose of pontoons during a later step of the method can be applied around the outer wall.

The hollow foot, shown in figure 4, has a shape such and a water displacement such that it has buoyancy.

If one applies the method of placing in a tide area then it is desirable that the lower portion of the construction as such or in easily connectable portions respectively is placed upon the annulose of pontoons so that the operations of the work can take place within the time period of low tide.

Therewith one may make use of a platform 25 in the center of the annulose which if needed can be removable, as shown in figure 3.

However, if one operates in the dry, e.g. in a dock, then the

lower portion can be assembled piece by piece on top of the annulose of pontoons.

If, however, operation takes place in the wet with pontoons remaining below water level constantly then it is preferred to prefabricate the lower portion entirely and place it upon the pontoons.

After having finished the annulose of pontoons with the lower portion on top of it said annulose has to be displaced. This takes place by floating the pontoons by taking away the ballast and with sufficient water level, which happens automatically in tide areas.

The assembly then is brought towards deeper water, the pontoons are ballasted again until the lower portion floats, after which the pontoons are drawn away from below the floating lower portion. Said lower portion then one moves towards a place with quiet water, e.g. a harbour, if it did not already arrive there or has been there. This lower portion then by ballasting is placed upon the bottom of the water and then the situation is generated which diagrammatically has been shown in figure 8, in which the lower portion 21 with the sharp lower edge 24 stands upon the bottom 26 of the body of water, preferably with part of the upper portion 27 extending above water.

The annulose of pontoons 16 then is placed around the upper portion and this upper portion is further built upwardly.

If said upper portion in the light of the occurring circumstances has been continued upwardly far enough then the pontoons in the manner shown in figure 9 are connected by means of the cables 19 with the foot 20 and tensioned by means of the winches 18.

When then can ballast the pontoons by pumping water into them as indicated at 28, so that they come to lie more deep into the water.

If thereafter water is removed, as indicated at 29 in figure 10, then the pontoons will lift the construction and said construction then can be displaced with the aid of one or more tow boats 30.

Said displacement takes place towards deeper water where the construction is lowered with the aid of cables with or without support by supplying water into the ballast spaces 31 (figure 1 and 13). Said operations can, if desired, be repeated several times.

Figure 11 shows a possible manner of coupling the pontoons 16. To this end they are provided with side surfaces turned towards each other and provided with flanges 32, 33 with coupling means, not shown, which could be formed by bolts which e.g. according to line 34 extend through holes of the flanges.

Said connection may be insufficient for taking up the forces

generated by wave movements in which case tension anchors 35 are applied, which with their outer ends are connected to the upper surface and lower surface (not shown) of the pontoons.

At 36 guiding means are shown diagrammatically, by means of which
5 each pontoon is guided upon hollow profiles 8 and 9 provided at the outer side of the construction.

A possible cross sectional shape permitting guidance, is shown in figure 12. In said figure 2 forms a piece of the outer wall plate of the construction and 17 is the surface of a trapezium shaped pontoon 16
10 turned towards it.

The hollow profile, such as 8, has, as shown in figure 12, such a horizontal cross section that guiding surfaces 37 and 38 are formed which extend perpendicular to the side faces of the hollow profiles 8.

The guiding means 36 of figure 11 have profiles 39 and 40 connect-
15 ed thereto. Said profiles with the walls of the hollow profiles form a hollow space within which rolling guiding means can be provided.

In their most simple form said profiles 39 and 40 have horizontal transverse surfaces at the outer ends, so that a closed chamber is formed. In said chamber rolls, such as balls, can be placed which then
20 take care of a guidance with lower friction. If rolls are used which are enclosed in a fixed path, some friction of the rolls over at least one of the relatively movable surfaces cannot be excluded. Since the movements concerned are slow this need not to be an objection.

If this, however, could be an objection then one can provide in
25 the space formed e.g. between profile 39 and surface 37 rollers or wheels 40 having an axis of rotation which e.g. has been attached to profile 39, in which case the wheel or roller is rotatable free from profile 39 and in engagement with the surface 37 of the wall 38. The application 40 wheels requires shafts which extend perpendicular to
30 each other, the forces then are taken up in two perpendicular horizontal directions and therewith the pontoon is guided upon the profile 8 such that displacements only are possible in vertical direction, vide figure 13.

C L A I M S

1. Method of manufacturing an artificial construction on the bottom of a body of water, such as an artificial island or the like, a column, a pile, a harbour etc., in which a large part of the construction
- 5 is manufactured at a distance from the location in an area which is free of weather circumstances which are disadvantageous for the work, and in which said part of the construction, after completion, in floating condition is moved towards the location and there is lowered upon the bottom of the body of water, characterized in that
- 10 first in the dry a series of interconnectable pontoons of floats is manufactured,
- said pontoons as interconnected and placed on a working surface which can be brought below water surface or can get below water surface,
- 15 on the upper surface of said series of pontoons a part of the construction is made at least comprising the lower portion of the construction to be manufactured and that
- this lower part is made such that it has its own buoyancy,
- subsequently the series of pontoons with upon it said portion is
- 20 brought into floating condition and thereafter moved towards a water depth which is such that the portion of the construction can float in it with between its lower edge and the bottom a distance which is larger than the height of the pontoons,
- subsequently the pontoons are ballasted and removed,
- 25 after which the floating construction in quiet water is placed upon a bottom and there at least one further portion of the construction is made,
- at least partly from pontoons, which are placed close to the outer wall of the construction and coupled therewith,
- 30 that after completion of said further portion the construction with the aid of the buoyancy of the pontoons and/or its own buoyancy is moved towards the location.
2. Method according to claim 1, characterized in that during
- 35 manufacturing of said further portion of the construction this portion is therewith only partly completed and subsequently with the aid of the pontoons moved towards deeper water, where the already manufactured portion is placed upon the bottom of the body of water and a next portion of the construction is made upon the already manufactured portion,
- 40 which steps of buoyant moving, lowering and further completing is re-

peated as often as necessary until the construction can go towards the location or is completed there.

3. Method according to claim 1 or 2, characterized in that placing
5 of the series of pontoons takes place on a prepared flat bottom of a water area, which is subjected to tides and that this takes place at a place which allows assembly during low tide and floating during high tide.

10 4. Method according to claim 1 or 2, characterized in that placing the series of pontoons takes place on a flat bottom of space which can be closed with respect to the surrounding water, and from which water can be removed, such as a dock area.

15 5. Method according to claim 1 or 2, characterized in that placing of the series of pontoons takes place by lowering said pontoons by means of ballast at a prepared flat bottom of a body of water having a substantially stable level and a depth which is sufficient to make the pontoons with a portion of the construction placed thereon free from the
20 bottom by floating.

