

# 海底原油採掘을 為한

## CONCRETE DEEPWATER PLATFORM

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The pontoon deck is firmly anchored to the caisson during towing from the construction site to the

final operation location. The freeboard is thus so great for the composite unit-caisson and steel deck that during the towing period the structure can survive undamaged the severest storms which could be expected in the North Sea in summer. The calculations and tests have been based on a wave spectrum with a significant wave height of 8 metres and a maximum wave height of 16 metres. Towing speed will average 2 knots.

Four tugs are used to hold the platform in position during the submerging operation. Sea conditions with a wave height of not more than 4 metres are required, this being the approximate limit to which the tugs can operate effectively. By flooding the inner cells of the caisson, the composite unit of caisson and deck is submerged until the deck floats and the caisson with a certain amount

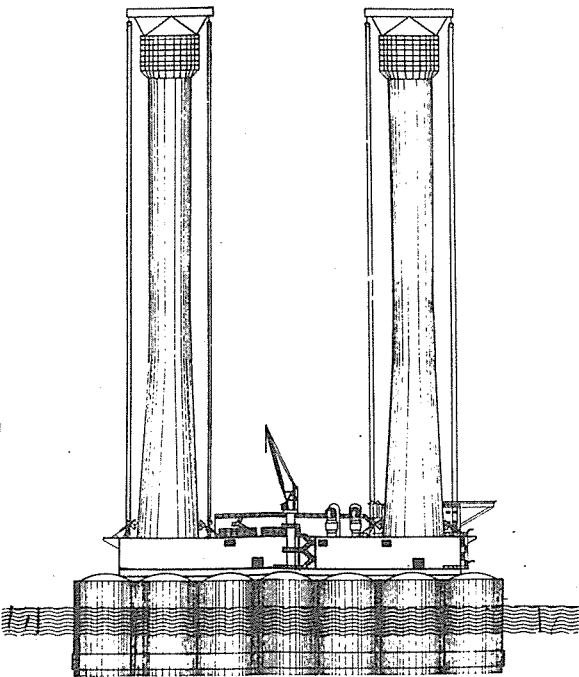


Fig. 8 (Phase 1); Towing to operating location-platform and base unit as composite buoyancy unit

of negative buoyancy is suspended from the floating deck.

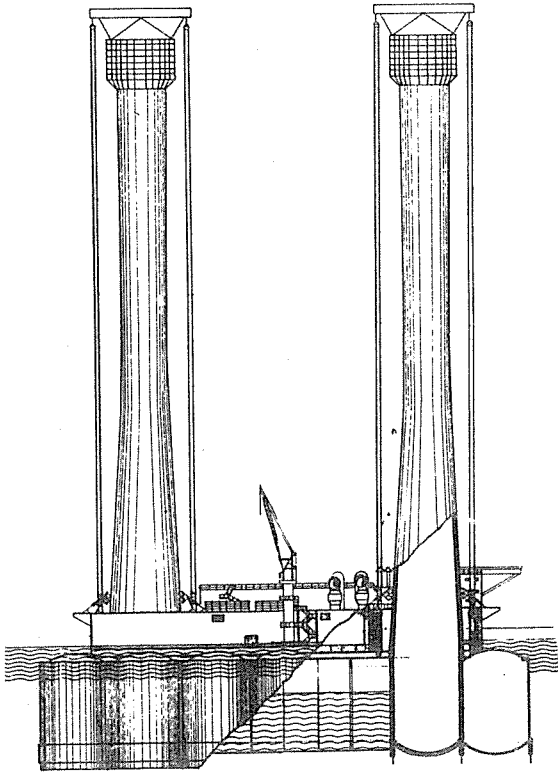


Fig. 9 (Phase 2); Submerging through flooding the inner cells of the base unit. Deck has reached its floating position

During the further submerging the deck floats whilst the caisson and shafts continue to submerge. The caisson and deck remain firmly connected with each other at all times through the cables and the lifting equipment installed in the deck. During this operation the stability of the substructure is supported by

the deck which is in floating condition. The adjustable hydraulic guides transfer the horizontal forces from the deck to the columns. The natural periods for pitch and heave are such that the structure remains very steady.

