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(54) REMOVABLE OFFSHORE PLATFORM

AUSWECHSELBARE OFFSHORE-PLATTFORM

PLATEFORME OFFSHORE DEMONTABLE

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(73) Proprietor:
DEN NORSKE STATS OLJESELSKAP A.S.
N-4001 Stavanger (NO)

(72) Inventors:
- **STEAD, Brian**
  N-4300 Sandnes (NO)
- **GUDMESTAD, Ove, Tobias**
  N-4350 Naerbo (NO)

(74) Representative: **Rees, David Christopher et al**
London WC1N 2DD (GB)

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Description

This invention relates to a platform structure for use in particular at relatively small offshore oil or gas fields, with re-use of substantial parts of the structure at change of location within the same field or at other fields having different water depths.

Both in the North Sea and at many other offshore sites there are established large field centers for the production and processing of hydrocarbons. As the production from original reservoirs is reduced there is a desire towards utilizing the surplus processing capacity of these centers by connecting the production from adjacent smaller reservoirs to the centers.

Moreover, there are in many places small reservoirs which can advantageously be produced during a relatively short time period.

Production from the small fields can take place from subsea production equipment or from wellhead platforms. It is common to many of these small fields that they will be in production during a period of relatively few years, typically 4-8 years. Accordingly, there is a need for inexpensive production equipment so as to attain a sufficiently profitable operation. Wellhead platforms known today are lattice structure platforms of steel onto which an associated production module has to be installed offshore. This makes it complicated and expensive both to install and remove such platforms. At fields having a short production time, this type of platforms will hardly result in the required profitability.

Furthermore, there is a steady requirement for platforms having supporting functions in association with offshore production of hydrocarbons. Typical examples in this connection are accomodation platforms, riser platforms and platforms for storage of hydrocarbons.

As representative of previously known structures being of interest in this connection, reference is made to GB-A-2.034.789, which shows a platform structure having a plurality of column or tower elements which are arranged one above the other for adaption to the maximum water depth concerned.

Thus, more accurately stated this invention takes as a starting point a platform structure comprising a base part designed to be placed on the seabed, a concrete column extending upwards form the base part, and at least one other column part above the concrete column for supporting a platform or deck module at a desired height above the mean water level.

An objective of the present invention is to provide a new type of platform which by simple means can be employed at several subsequent locations. The platform shall be used for the production of hydrocarbons or for supporting functions associated with the production of hydrocarbons.

Another objective is to provide a platform which can be installed and removed without offshore assembly or disassembly operations.

It is a further objective to provide a removable platform which can be used as a wellhead platform or for other supporting functions and which involves low maintenance cost.

It is also an objective to provide a platform having good stability against geotechnical failure during the operational period.

On the background of known techniques and in view of the above objectives, there is according to the invention provided a new platform structure, the novel and specific features of which in the first place consist therein that the upper end of the concrete column is closable with a cover and adapted to have a position above the water level both after installation on the seabed at the field concerned and during transport to the installation location or during change of location, that there is provided another part in the form of a top unit, preferably a lattice structure, on which said module is mounted, and that there are provided detachable, joining means at the upper end of the concrete column and at the lower end of the top unit respectively.

In the following description the invention will be more accurately explained with reference to the accompanying drawings, which schematically show the platform structure according to the invention in various embodiments.

Fig. 1	shows a first embodiment of the platform structure according to the invention, and
Figs. 2A, 2B and 2C	show another embodiment of the platform structure according to the invention in three different configurations and based upon the same principles as the embodiment of Fig. 1.

In Fig. 1 the platform is shown in an operational situation, and is resting on the seabed 3. It comprises a base part 4, a column 1 which extends somewhat above the water level 10, and an upper part (top unit) 5 standing on the upper portion of the column 1 and supporting a platform or deck module 6. Both the base part 4 and the column 1 are preferably made of concrete.

