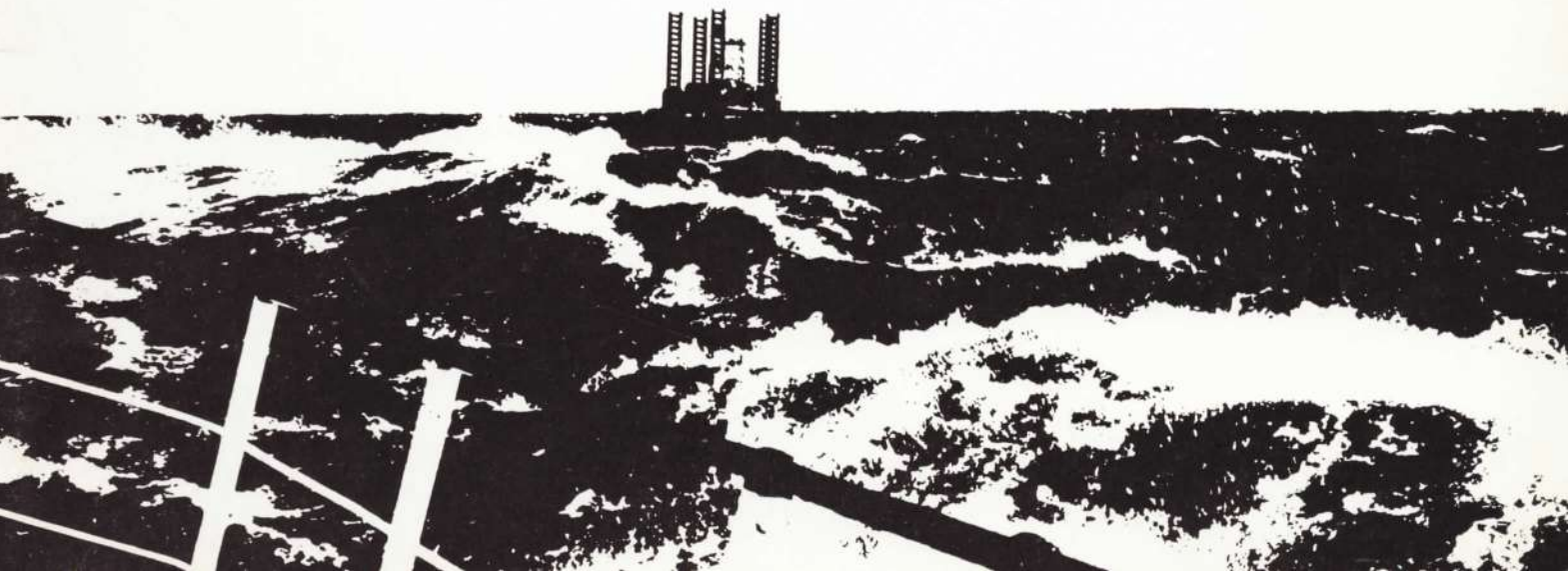
PU 6A

I.H.C.HOLLAND

OIL

EQUIPMENT DIVISION



PRODUCTION PROGRAMME

Offshore Oil Equipment

Mobile offshore drilling units
Single buoy mooring systems (SBM)
Floating unit movers
Heavy lift equipment
Oil drilling tenders
Jackets
Special ships
Winches

Dredging equipment

Trailing dredgers
Cutter suction dredgers
Bucket dredgers, etc.
Standard- and Custom-built

Marine Mining- and Bulk Handling Equipment

Dredgers for alluvial mining,
Jigs, Pneumatic elevators

Diesel Engines

Two-stroke, crosshead
Smit-Bolnes up to 5000 hp

I.H.C. Holland Publication PU6A

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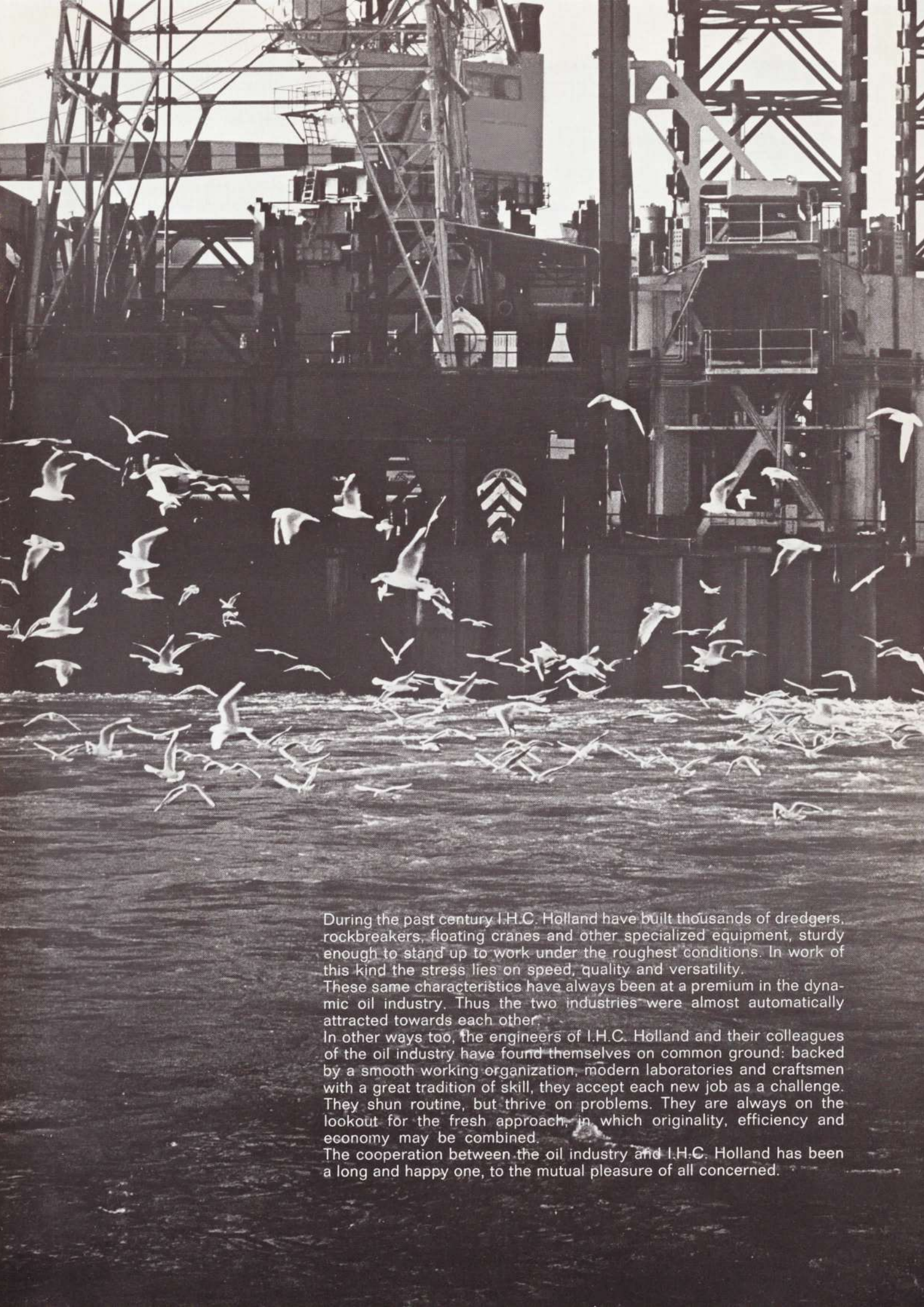


During the past century I.H.C. Holland have built thousands of dredgers, rockbreakers, floating cranes and other specialized equipment, sturdy enough to stand up to work under the roughest conditions. In work of this kind the stress lies on speed, quality and versatility.
These same characteristics have always been at a premium in the dynamic oil industry. Thus the two industries were almost automatically attracted towards each other.
In other ways too, the engineers of I.H.C. Holland and their colleagues of the oil industry have found themselves on common ground: backed by a smooth working organization, modern laboratories and craftsmen with a great tradition of skill, they accept each new job as a challenge. They shun routine, but thrive on problems. They are always on the lookout for the fresh approach, in which originality, efficiency and economy may be combined.
The cooperation between the oil industry and I.H.C. Holland has been a long and happy one, to the mutual pleasure of all concerned.