When the caisson is submerged 12 metres the inner cells are completely

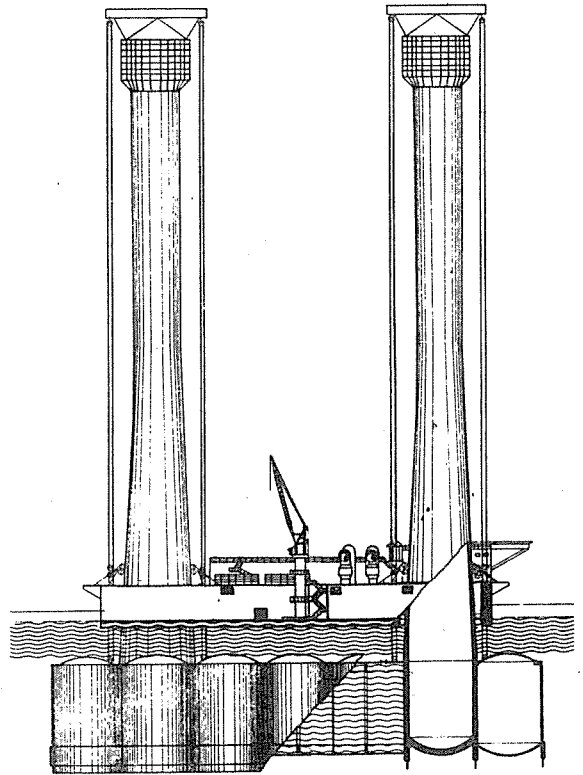


Fig. 10 (Phase 3); Further submerging, stabilised by the floating deck. The inner cells are completely full, and there is pressure equilibration with all surrounding water

filled with water. At this stage there is a balance in pressure internally and externally so that by further submerging no hydrostatic loading of the inner cells occurs.

To submerge further the outer cylindrical cells are flooded. As these cells are designed for excess hydrostatic pressure there is no need for use of compressed air. The pitch and heave natural periods increase

steadily. Shortly before reaching the sea bed the stability by form changes into stability by weight.

The first contact with the sea bed is through four dowels which project beyond the skirts and position the platform. By further flooding the cylindrical cells the steel skirts penetrate the soil. The dowels which operate hydraulically, are designed