The base part 4 can be of a type known per se, and can for example consist of a concrete caisson 11 which rests on the seabed 3, whereby onto the lower part of this concrete caisson there is placed a part 12 of conical shape with the major area thereof anchored to the bottom of the concrete caisson, whereas the upper, narrower end of this part joins the column 1.

As an alternative the base part can be made up of several cells, of which one or more cells can be extended upwards to constitute the column 1, as in some previously known structures.

At the underside of base part 4 there can be provided skirts 2 which penetrate the seabed and secure the stability of the platform. The skirts also prevent excavation underneath the platform with consequent uneven settlement thereof.

Besides, both the base part and the skirts must be planned and dimensioned for the types of ground conditions on which the platform in the first place is intended to be used. Also the column 1 is of a type known per se. The height of the column is chosen so large that the upper end thereof extends above the mean water level at all locations where the platform is to be employed. The upper part of the column is tightly closed, preferably by means of a spherical shell 7 in order to prevent the intrusion of water in an uncontrolled manner during towing and lowering. Instead of a spherical shell 7 it may be possible to use a plane plate. The spherical shell 7 is provided with required manholes for access to the internal spaces of the column and pipes therein, for communication with wells etc.

On the top of column 1 and along the outer periphery thereof there are provided a number of openings 9 in which legs 23 extending downwards from the top unit 5 are supported. The size, positions and dimensions of the openings will be determined in view of the dimensions of the top unit and the weight of the module 6 to be supported. Preferably the top unit 5 is designed as a lattice work of steel. The vertical legs 23 being inserted in the openings 9 provided, can be secured further to the top of the column, for example by means of bolt connections. The joining means referred to here apparently can be replaced by or supplemented with other known forms of detachable joining means. The top unit 5 can in practice be installed in quiet waters before the platform is towed to the offshore field concerned.

The module 6 which rests on the upper surface of the top unit 5 comprises equipment being known per se for a wellhead platform or for other types of platforms.

In order for the platform to be employed at varying water depths, each platform is designed for a predetermined range of water depths, for example 70-90 m, 90-110 m or 110-130 m. In the case of a removable platform for the depth range 70-90 m the upper end of column 1 typically will extend 5 m above the mean water level at a water depth of 90 m. In order to adapt the platform for the water depth in question, such that the module 6 with its equipment is positioned at a suitable level above the wave zone, the height of the top unit 5 is adjusted according to the water depth concerned.

For removing the platform the base part 5 and the column 1 are de-balasted so that the whole platform will be floating, and if necessary the platform is towed to quiet waters for replacement of the top unit with a top unit intended for another water depth, and for exchanging the module 6 as the case may be. Then the platform is towed to the new location and is installed there in order to produce from the new reservoir.

In connection with transport or removal of this platform structure and also after installation thereof on the seabed, it is essential that the upper end of the concrete column 1 is closed with the cover 7, and that this upper end is positioned above the sea level 10 at all times. This means that a water line will always exist, which, as known, is required for the floating stability of such a floating structure.

The top unit 5 can be regarded as an extended part being intended to extend the platform upwards above the sea level 10. In the case of waves on the sea surface these will to a substantial degree act on the top unit, and when this unit as mentioned is preferably a lattice structure, the waves may more easily pass through the structure without excerting too large forces thereon. In particular the cross braces as shown at 22 in Fig. 1 are preferred to be made of steel, whereas the vertical elements 21 can be more or less massive concrete columns as the case may be. It is also possible to manufacture the complete, supporting lattice structure of top unit 5 of concrete.

In the embodiment of Fig. 1 the cover 7 preferably constitutes an integral part of the actual concrete column 1. Another more or less integrated part of the column structure is constituted by inclined walls 12 which together with the opposed walls of column 1 form one or more storage spaces 41, in particular to be utilized for storing oil and/or gas. As will be seen in Fig. 1, these inclined walls 12 extend from the outer edges of base part 4 up to a level on the concrete column 1, preferably somewhat below the mean water level or sea surface 10.