1 1 PENTAGONAL JACK-UP RIG "ILE DE FRANCE"

The *Ile de France* was designed by I.H.C. Holland for operation in areas such as the North Sea where heavy seas and dangerous ground swells are common occurrences. To combat the problem of bottom scouring (washing away of sand under the spuds as a result of turbulence) in such areas, supports of the rig were designed to be preloaded.
That is, pressure can be exerted on the spuds so that they can be driven deeply into the sea bed to provide firm support.

The hull of the unit was constructed in the shape of a pentagon with sides of approximately equal length. Five spuds or legs are located at angular points on the hull. This arrangement provides excellent stability and safety. In fact, only three spuds can safely support the structure.

Under unfavourable weather conditions such as are often encountered in northwestern Europe, the platform can operate in up to 60 m (200 feet) of water and drill to about 6000 m (20,000 feet).

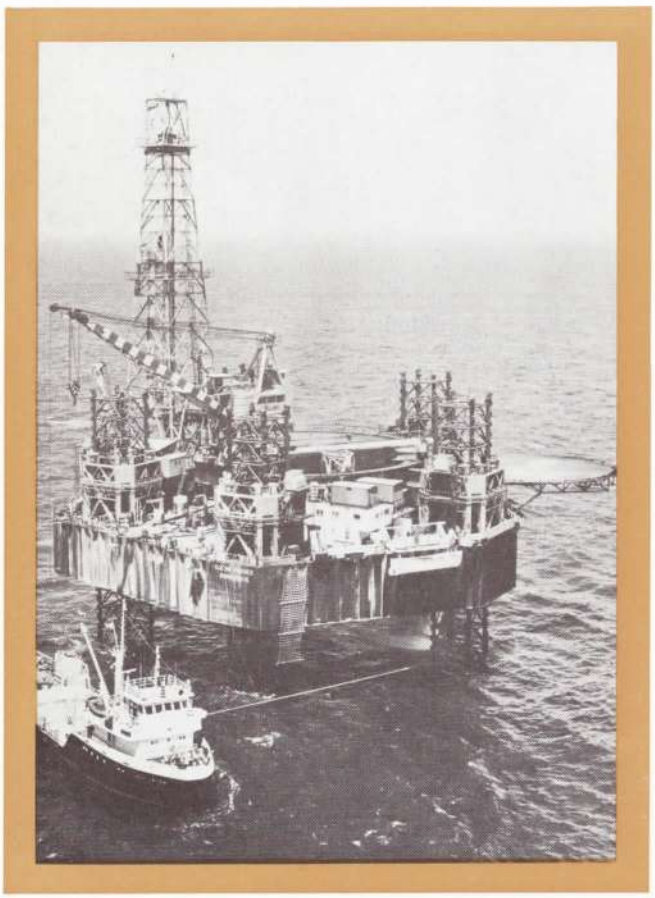
Research indicated that the best possible design for this length of spuds was an open framework. This was confirmed by extensive tests conducted with scale models in a hydraulics laboratory and a ship model testing station.

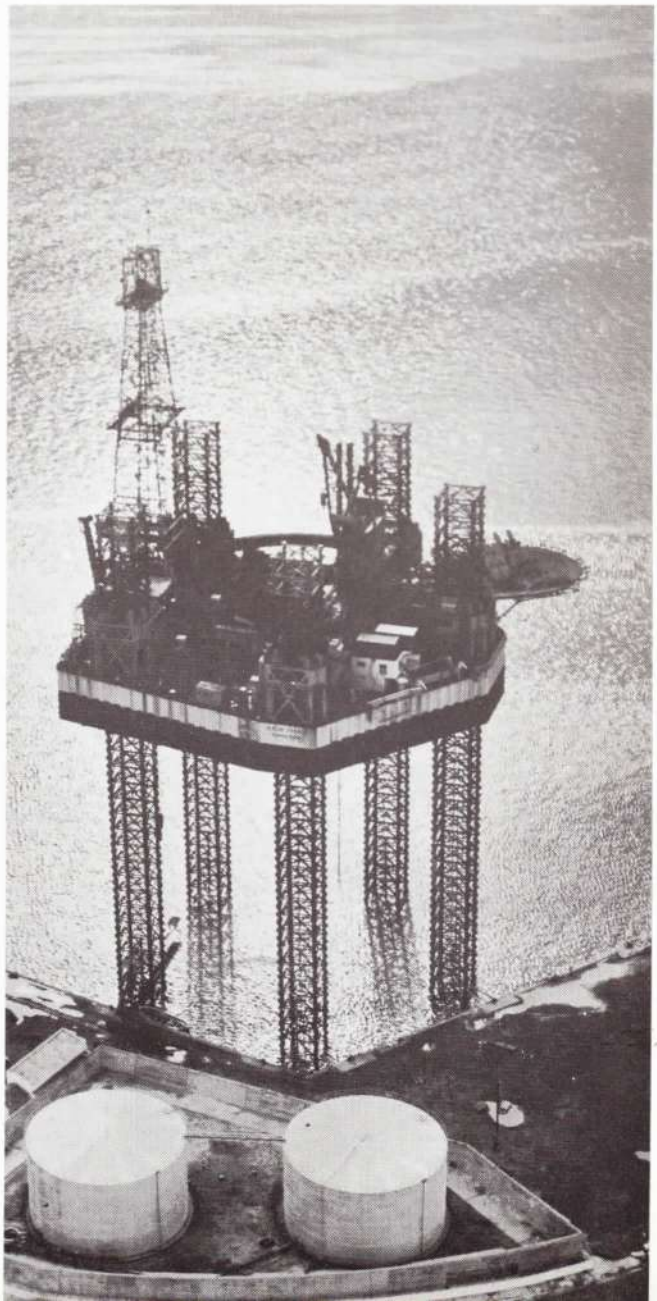
Welded joints for the spuds and design of the toothed racks on the spuds were also tested extensively. One full size spud section was used for stress tests. Strain gauges mounted at stategic points indicated stress concentrations and patterns in the area around the radii at the root of the teeth.

Main dimensions of the unit are:

Length	55,00 m	(181 ft)
Width	53,50 m	(175 ft)
Depth	7,60 m	(25 ft)
Spud length . .	90,00 m	(293 ft)

This unit has been designed to withstand waves of 15 m (50 ft). When operating, the barge can be loaded with 3000 tons of movable stores.





Gusto Hydraulic Jacking System

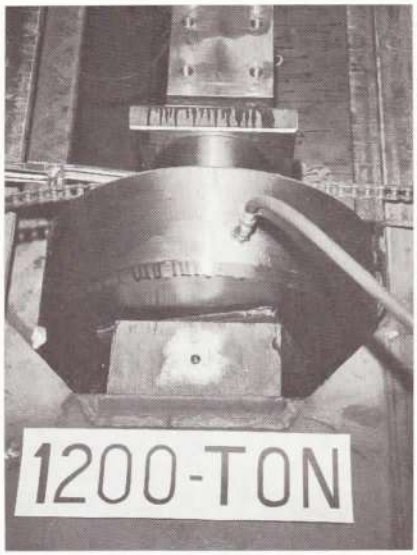
The platform is raised above the water's surface by means of a patented Gusto jacking system.

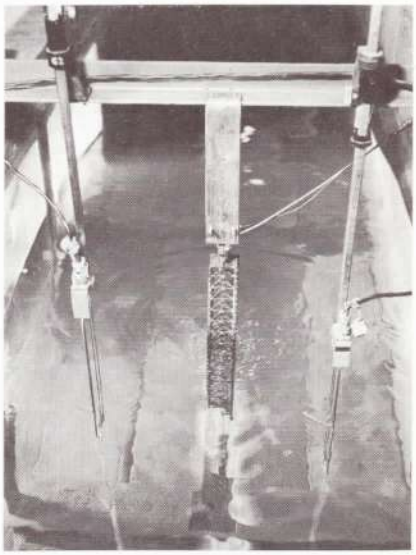
Toothed racks with rectangular teeth are mounted on the corners of each spud, and extend over its entire length. Each spud slides up and down through a square aperture in the platform deck and a steel framework mounted above the deck.