6. Method according to one or more of the preceding claims, characterized in that manufacturing of the further portion takes place in quiet water in a harbour or the like area protected with respect to the
25 sea.

7. Method according to one or more of the preceding claims 1 to 5, characterized in that the manufacturing of said further portion takes place inside a dock area.

30 8. Method according to one or more of the preceding claims 1 to 7, characterized in that the pontoons during the manufacturing of the further portion or portions and during displacements are coupled with the construction such that only a controllable relevant vertical movement between construction and pontoons may be possible.
35

9. Method according to claim 8, characterized in that the connection in vertical direction between pontoons and construction is performed by means of cables one end of which is connected to the foot of the
40 construction and the other end to a winch placed on the pontoons and by

means of which from the side of the pontoons cable by cable a controllable tension force can be performed.

10. Device for manufacturing a column or the like construction on the bottom of a body of water, comprising at least two pontoons which can be interconnected and define a space within which the construction can be performed and can be displaced in vertical direction with respect to the pontoons, in particular device for performing the method according to one or more of the preceding claims 1 to 9 incl. characterized in that said device comprises a plurality of pontoons which in the interconnected condition together form a closed endless series the inner circumference of which corresponds to the contours of the outer circumference of the construction to be manufactured.

11. Device according to claim 10, characterized in that the pontoons each are provided with guiding means, which cooperate with guiding members upon the construction enclosed by the pontoons and allowing only relative movement in vertical direction.

12. Device according to claim 11, characterized in that the pontoons each are provided with means by means of which a relative displacement upwardly as well as downwardly can be performed and by means of which the pontoons can be locked with respect to the construction.

13. Device according to claim 12, characterized in that said means comprise cables which with their free end are connected to the foot of the construction and with their other ends to a winch, each pontoon having at least one winch with cable.

14. Device according to claim 12, characterized in that said means comprise a climbing mechanism having a toothed stroke or the like at the outer side of the construction and a drivable and lockable gearwheel system upon or in each pontoon.

15. Device according to claim 12, characterized in that said means comprise a climbing mechanism of the type comprising locking beams and displacement cylinders by means of which a relative displacement can be performed in steps.

16. Device according to one or more of the claims 10 to 15, cha-

racterized in that the pontoons are disconnectably interconnected by means of flanges at the side faces and tension bars at least at the upper surface which bridge the flange connection.

- 5 17. Device according to one or more of the preceding claims 10 to 16, characterized in that each pontoon has an inner surface turned towards the construction which is complementary to the outer surface of the construction as well as side faces starting from said inner surface which are at an angle with respect to the inner surface such that by the
10 coupling of the pontoons with each other the profile of the outside of the construction is followed.

18. Construction suitable for being manufactured with the method according to one or more of the claims 1 to 9 incl. and by means of the
15 device according to one or more of the claims 10 to 17, which construction has a hollow wall closed at the bottom and open at the top and having a sharp lower edge, characterized in that each inner wall and each outer wall of the double wall is a double wall itself, said last mentioned double wall at least in vertical direction being locally
20 interconnected by double transverse walls and that the walls of the double walls of outer wall, inner wall and transverse wall are interconnected by anchors, said last mentioned double walls provided with anchors being fillable with a hardening material, such as concrete.

- 25 19. Construction according to claim 18, characterized in that the outer wall of the construction for the coupling with a pontoon has been provided with at least one hollow profile having outer guiding edges for cooperation with guiding means of the pontoons which guiding means grip behind said guiding edges.

- 30 20. Construction according to claim 18 or 19, characterized in that the inner wall of the construction has been provided at spaced apart spaces with hollow profiles extending from top to bottom and open from top to bottom.