Figs. 2A-2B-2C illustrate an embodiment of the invention which involves somewhat expanded possibilities of water depth variation compared to what is found in Fig. 1. Thus, Fig. 2A shows a configuration of a platform structure according to the invention, intended for smaller water depths, as indicted with the depth measure 85 m on this Fig. Fig. 2B shows a configuration intended for a medium water depth, indicated as a maximum of 105 m on that Fig., whereas Fig. 2C shows a configuration of the platform structure for a maximum water depth, indicated as an example with the marking 125 m on this figure.

From Figs. 2A, 2B and 2C the structures shown can be considered to constitute a platform system which has a high degree of flexibility for adaption to the water depth occurring at different offshore fields where it may be of interest to employ such platforms, and with possibilities of changing location within the same field or use at other fields normally via certain operations in quiet waters near the shore.

Figs. 2A, 2B and 2C show main components which correspond to main components in Fig. 1, but the illustrations of Figs. 2A, 2B and 2C are somewhat more schematical and simplified, so that for example details of the joining means (9, 23 in Fig. 1) are not shown.

In Figs. 2A, 2B and 2C the seabed is indicated at 13, whereas 11 designates the concrete column and 14 designates

the base part in all three configurations. Moreover, there are shown inclined walls 32 forming storage spaces 51 corresponding to respective elements 12 and 41 in Fig. 1.

Fig. 2A shows a top unit 15 having a very low height, for supporting a module 16 being analogue to the module 6 in Fig. 1. At the lower end of top unit 15 there is provided a cover 17 which preferably constitutes an integral part of this top unit. By mounting the top unit 15 on the upper end of the concrete column 11 and joining with means as previously mentioned, the cover 17 like cover 7 in Fig. 1 will close the top of the concrete column.

In the configuration of Fig. 2B the same base part and concrete column as shown in Fig. 2A are utilized, but the top unit 25 has a more "normal" height, similar to the one in Fig. 1, aiming at employment at a larger water depth. The top unit 25 carries a platform or deck module 26 and at a lower portion it is provided with a cover 27 for closing the concrete column 11 at the top.

In Fig. 2C the same top unit 25 is again found, but for employment at a still larger water depth there is here inserted another column part in the form of a hollow concrete cylinder 33 which can also be regarded as a more or less direct extension or upper portion of the concrete column 11 itself. Thus, in this configuration the cover 27 at the lower end of the top unit 25 closes the upper open end of concrete cylinder 33. This concrete cylinder is provided with joining means at the top and bottom for joining with corresponding means as previously mentioned, on the top unit and the concrete column respectively.

When a concrete cylinder 33 is referred to here, this only represents one possible practical design. An alternative design, which may be preferred in practice, is to make the hollow cylinder of steel. Moreover, it will be understood that the geometrical shape does not necessarily have to be exactly cylindrical.

The top units 15 and 25 shown, in particular the latter, can be manufactured with various heights according to the requirements, and can advantageously be exchangeable in its entirety. In actual practice, however, it may be an advantageous method when exchanging such a top unit, to divide or cut the same at a level just above the cover 27, which means that the cover may be left in its position, joined to the upper end of the concrete column 11 or the concrete cylinder 33 as the case may be, with subsequent mounting of a new and possibly higher or lower top unit by welding, bolt connections or the like, so that the same lower portion with cover 27 is still used. The configurations illustrated in Figs. 2A, 2B and 2C can be considered to constitute a platform system with main components in the form of a base part 14 with the associated column 11, a top unit or units 15 and 25 respectively, and a concrete cylinder 33 as shown in Fig. 2C. In particular the top unit 25 and the concrete cylinder 33 contribute to a substantial degree to the flexibility and adaptability which is explained above.