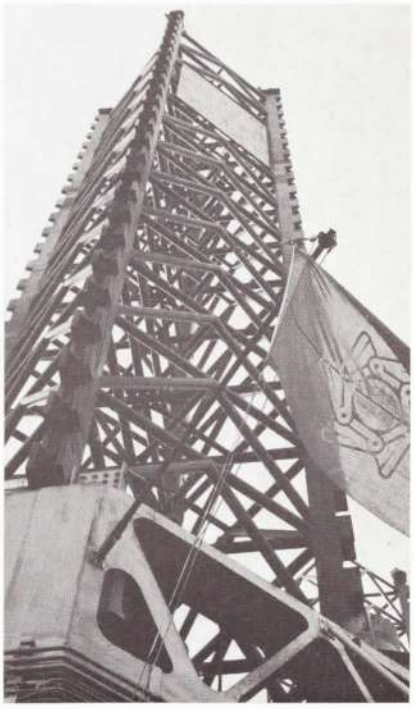
A double acting hydraulic jack is mounted at each corner of the deck framework.

Each pair of jacks operates a catch upward or downward as required.

Small hydraulic cylinders move catches horizontally so they can be positioned between two teeth of the racks. Operation of the four jacks causes the catches to move simultaneously. Once catches and teeth are engaged, position of the platform changes in relation to the spuds.







1 2 JACK-UP RIG "SEASHEL"

This offshore mobile drilling unit is of the self-supporting pontoon type for drilling oil wells abt. 5,000 m (17,000 ft) deep, in water depth from 4,5-40 m (15 ft to 132 ft). The pontoon is supported by eight legs. By means of the patented Gusto jacking system the pontoon can be lifted up to abt. 15 m (50 ft) above sea level.

The unit has been designed to withstand waves of nearly 10 m (33 ft) high, and a wind velocity of 100 mile/h when standing in a depth of 27.4 m (90 ft). The length of the spuds is such, that they can penetrate 13.7 m (45 ft) into the sea-bottom when standing in maximum water depth.

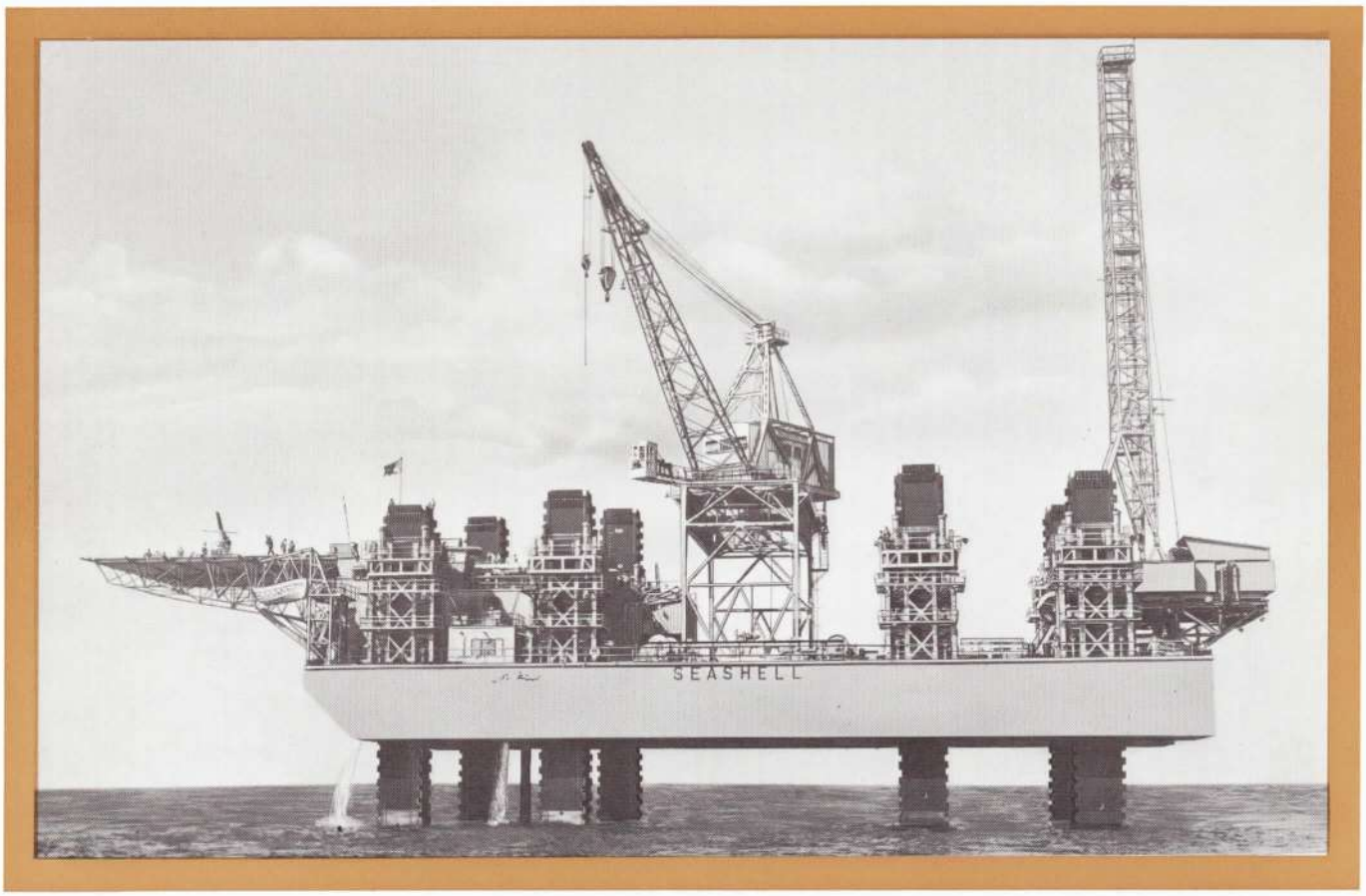
When placing the unit on location, each spud point is pre-stressed with 1600 tons, to avoid the danger of a sudden sag during drilling operations. For normal operation the maximum load for each spud is 1300 tons, or 16 kg/cm^2 (227.6 lbs/in^2), which is the load to be expected during the heaviest gale. The design is such, that bearing on seven spuds is possible.

Total weight resting on the sea bed is 8000 tons.

The *Seashell* can be used on hard coral bottom as well as on a soft, muddy sea bed.

Motor- and drilling installation

The power installation consists of four main diesels, each of 795 hp, driving two DC generators of 500 kW, and two diesels of 470 hp, driving two AC generators of 326 kW. The drilling floor has been arranged over a drilling slot of 10 x 15 m (33′ x 49′); by means of hydraulic rams the drilling floor can be moved athwartships, the substructure lengthwise, to enable drilling in an area of 4.12 x 4.12 m (13.5′ x 13.5′). Consequently, several wells can be drilled without moving the unit. Lengthwise, the drilling floor and substructure can be moved far enough to free the slot; this is essential, because when a well-protector is left on location after oil has been struck, this structure would be in the way when the pontoon is lowered.



Dimensions pontoons

Length	63 m (209 ft)
Width	32 m (105 ft)
Depth to main deck	5 m (16½ ft)
Draft maximum . .	4 m (13½ ft)

1 3 PENTAGONAL JACK-UP RIG "SEDNETH II"

Like the rig *Ile de France*, the *Sedneth II* is pentagonal in shape. It is the seventh platform, which has been equipped with the patented Gusto hydraulic jacking system.

It operates on the Continental Shelf beneath the North Sea.

The *Sedneth II* has been designed to withstand waves of 18 m (60 ft).

The pontoon measures: 55x53.50 m (180'6" x 175'6") and has a depth of 7.75 m (25'5"). The five legs, which are of lattice construction, are 92 m (301'10") long, permitting the platform to be used in up to 60 m (200 ft) of water.