fig -1

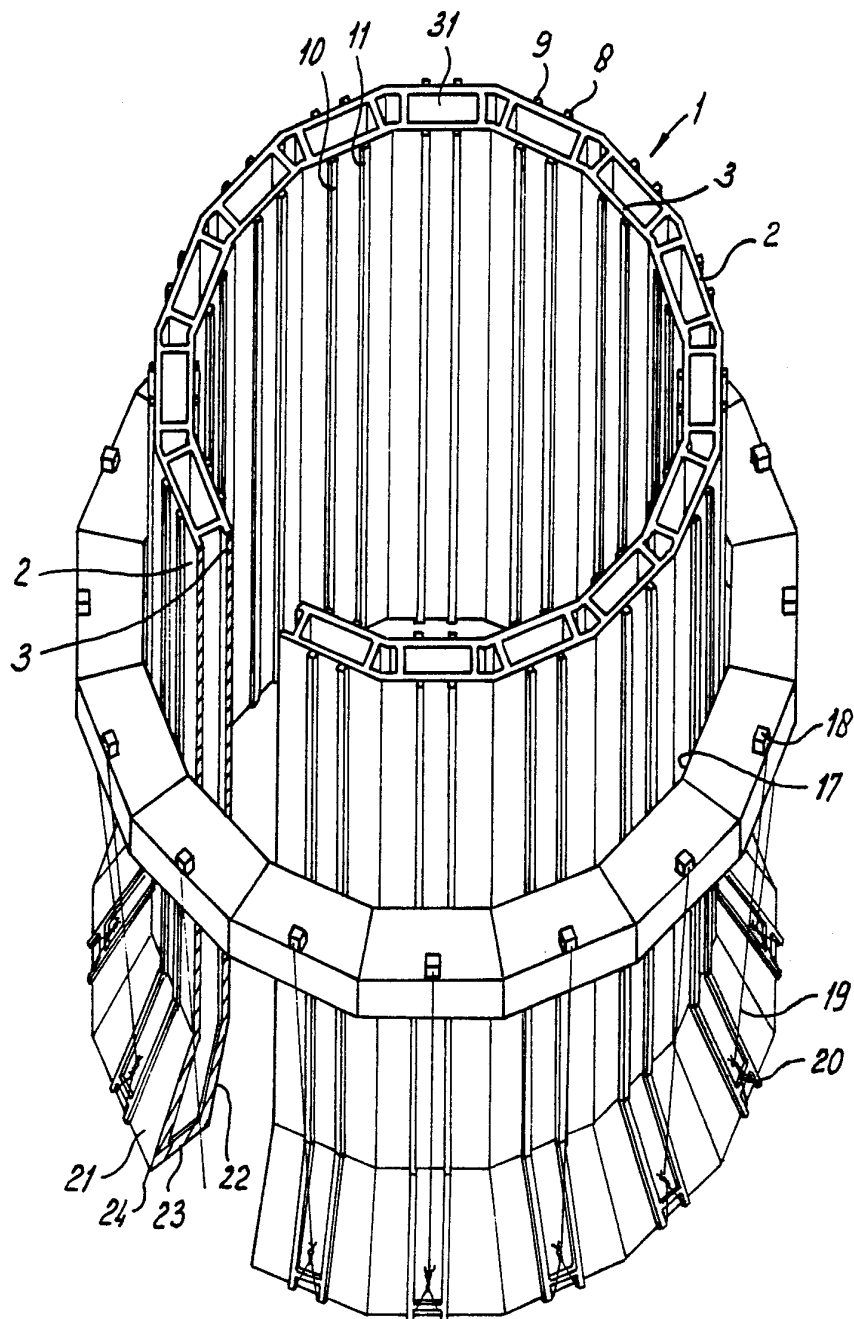


fig - 2

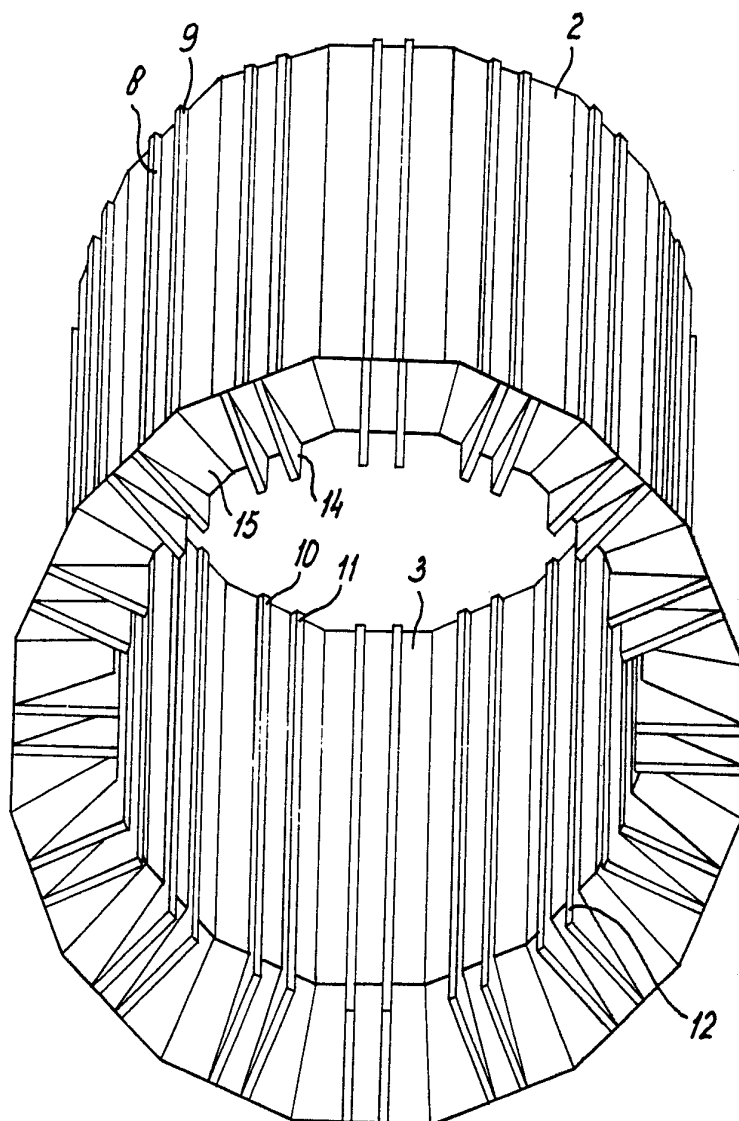


fig - 3

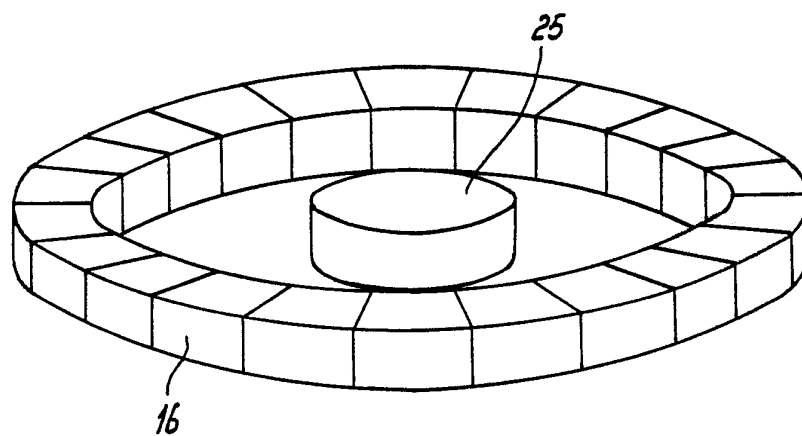
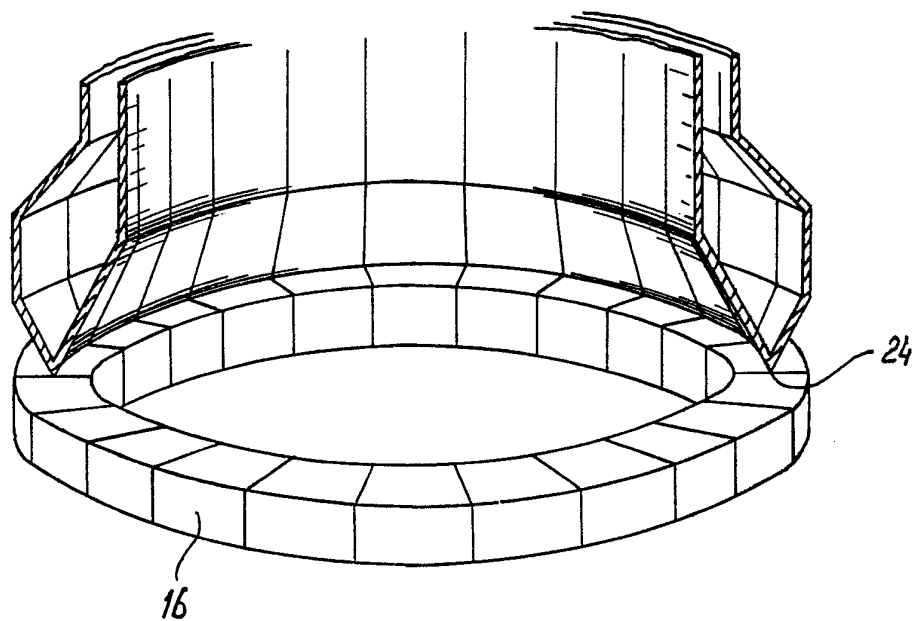