Thus, what is described here is a re-usable platform structure whereby in operations at a field having the lowest water depth (Fig. 2A) there is employed a configuration having dimensions adapted to such water depth, and is closed at the upper end by means of a cover 17, whereby the top unit 15 directly supports a platform module 16. When installed at a field having a moderate water depth (Fig. 2B) exceeding the above lowest water depth (Fig. 2A) there is employed a configuration having a larger height, whereby a top unit 25 with a cover 27 at its lower end supports a platform module 26. In the case of a maximum water depth (Fig. 2C), the very concrete column 11 can be regarded as extended with the concrete cylinder 33 shown, which is open at both ends, and where the top unit 25 with its cover 27 in the first place closes the top of the concrete cylinder 33, and in the second place carries the module 26. This method of adapting the structure is made possible with a platform system as described above and illustrated in Figs. 2A, 2B and 2C, and which in a more simplified and principle form is illustrated in Fig. 1.

Claims

1. Platform structure for use in particular at relatively small offshore oil or gas fields, with re-use of substantial parts of the structure after change of location within the same field or at other fields having different water depths, comprising a base part (4,14) suitable to be placed on the seabed (3,13), a concrete column (1,11) extending upwards form the base part (4,14), and at least one other column part above the concrete column (1,11) for supporting a platform or deck module (6,16,26) at a desired height above the mean water level (10),
characterized in
that the upper end of the concrete column (1,11) is closable with a cover (7,17,27) and arranged to have a position above the water level (10) both upon installation on the seabed at the field concerned (3,13) and during transport to the installation location or during change of location,
that there is provided another column part in the form of a top unit (5,15, 25) preferably with a lattice structure (21,22), on which said platform (6,16,26) is mounted, and that there are provided detachable, joining means (9,23) at the upper end of the concrete column (1,11) and at the lower end of the top unit (5,15,25) respectively.

2. Platform structure according to claim 1,
characterized by

another, additional column part in the form of a hollow cylinder (33) arranged to constitute an upper part of the concrete column (11) for supporting the top unit (25) and to be closed by a cover (27) at its upper end, and moreover to have its upper end positioned above the water level both upon installation of the platform structure on the seabed (13) at the field concerned, and during transport to the installation location or during change of location,with detachable joining means provided at the upper and lower ends of the cylinder (33) for joining with said joining means on the concrete column (11) and the top unit (25) respectively. (Fig. 2C).

3. Platform structure according to claim 1,
characterized in that the cover (7) is an integral part of the concrete column (1). (Fig. 1).

4. Platform structure according to claim 1 or 2,
characterized in that the cover (17,27) is provided at the lower end of the top unit (15,25) and preferably is an integral part thereof.

5. Platform structure according to any one of claims 1 to 4,
characterized in that the top unit (5,25) is designed substantially as a steel lattice work.

6. Platform structure according to any one of claims 1 to 5,
characterized in that the cover (7,17,27) has a spherical shell shape.

7. Platform structure according to any one of claims 1 to 5,
characterized in that the cover has the shape of a plane plate.

8. Platform structure according to any one of claims 1 to 7,
characterized in that the upper end of the concrete column (1) is provided with a number of openings (9) being upwardly open and adapted to receive a corresponding number of legs (23) projecting downwards from the lower end of the top unit (5), in order for at least in part to form said detachable, joining means. (Fig. 1).

9. Platform structure according to any one of claims 1 to 8,
characterized in the provision of inclined walls (12,32) preferably from the outer edges of the base part (4,14) to a level on the concrete column (1,11), so as to form a storage space (41,51) for oil.