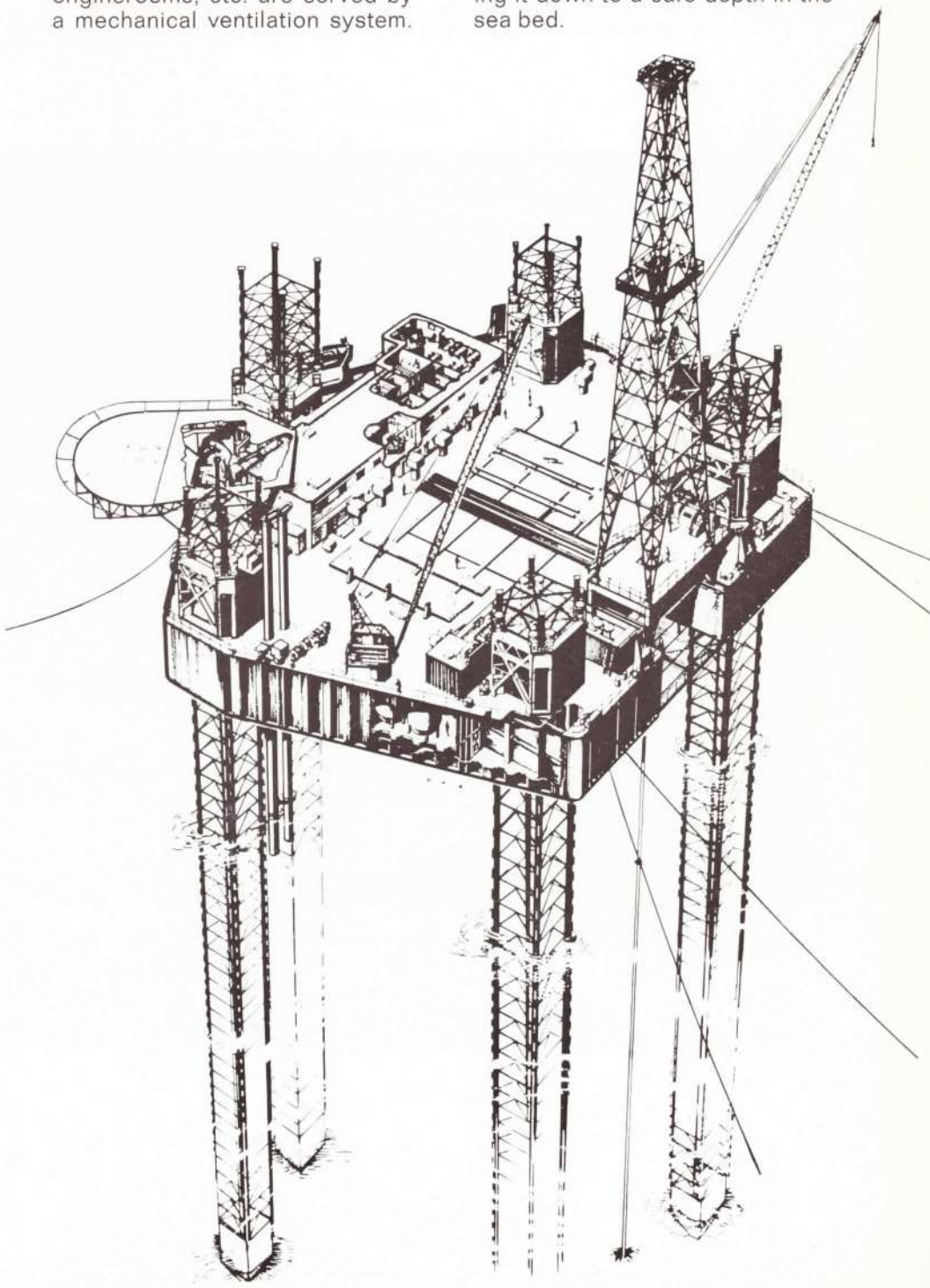
A large deckhouse containing the accommodation for technicians and crew, and a central jacking control room are mounted on the main deck. The pontoon houses the auxiliary services concerned with the drilling operations, such as cement and mud pumps, compressors, cement and barite silos, mixing basins, etc., and also the diesel-driven generators supplying current. A comprehensive fire alarm system has been installed.

The cabins and messrooms are air-conditioned. Galleys, toilets, enginerooms, etc. are served by a mechanical ventilation system.

North Sea hazards

Bottom-supported offshore drilling platforms used in the North Sea are frequently subjected to the hazard of scouring — i.e., the washing away of the sand around the base of the legs: this is caused by the short waves and ground swells peculiar to this area of water.

In order to eliminate this hazard, the legs fitted to the drilling platforms designed and built by I.H.C. Holland for operations in the North Sea are equipped with conical feet. Moreover, the hydraulic jacking system employed allows the legs to be pre-loaded, an operation which involves imposing roughly twice the normal load on each spud, thereby forcing it down to a safe depth in the sea bed.



1 4 INSHORE WORK-OVER PLATFORM FOR OPERATIONS IN NIGERIA

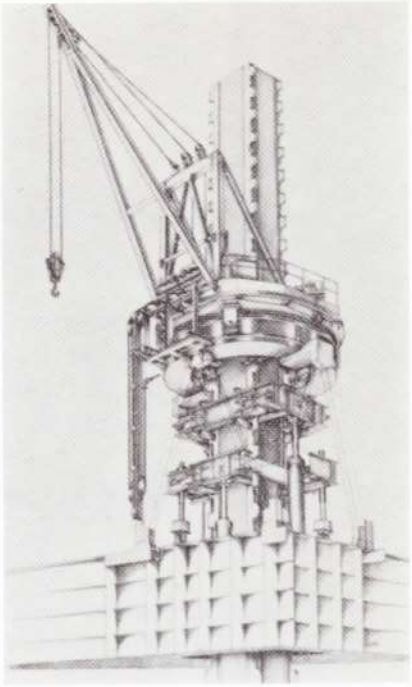
For Royal Dutch/Shell Group a work-over rig for operations in African waters has been constructed.

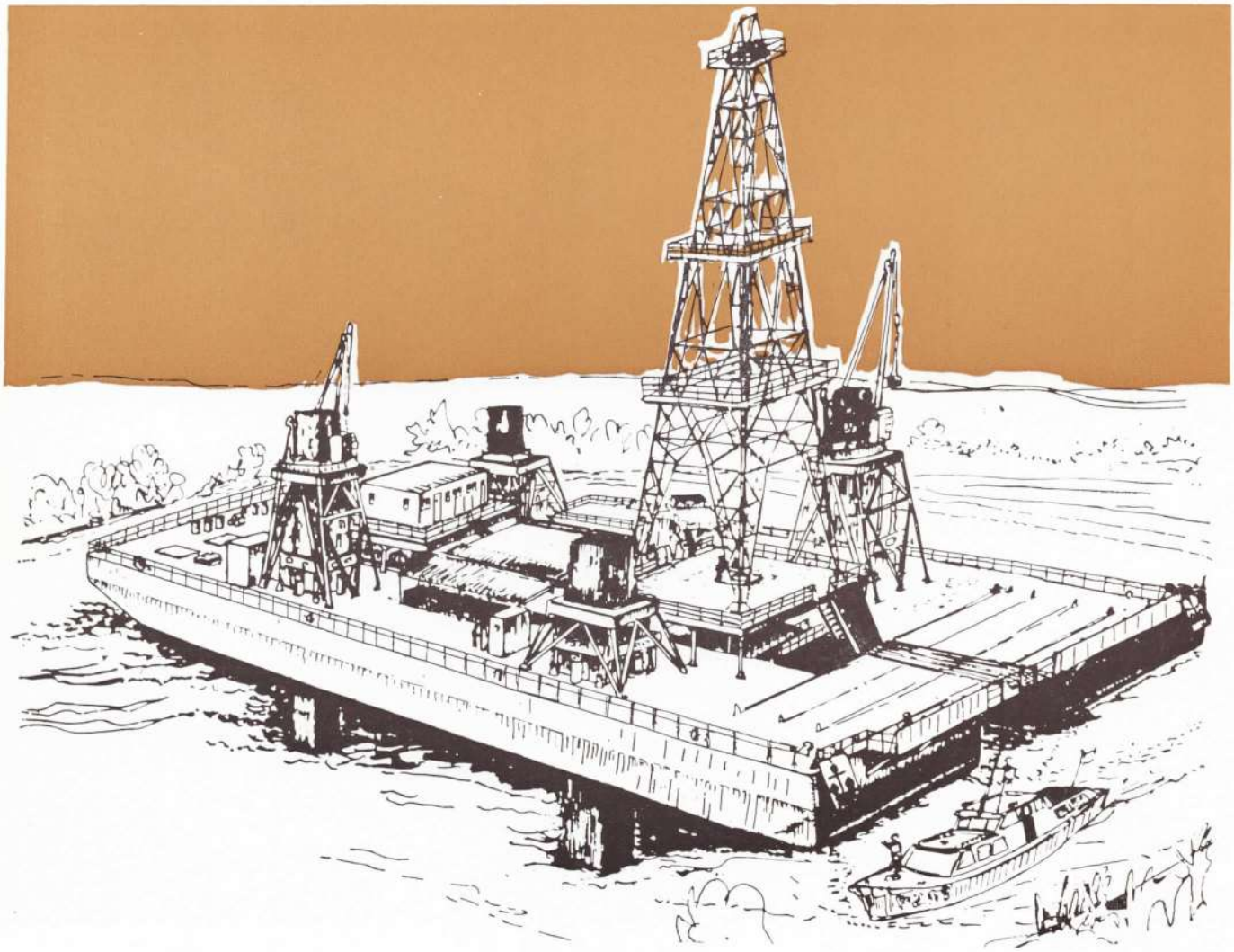
Length of pontoon	50.00 m (164′)
Width	23.00 m (75′6″)
Height	3.90 m (12′9″)