fig - 4



4/10

fig - 5

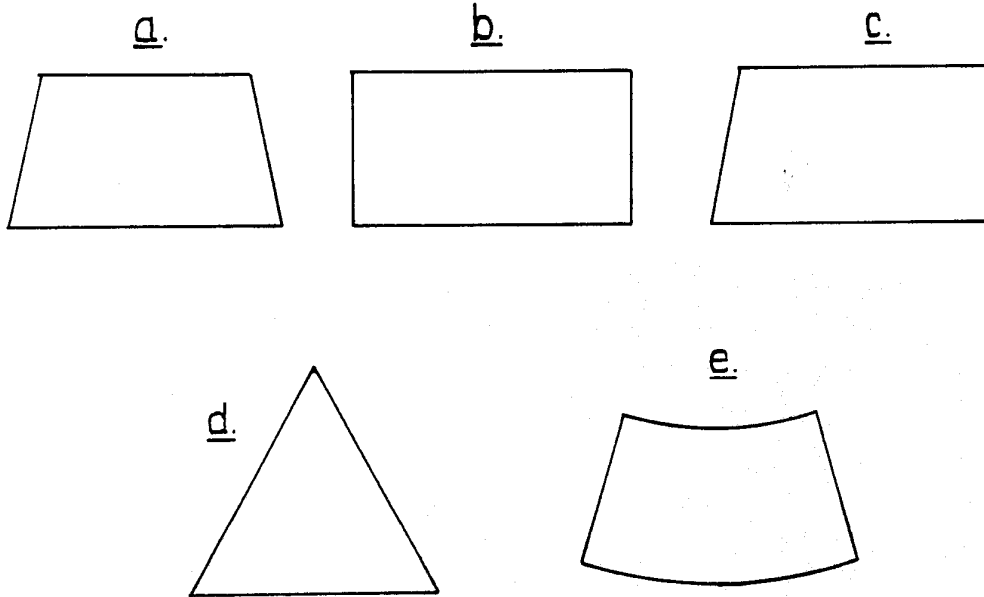


fig - 6

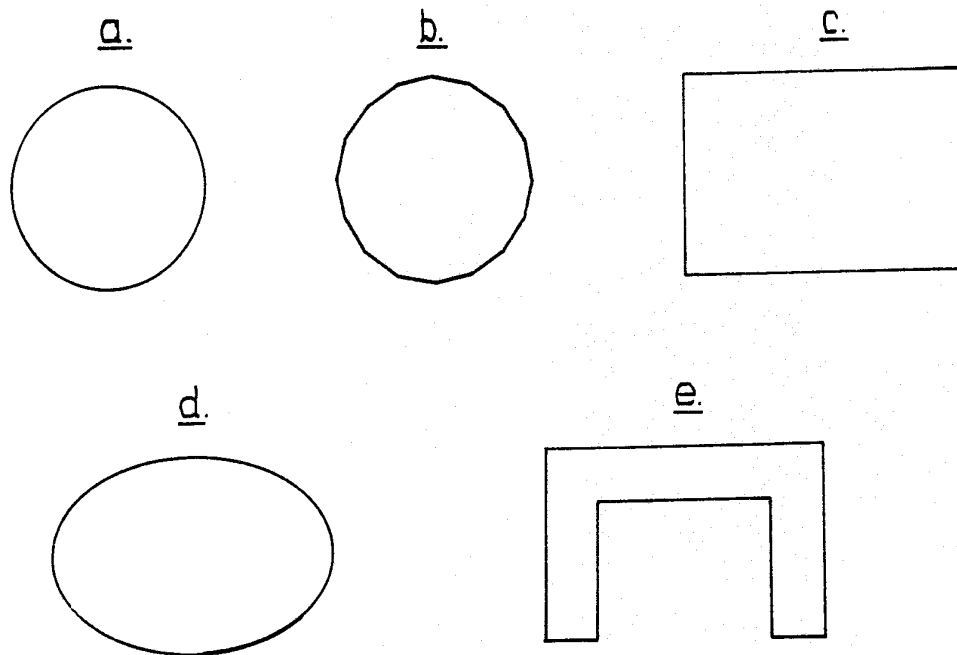
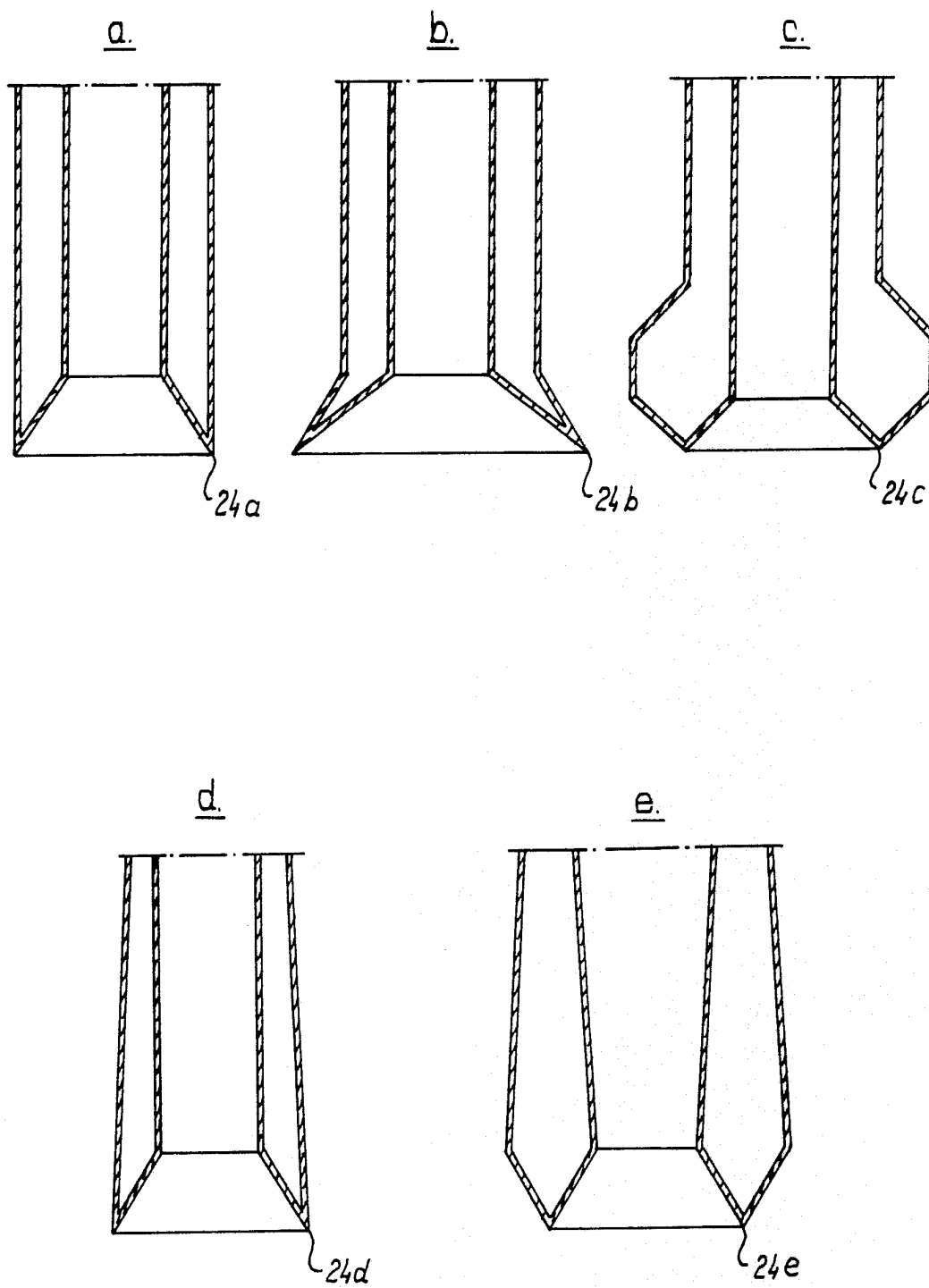