Patentansprüche

1. Plattformkonstruktion insbesondere zur Verwendung bei verhältnismäßig kleinen küstennahen Öl- oder Gasfeldern mit Wiederverwendung wesentlicher Teile der Konstruktion nach einem Ortswechsel innerhalb desselben Feldes oder zu anderen Feldern mit unterschiedlichen Wassertiefen, mit einem Basisteil (4, 14), der zum Stellen auf dem Meeresboden (3, 13) geeignet ist, mit einer Betonsäule (1, 11), die von dem Basisteil (4, 14) aus nach oben ragt, und mit mindestens einem weiteren Säulenteil über der Betonsäule (1, 11) zum Tragen einer Plattform oder eines Deckmoduls (6, 16, 26) in einer gewünschten Höhe über dem mittleren Wasserspiegel (10), dadurch gekennzeichnet, daß das obere Ende der Betonsäule (1, 11) mit einer Abdeckung (7, 17, 27) verschließbar ist und so angeordnet ist, daß es eine Position über dem Wasserspiegel (10) sowohl nach der Installation auf dem Meeresboden in dem fraglichen Feld (3, 13) als auch während des Transportes zur Installationsstelle oder während des Ortswechsels einnimmt, daß ein weiterer Säulenteil in Form einer oberen Einheit (5, 15, 25) vorzugsweise mit einer Gitterstruktur (21, 22) vorgesehen ist, auf dem die Plattform (6, 16, 26) befestigt ist, und daß lösbare Verbindungsmittel (9, 23) an dem oberen Ende der Betonsäule (1, 11) bzw. an dem unteren Ende der oberen Einheit (5, 15, 25) vorgesehen sind.

2. Plattformkonstruktion nach Anspruch 1, gekennzeichnet durch einen weiteren zusätzlichen Säulenteil in Form eines Hohlzylinders (33), der zur Bildung eines oberen Teiles der Betonsäule (11) zum Tragen der oberen Einheit (25) angeordnet ist und durch eine Abdeckung (27) an seinem oberen Ende verschließbar ist und dessen oberes Ende sich ferner sowohl nach der Installation der Plattformkonstruktion auf dem Meeresboden (13) in dem fraglichen Feld als auch während des Transportes zur Installationsstelle oder während des Ortswechsels über dem Wasserspiegel befindet, wobei lösbare Verbindungsmittel an den oberen und unteren Enden des Zylinders (33) zum Verbinden mit den Verbindungsmitteln an der Betonsäule (11) bzw. der oberen Einheit (25) vorgesehen sind. (Fig. 2C)

3. Plattformkonstruktion nach Anspruch 1, dadurch gekennzeichnet, daß die Abdeckung (7) ein integrierter Teil der

Betonsäule (1) ist. (Fig. 1)

4. Plattformkonstruktion nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Abdeckung (17, 27) an dem unteren Ende der oberen Einheit (15, 25) vorgesehen ist und vorzugsweise mit diesem einstückig ausgebildet ist.

5. Plattformkonstruktion nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die obere Einheit (5, 25) im wesentlichen als Stahlfachwerk konstruiert ist.

6. Plattformkonstruktion nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Abdeckung (7, 17, 27) eine sphärische Schalenform aufweist.

7. Plattformkonstruktion nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Abdeckung die Form einer ebenen Platte aufweist.

8. Plattformkonstruktion nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß das obere Ende der Betonsäule (1) mit einer Anzahl von nach oben offenen Öffnungen (9) versehen ist, die für die zumindest teilweise Bildung des lösbaren Verbindungsmittels zur Aufnahme einer entsprechenden Anzahl von Beinen (23) ausgebildet sind, die sich von dem unteren Ende der oberen Einheit (5) nach unten erstrecken. (Fig. 1)

9. Plattformkonstruktion nach einem der Ansprüche 1 bis 8, gekennzeichnet durch die Bereitstellung von schrägen Wänden (12, 32) vorzugsweise von den äußeren Rändern des Basisteils (4, 14) zu einer Höhe auf der Betonsäule (1, 11), um einen Lagerraum (41, 51) für Öl zu bilden.