Current for the drilling equipment is supplied by four 500 kW D.C. generators and that for lighting purposes, winches, etc. by two 350 kW 3-phase alternators.

The rig is designed to operate in marshy on-shore waters and equipped with four square box type spuds.

Two 12½-ton cranes are installed, each mounted on a frame built around the spuds and serving the area around these.





1 5 JACK-UP RIG "CHAZAR"

A noteworthy aspect of the Russian *Chazar* stems from the fact that the platform is operating in the Caspian Sea, a destination which involved towing it through the Baltic Sea to Leningrad, and thence via 3,000 miles of rivers and canals. In order to meet the limits imposed by the inland locks and narrow stretches of water, the platform has been constructed in three sections each about 16 m (53 ft) wide.

The drilling platform *Chazar* has been designed to operate in depths of 7-60 m (23-197 ft) and in temperatures ranging from —10° C to 45° C (14° - 113° F).

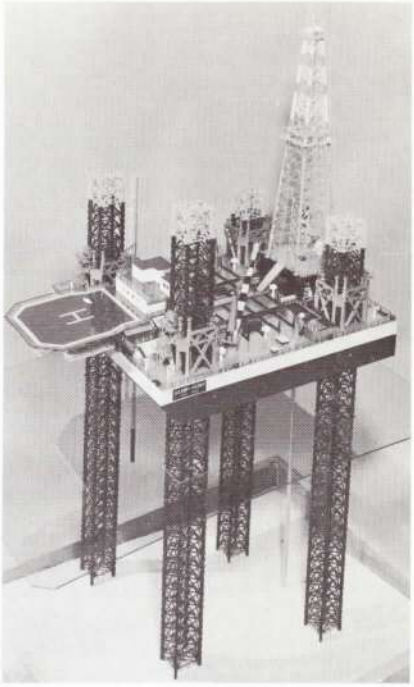
The spuds, which are 94 m (308′5″) in length, are of heavy tubular construction and embody each four corner beams with toothed racks running throughout their length.

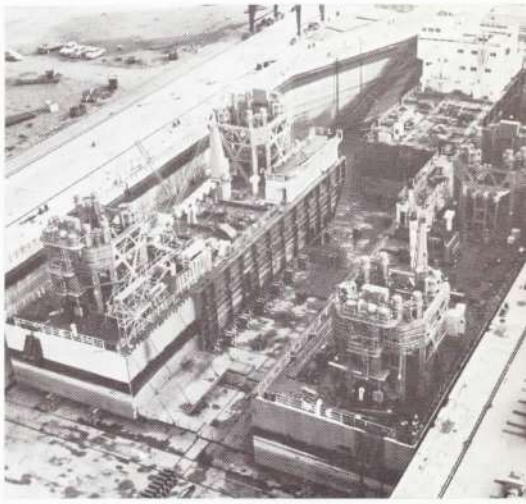
This rig too, has been fitted with the patented Gusto hydraulic jacking system. Two cranes of 12.5 and 25 tons resp. are mounted on the main deck.

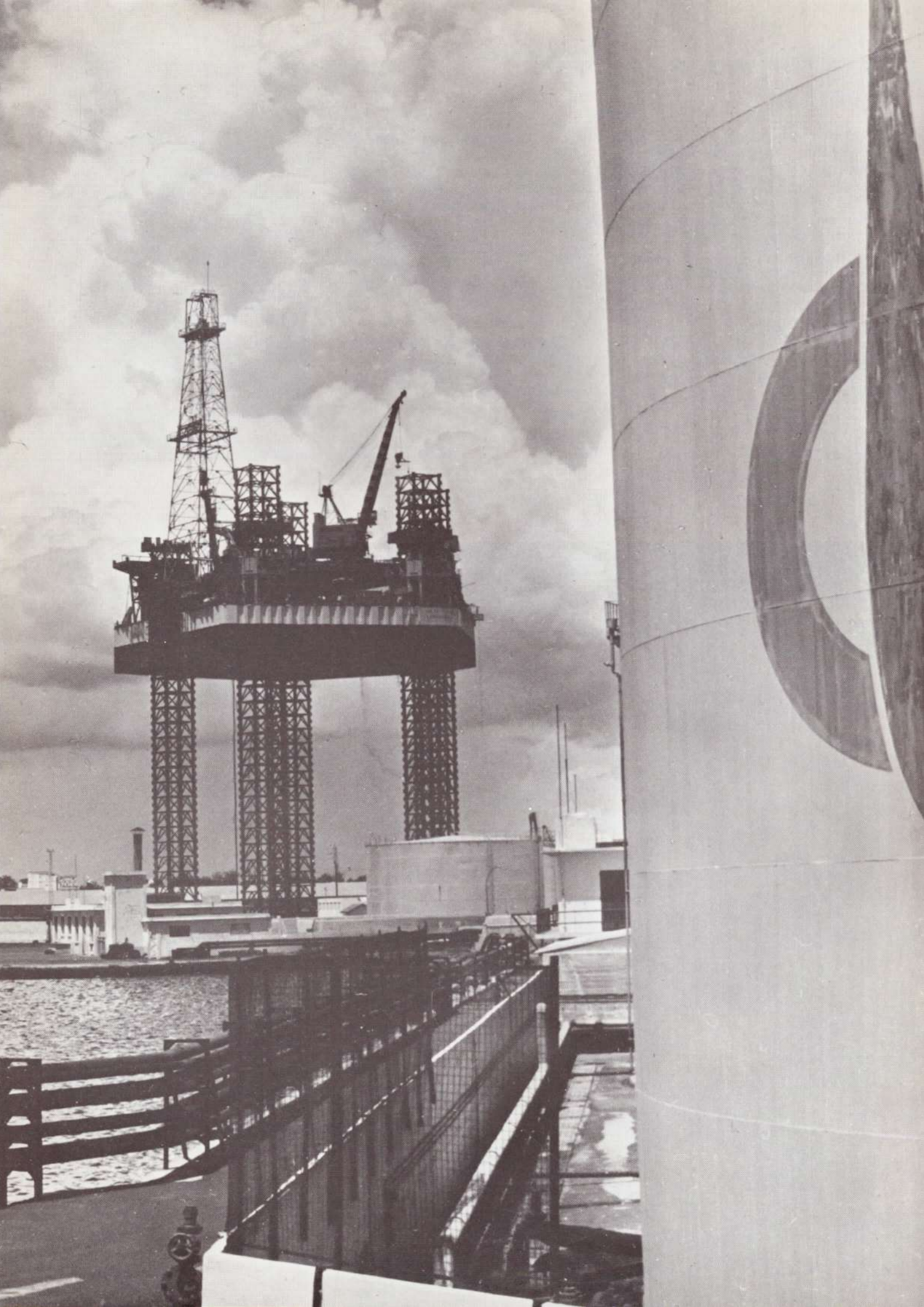
Main dimensions

The platform has been built to the requirements, and under the supervision, of Bureau Veritas. Its main dimensions are:

Length	50.50 m	(165′9″)
Width	45.00 m	(147′8″)
Depth	7.25 m	(23′9″)