fig - 7



6/10

fig - 8

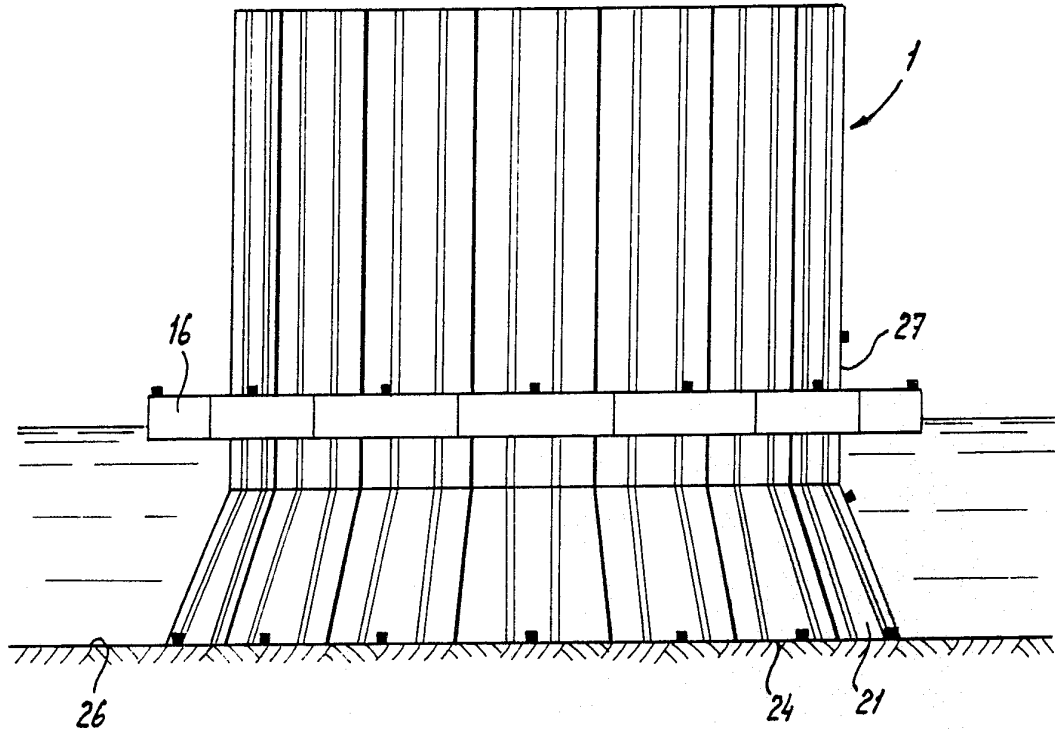
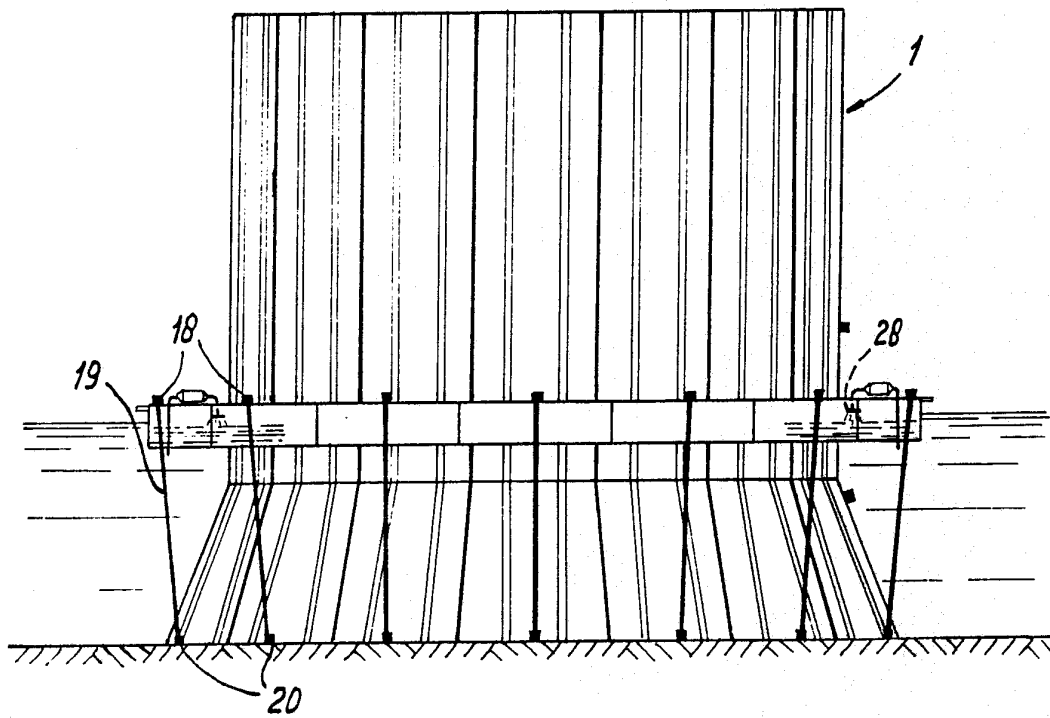