Revendications

1. Structure de plate-forme à utiliser en particulier pour des champs de pétrole ou de gaz naturel offshore relativement petits, avec réutilisation de parties substantielles de la structure après changement d'emplacement dans le même champ ou dans d'autres champs ayant des profondeurs d'eau différentes, comprenant une embase (4, 14) apte à être placée sur le fond de la mer (3, 13), une colonne de béton (1, 11) qui s'étend vers le haut depuis l'embase (4, 14), et au moins une autre partie de colonne placée au-dessus de la colonne de béton (1, 11) afin de supporter une plate-forme ou un module de pont (6, 16, 26) à une hauteur souhaitée au-dessus du niveau moyen de l'eau (10), caractérisée en ce que l'extrémité supérieure de la colonne de béton (1, 11) peut être fermée par un couvercle (7, 17, 27) et est disposée de manière à occuper une position située au-dessus du niveau de l'eau (10) à la fois lors de l'installation sur le fond de la mer dans le champ concerné (3, 13) et pendant le transport vers l'emplacement d'installation ou pendant le changement d'emplacement, qu'une autre partie de colonne est prévue sous la forme d'une unité supérieure (5, 15, 25), de préférence avec une structure en treillis (21, 22), sur laquelle ladite plate-forme (6, 16, 26) est montée, et que des moyens d'assemblage détachables (9, 23) sont prévus à l'extrémité supérieure de la colonne de béton (1, 11) et à l'extrémité inférieure de l'unité supérieure (5, 15, 25), respectivement.

2. Structure de plate-forme suivant la revendication 1,
caractérisée par une autre partie de colonne supplémentaire ayant la forme d'un cylindre creux (33) agencée de manière à constituer une partie supérieure de la colonne de béton (11) afin de supporter l'unité supérieure (25) et de manière à être fermée par un couvercle (27) à son extrémité supérieure, et en plus de manière à avoir son extrémité supérieure placée au-dessus du niveau de l'eau à la fois lors de l'installation de la structure de plate-forme sur le fond de la mer (13) dans le champ concerné, et pendant le transport vers l'emplacement d'installation ou pendant le changement d'emplacement, avec des moyens d'assemblage détachables prévus aux extrémités supérieure et inférieure du cylindre (33) pour assembler lesdits moyens d'assemblage sur la colonne de béton (11) et l'unité supérieure (25), respectivement. (Fig. 2C).

3. Structure de plate-forme suivant la revendication 1,
caractérisée en ce que le couvercle (7) est une partie intégrante de la colonne de béton (1). (Fig. 1).

4. Structure de plate-forme suivant la revendication 1 ou 2,
caractérisée en ce que le couvercle (17, 27) est prévu à l'extrémité inférieure de l'unité supérieure (15, 25) et est, de préférence, une partie intégrante de celle-ci.

5. Structure de plate-forme suivant l'une quelconque des revendications 1 à 4,

caractérisée en ce que l'unité supérieure (5, 25) est conçue sensiblement comme un treillis d'acier.

6. Structure de plate-forme suivant l'une quelconque des revendications 1 à 5, caractérisée en ce que le couvercle (7, 17, 27) a la forme d'une coque sphérique.

7. Structure de plate-forme suivant l'une quelconque des revendications 1 à 5, caractérisée en ce que le couvercle a la forme d'une plaque plane.

8. Structure de plate-forme suivant l'une quelconque des revendications 1 à 7, caractérisée en ce que l'extrémité supérieure de la colonne de béton (1) présente un certain nombre d'ouvertures (9) qui sont ouvertes vers le haut et sont destinées à recevoir un nombre correspondant de jambes (23) saillant vers le bas depuis l'extrémité inférieure de l'unité supérieure (5), de manière à former au moins, en partie, lesdits moyens d'assemblage détachables. (Fig. 1).

9. Structure de plate-forme suivant l'une quelconque des revendications 1 à 8, caractérisée par la présence de parois inclinées (12, 32) qui s'étendent, de préférence, depuis les bords extérieurs de l'embase (4, 14) jusqu'à un certain niveau sur la colonne de béton (1, 11), de manière à former un espace de stockage (41, 51) pour le pétrole.