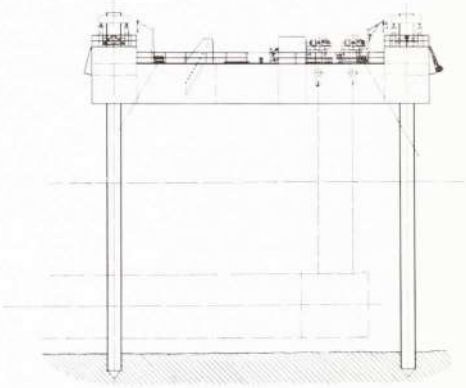
2 1 FOUR-SPUD SELF-ELEVATING PONTOON FOR SEWER PROJECT

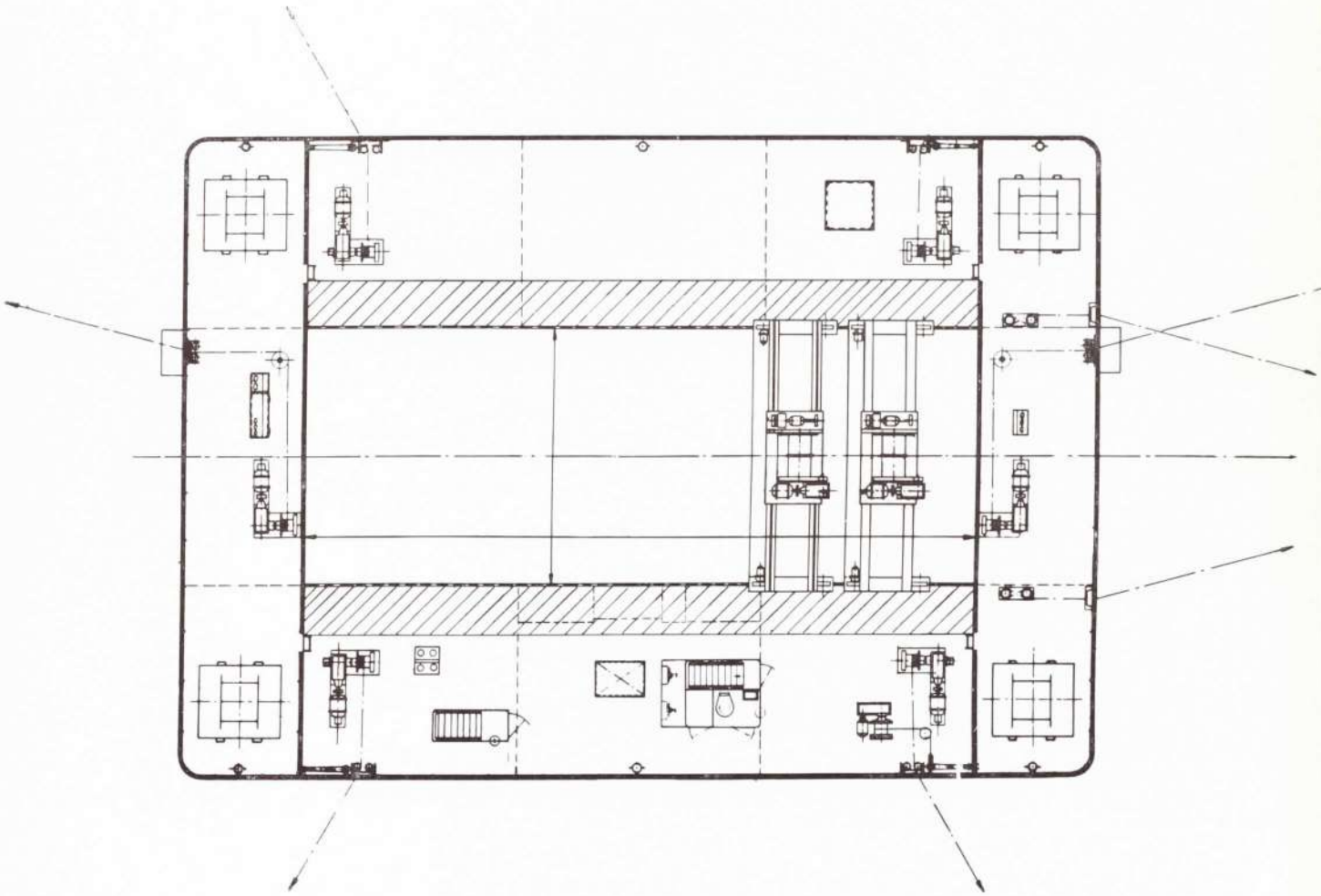
The pontoon of this self-elevating platform is designed on the catamaran principle -i.e., it consists of two comparatively small pontoons situated 8.5 m (27′11″) apart and linked by a work deck. The platform is 30 m (100 ft) long and has an overall width of 21 m (69 ft).

Like the self-elevating platform built by I.H.C. Holland for the laying of tunnel sections in the fast-flowing Paraná river in Argentina, this one is equipped with four spuds; in this case they are 31 m (102 ft) long and 1.25 m (4′1″) square.

The pontoon is raised and lowered by means of the patented Gusto hydraulic jacking system. The platform is designed to operate in 15 m (50 ft) of water and at wave heights of 3 m (10 ft). Six 5-ton electric winches are used for warping.

Two travelling gantries with 40-ton crabs are used to position the sewer sections. The gantries traverse the open part of the work deck. Current for the crab motors is supplied by two 50 kW 3-phase alternators, each of which is coupled to a 75 hp diesel engine.





2 2 SELF-ELEVATING PONTOON "RIO PARANA"

The experience gained by I.H.C. Holland in the design and construction of oil drilling platforms was first applied in the civil engineering field in the construction of the crane platforms *Lepelaar* and *Kraanvogel*, which have been operating successfully in all weathers on the IJmuiden harbour extension scheme. For the first time in engineering history, the self-elevating platform *Rio Parana* is being used on a tunnelling project.

This concerns the laying of a 2.5 km (1.5 mile) road tunnel under the Rio Paraná in Argentina.

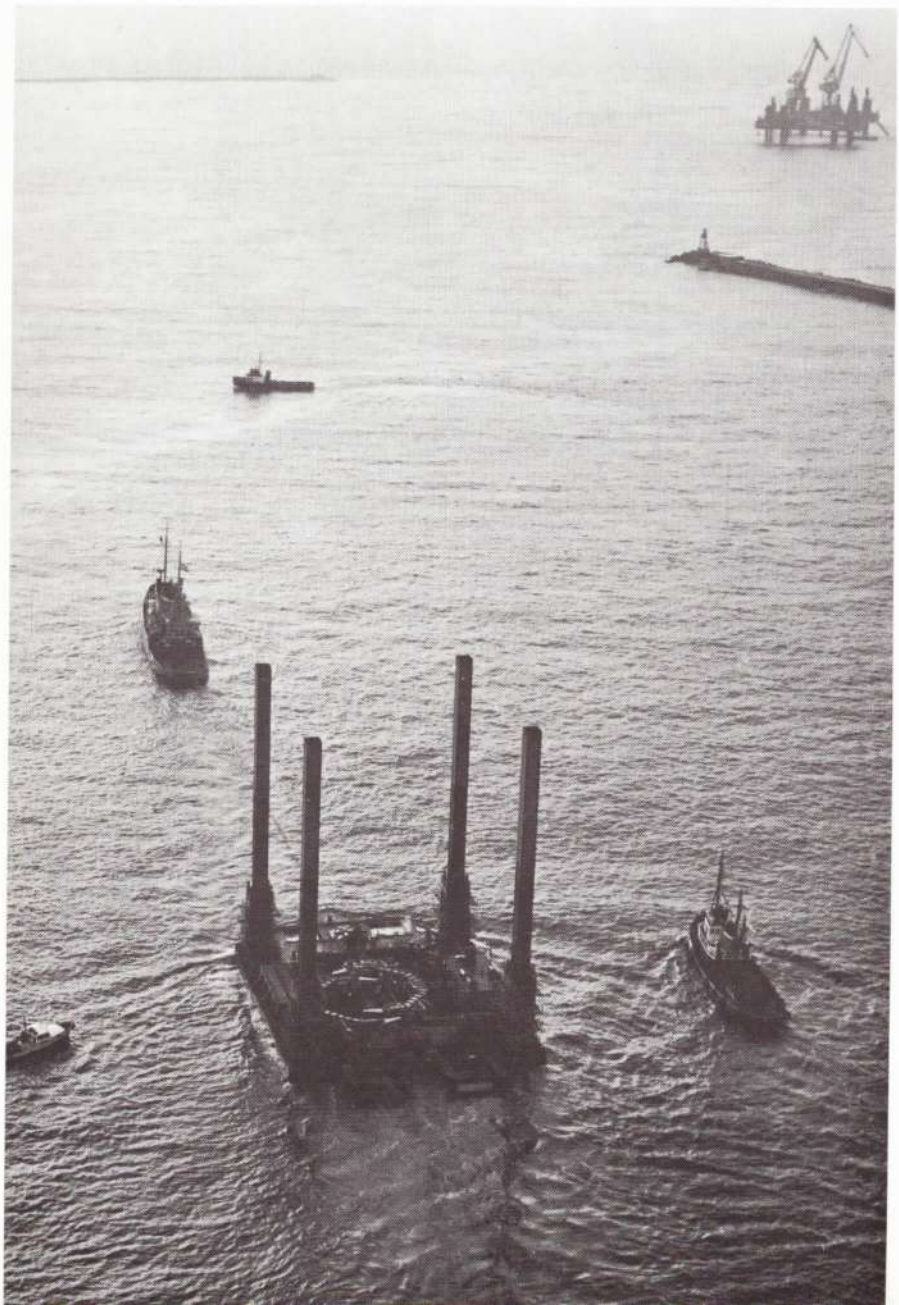
The tunnel, which will lie at a depth of 30 m (100 ft), will carry much of the traffic between Paraná and Santa Fé. The decision by the Comisión Interprovincial del Túnel Subfluvial Paraná-Santa Fé to use such equipment was taken in the light of a number of natural problems, viz. strong currents in the river which hamper the lowering of the prefabricated tunnel sections, a rise and fall of 1 m (3′3″) in the tide, and waves of up to 2 m (6′6″) in height.