fig - 9



7/10

fig-10

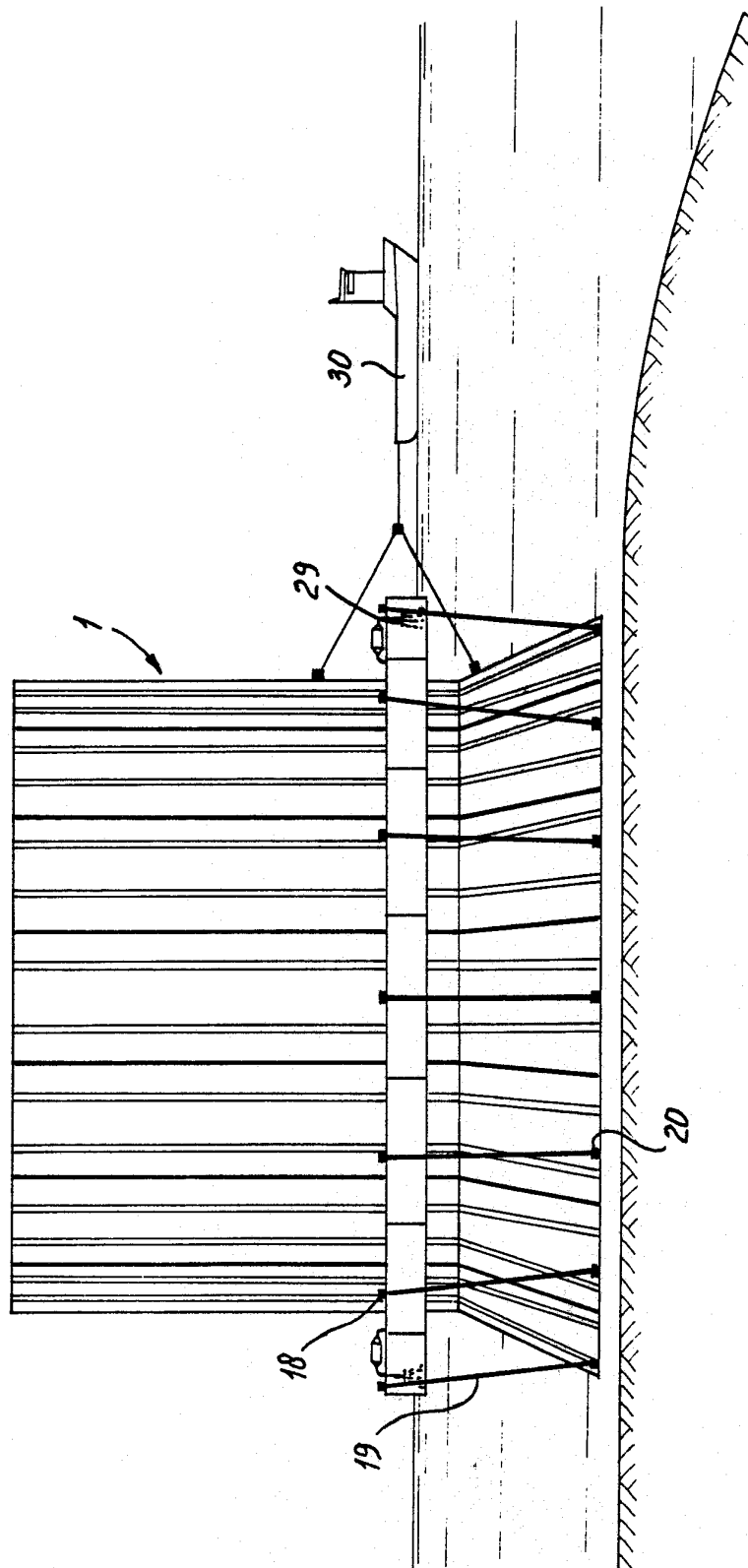
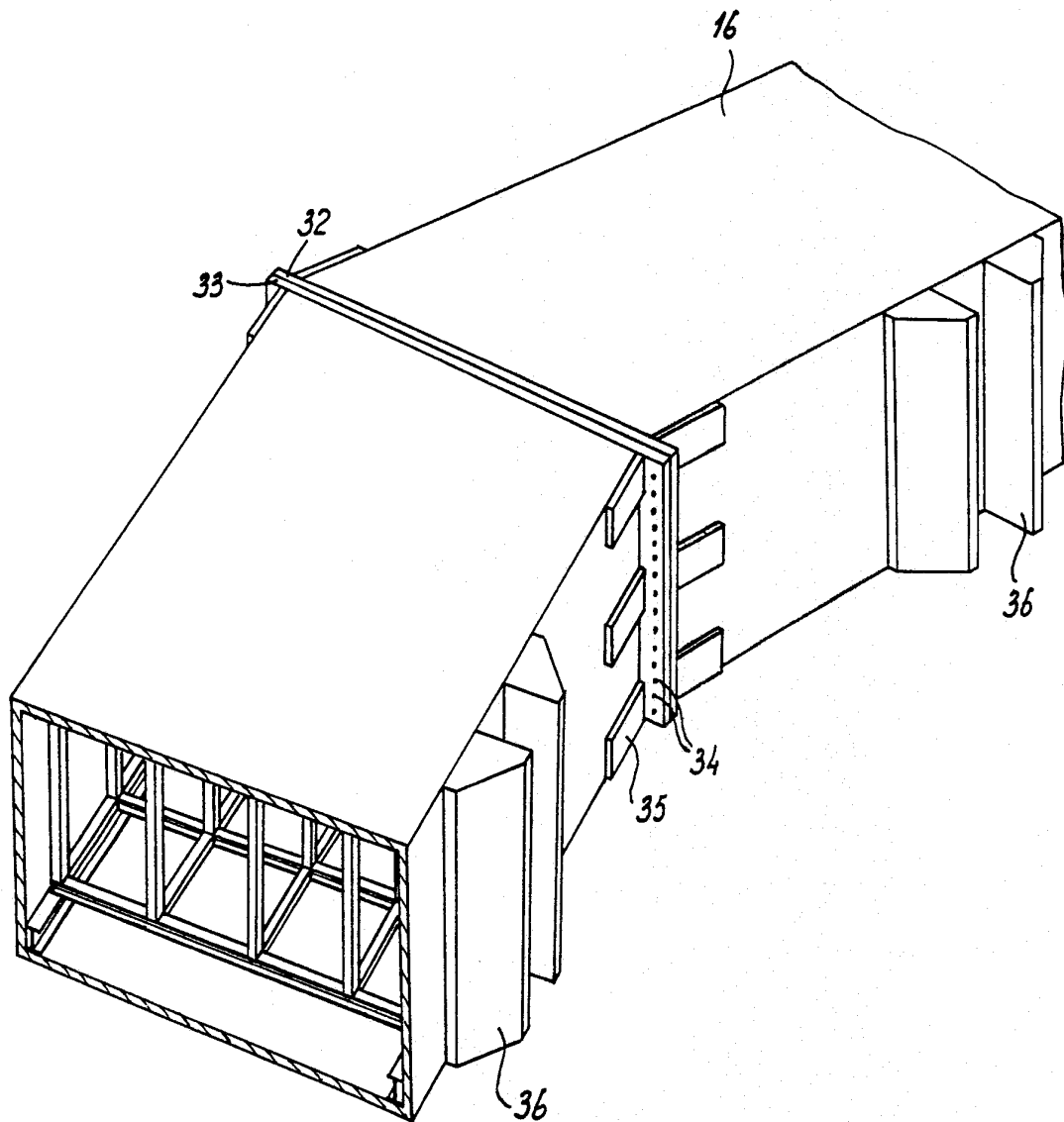