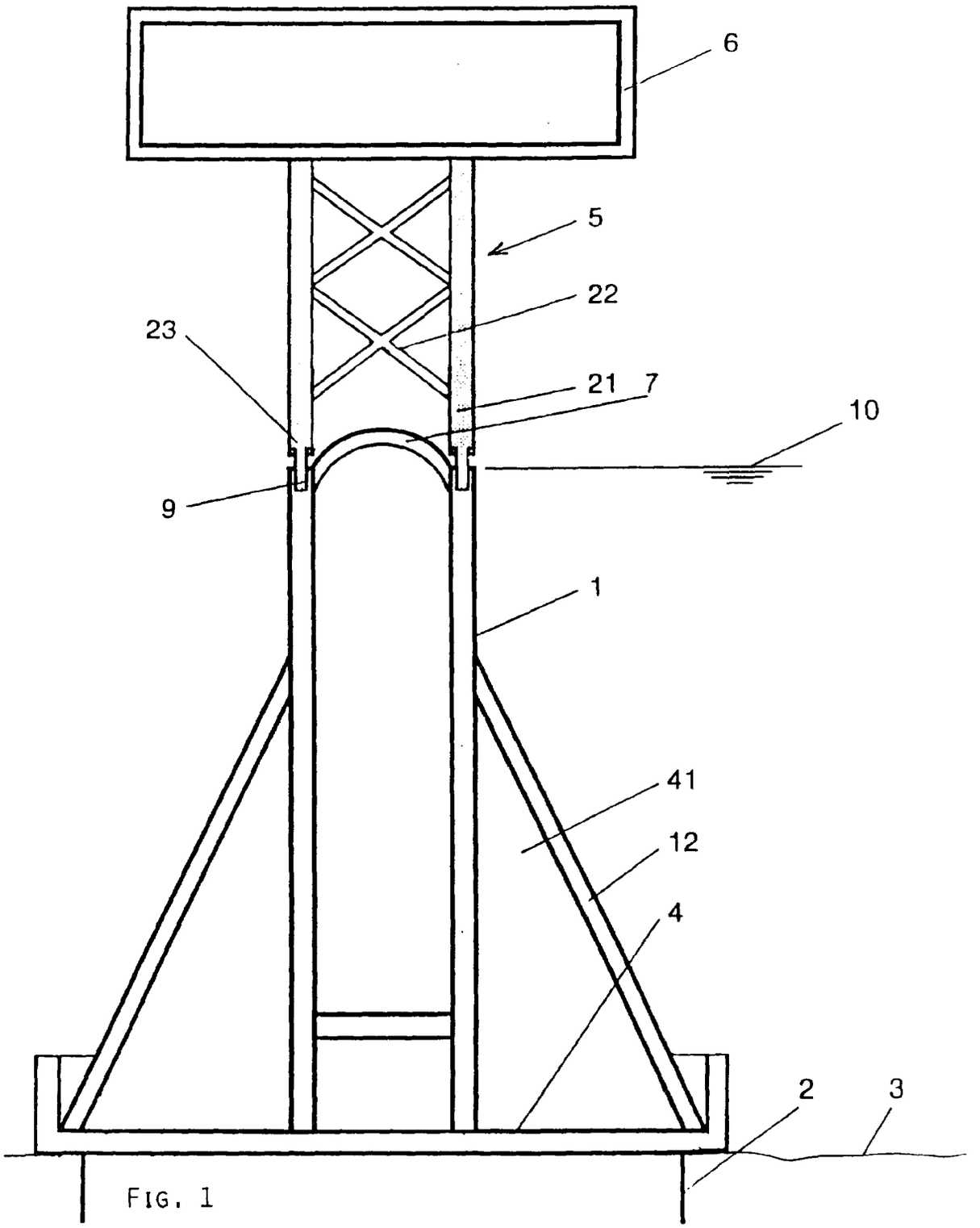

FIG. 1