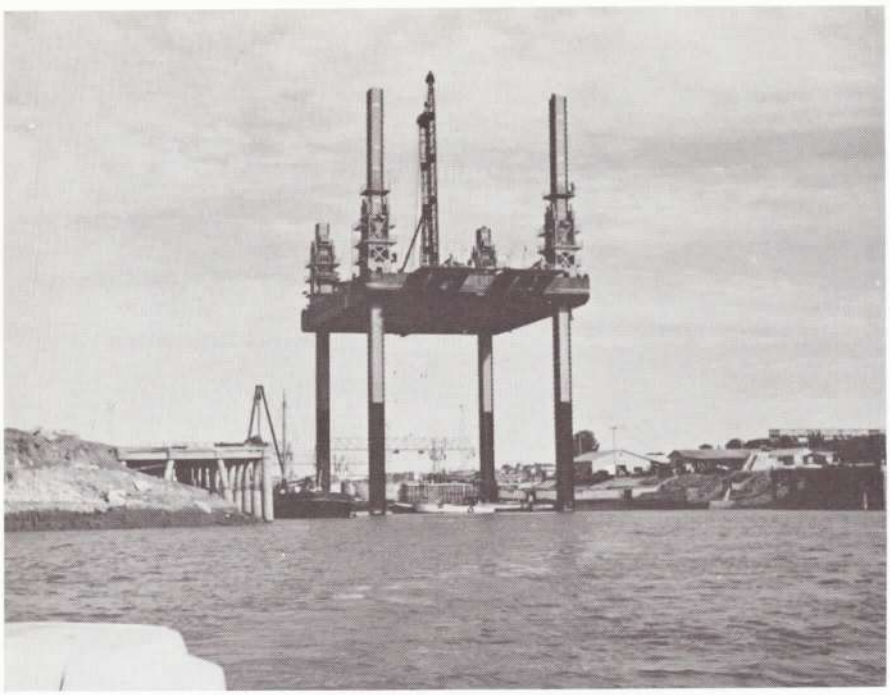
Held between the legs of the pontoon and kept in position by the power of no less than ten winches, the 65 m (215 ft) long tunnel sections are lowered into the turbulent water and manoeuvred longitudinally and laterally until they can be mated with the sections already in position on the bottom.

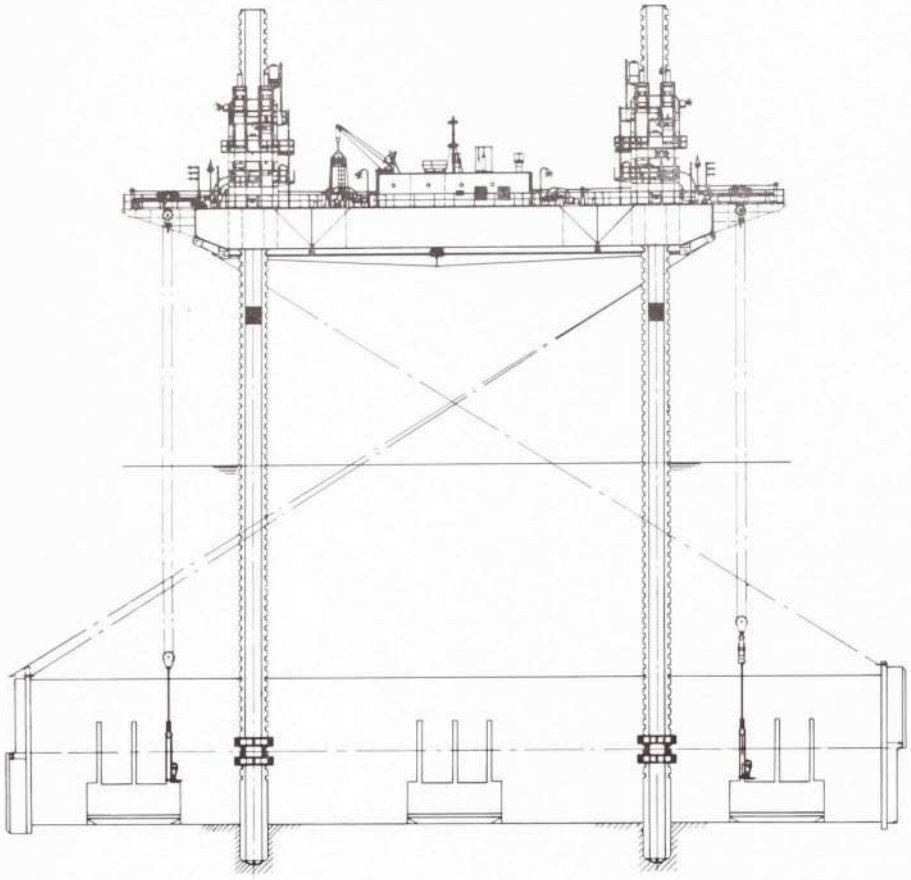
The pontoon measures 38.60 x 30 x 3 m (126′8″ x 100′ x 10′) and has a draught of 1.3 m (4′3″). It is equipped with four spuds, each 64 m (210 ft) in length, with the aid of which the pontoon deck can be raised to a height of 19 m (62′4″) above the water.