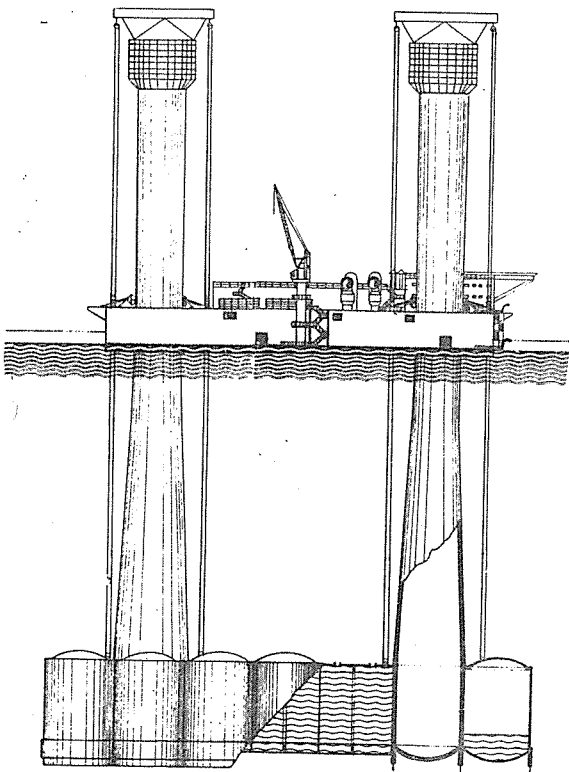


Fig. 11 (Phase 4); Further submerging by flooding the outer cylindrical cells

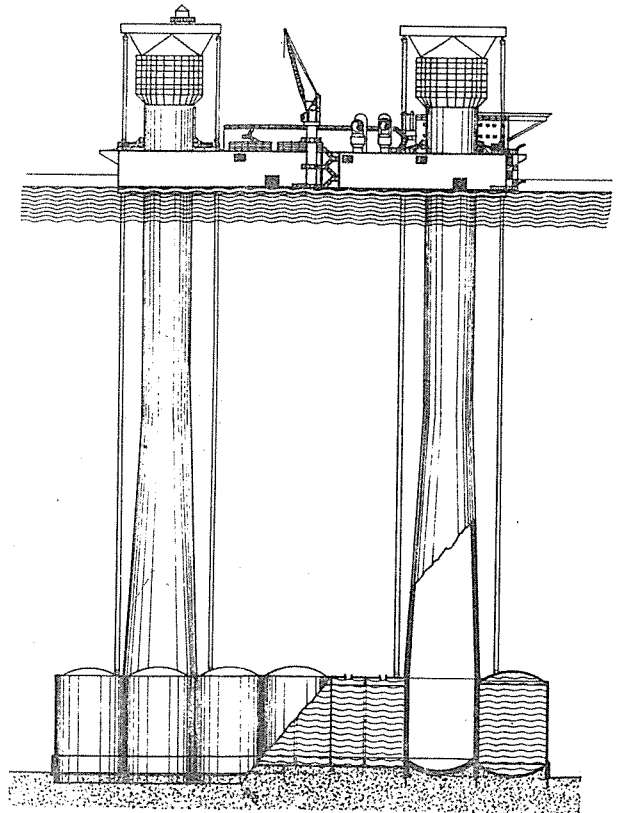


Fig. 12 (Phase 5); The sea bed is reached. The cylindrical cells are completely flooded—the steel skirts penetrate into the soil

to withdraw like a buffer when a certain load is exceeded, thus allowing the whole weight to be utilised for the penetration of the soil by the steel skirts. The penetration ceases when the wider concrete skirts under the circular cells reach the sea bed.

The deck is lifted on the cables with the help of the lifting equipment and rigidly fixed to the column heads. The column heads are constructed in steel which enables this work to be carried out in the shortest possible time. It is possible for an inclined position of the caisson of up to 1% to be corrected at this stage. The space between the caisson underside and the sea bed can be grouted so that an areal bearing exists. Should the soil conditions so require, scour protection is also provided.

After completion of the work the lifting equipment is demounted. It is possible after exploitation of the

field for the lifting equipment to be reinstalled and the platform re-floated. Investigations of this process are taking place at this moment.

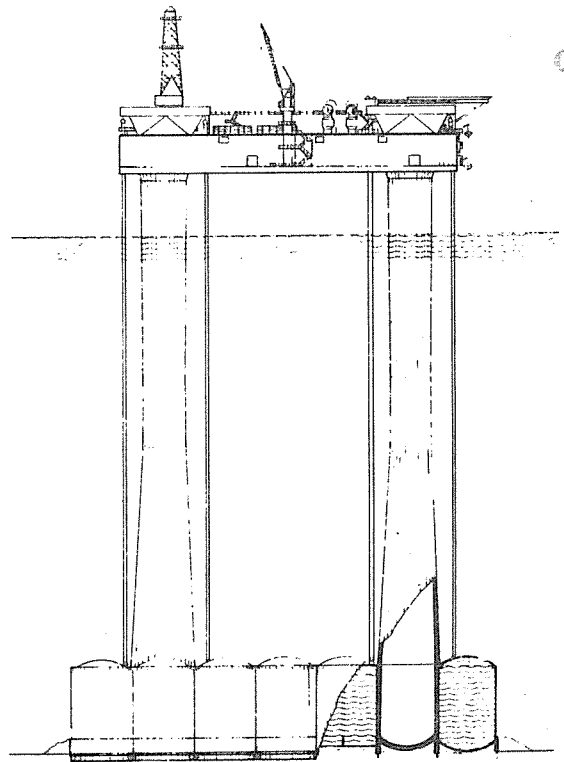


Fig. 13 (Phase 6); Raising of the deck and rigid connection with the columns  
Injection of sand under the base unit-protection against scouring