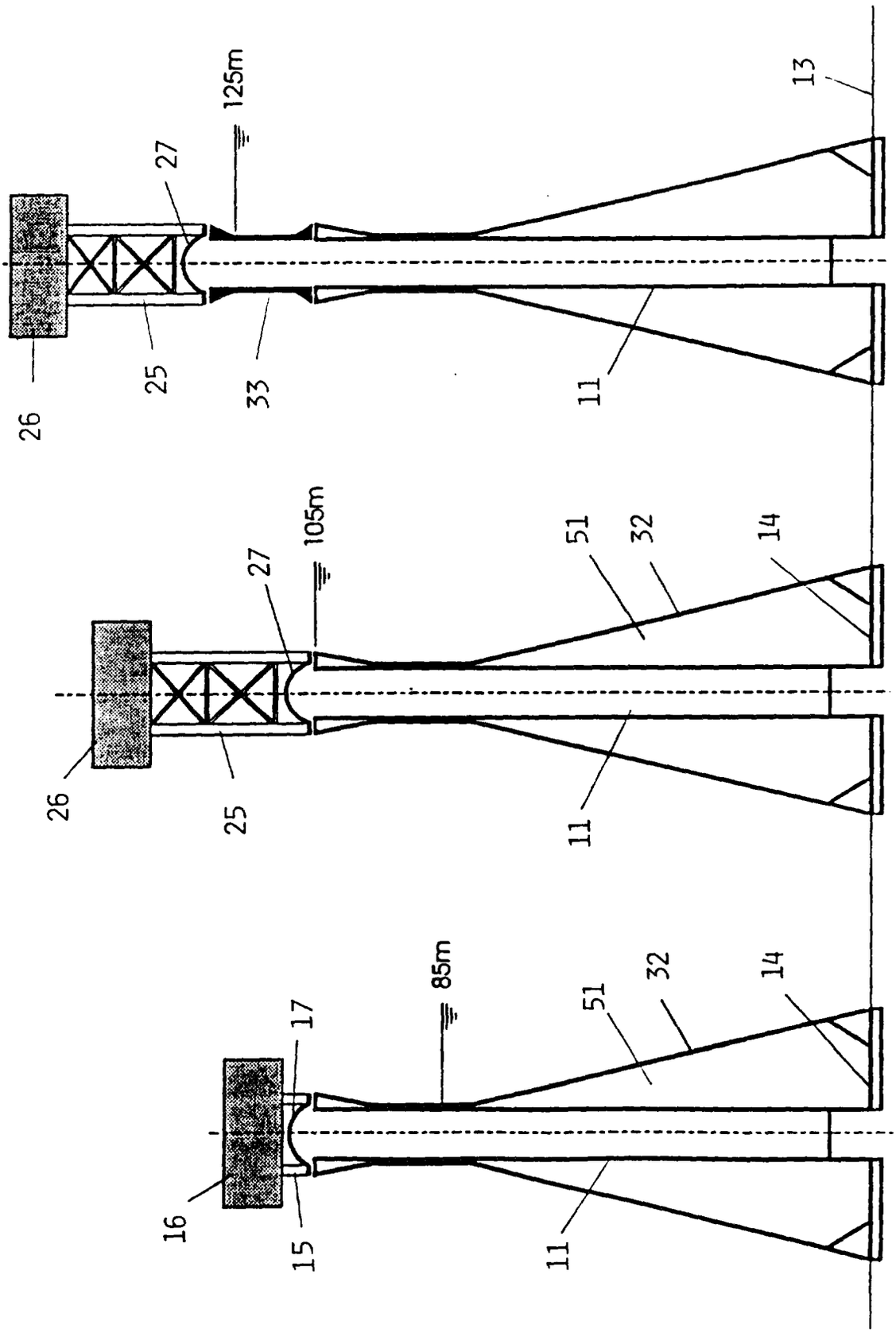

FIG. 2C

FIG. 2B

FIG. 2A