fig - 11



9/10

fig - 12

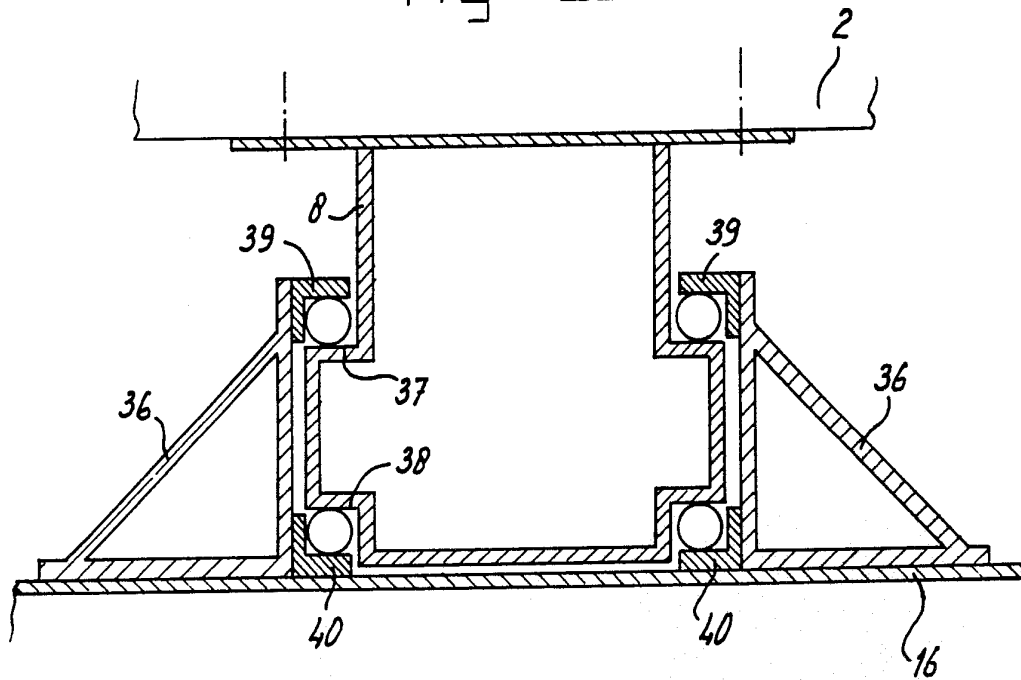


fig - 13

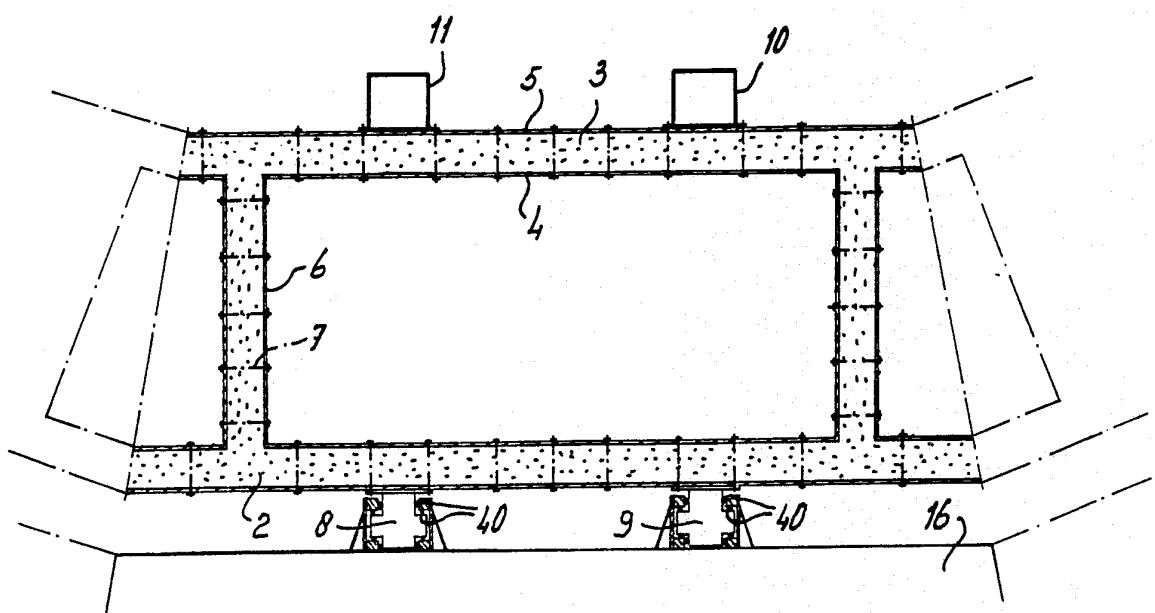
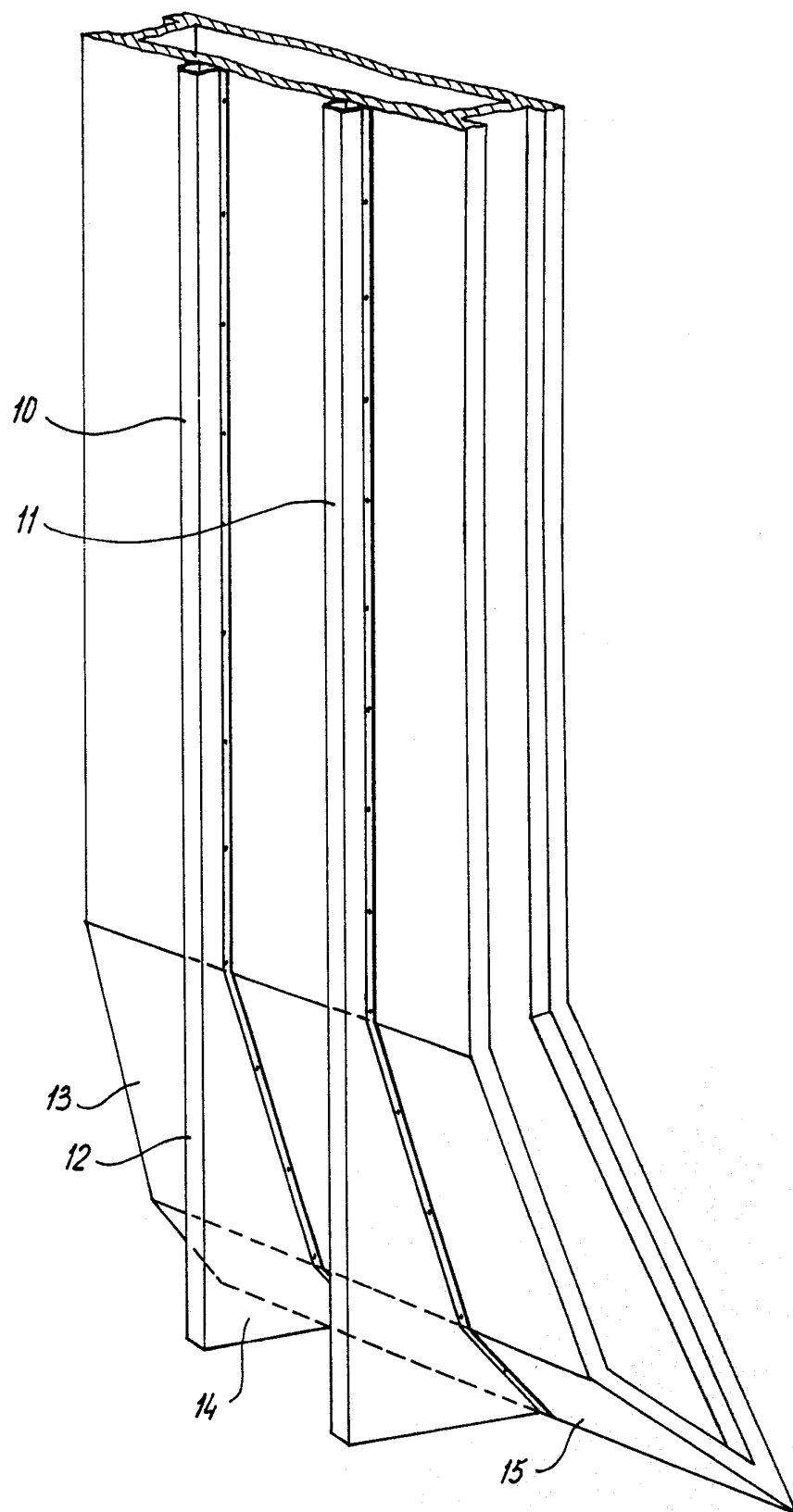


fig - 14



INTERNATIONAL SEARCH REPORT

International Application No **PCT/EP 90/01852**

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁴ According to International Patent Classification (IPC) or to both National Classification and IPC IPC ⁵ : E 02 D 23/02, E 02 B 17/00																										
II. FIELDS SEARCHED Minimum Documentation Searched ⁷ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; text-align: left; border-bottom: 1px solid black;">Classification System</th> <th style="text-align: left; border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">IPC⁵</td> <td style="border: 1px solid black; padding: 5px;">E 02 D, E 02 B</td> </tr> </table> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸			Classification System	Classification Symbols	IPC ⁵	E 02 D, E 02 B																				
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IPC ⁵	E 02 D, E 02 B																									
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; text-align: left; font-size: small;">Category ⁹</th> <th style="width: 70%; text-align: left; font-size: small;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%; text-align: left; font-size: small;">Relevant to Claim No. ¹³</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td>US, A, 2050727 (MISZ) 11 August 1936, see page 1, left-hand column, line 1 - page 2, right-hand column, line 45; page 3, right-hand column, line 30 - page 4, right-hand column, line 19; figures 1-15,24</td> <td style="vertical-align: top;">10-13,18,19</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td style="text-align: center;">--</td> <td style="vertical-align: top;">1,2,5,8</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td>US, A, 1758606 (JACOBS) 13 May 1930, see page 1, left-hand column, line 38 - right-hand column, line 65; figures 1,2</td> <td style="vertical-align: top;">10-13</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td style="text-align: center;">--</td> <td style="vertical-align: top;">9,14,15</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">Y</td> <td>US, A, 3740956 (GUY) 26 June 1973, see column 1, line 65 - column 3, line 13; figures 1-4</td> <td style="vertical-align: top;">18,19</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>US, A, 4118941 (BRUCE) 10 October 1978, see column 3, line 4 - column 6, line 4; figures 1-4</td> <td style="vertical-align: top;">16,17</td> </tr> <tr> <td></td> <td style="text-align: center;">--</td> <td></td> </tr> </tbody> </table>			Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	Y	US, A, 2050727 (MISZ) 11 August 1936, see page 1, left-hand column, line 1 - page 2, right-hand column, line 45; page 3, right-hand column, line 30 - page 4, right-hand column, line 19; figures 1-15,24	10-13,18,19	A	--	1,2,5,8	Y	US, A, 1758606 (JACOBS) 13 May 1930, see page 1, left-hand column, line 38 - right-hand column, line 65; figures 1,2	10-13	A	--	9,14,15	Y	US, A, 3740956 (GUY) 26 June 1973, see column 1, line 65 - column 3, line 13; figures 1-4	18,19	A	US, A, 4118941 (BRUCE) 10 October 1978, see column 3, line 4 - column 6, line 4; figures 1-4	16,17		--	
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¹⁰ Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		¹⁴ "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention ¹⁵ "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step ¹⁶ "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. ¹⁷ "Z" document member of the same patent family																								
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search 15th January 1991 </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;"> Date of Mailing of this International Search Report 31. 01. 91 </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;"> International Searching Authority EUROPEAN PATENT OFFICE </td> <td style="border-bottom: 1px solid black; padding: 5px;"> Signature of Authorized Officer miss T. MORTENSEN </td> </tr> </table>			Date of the Actual Completion of the International Search 15th January 1991	Date of Mailing of this International Search Report 31. 01. 91	International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer miss T. MORTENSEN																				
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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, " with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	GB, A, 1386053 (LIND) 5 March 1975, see page 1, line 53 - page 2, line 45; page 2, lines 69-120; figures 1-5 --	1,3,4,6,7
A	FR, A, 1497544 (CAMPENON BERNARD) 13 October 1967, see page 2, line 49 - page 3, line 45; figures 3a-4d -----	1,2,5

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

EP 9001852

SA 41100

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 25/01/91
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 2050727		None	
US-A- 1758606		None	
US-A- 3740956	26-06-73	None	
US-A- 4118941	10-10-78	CA-A- 1082933	05-08-80
		CA-A- 1086082	23-09-80
		JP-A, B, C53142013	11-12-78
GB-A- 1386053	05-03-75	None	
FR-A- 1497544		None	