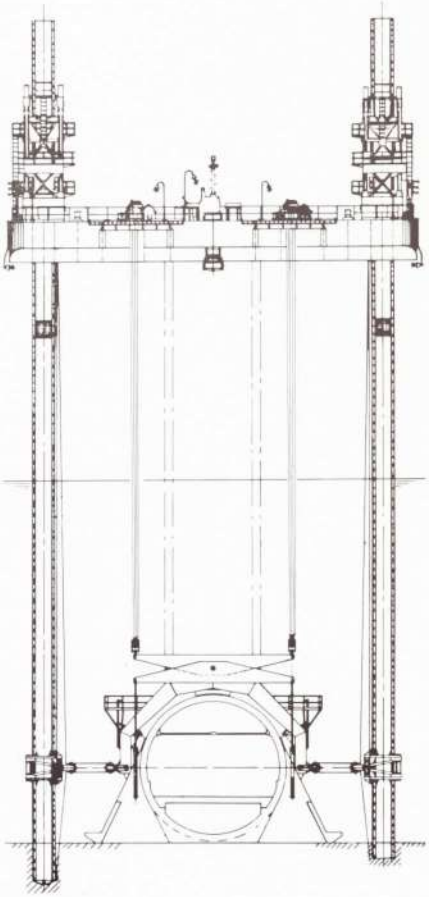
The ten electrically operated winches are divided into three groups:

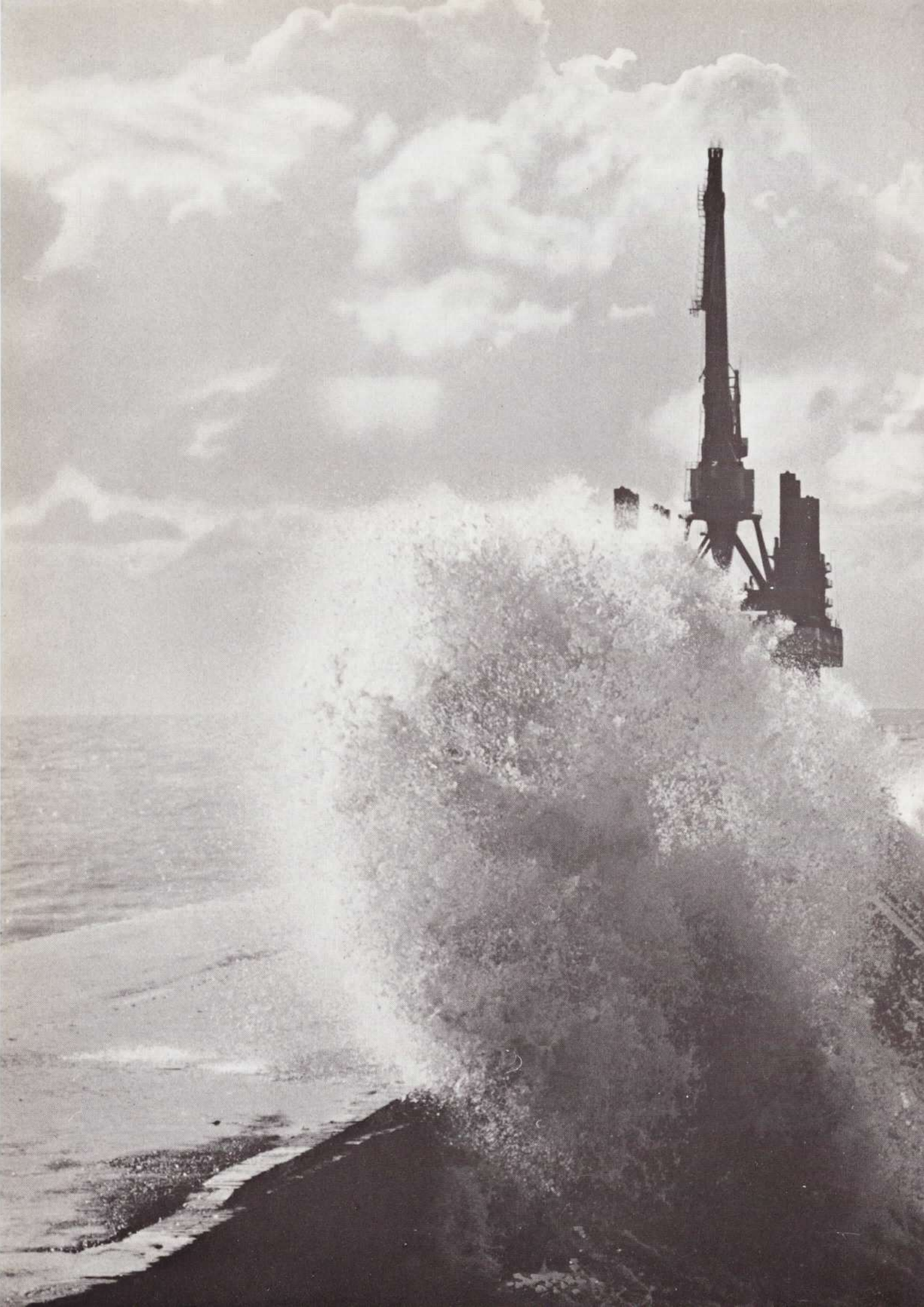
a. 4 for operating 50 tons vertical hoisting tackles
b. 4 for operating 30 tons horizontal tackles
c. 2 twenty tons for operating a crab located beneath the pontoon.

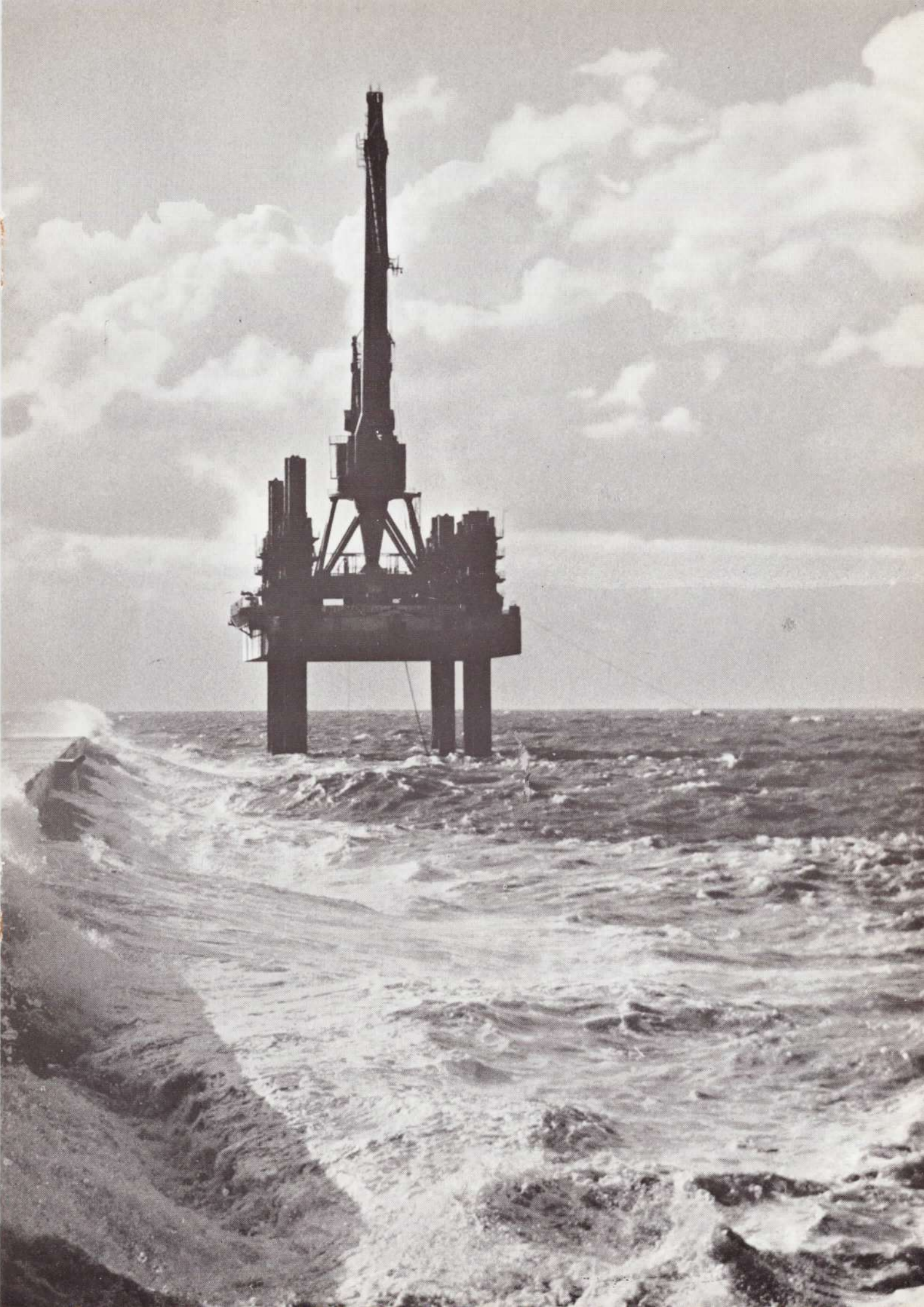












2 3 SELF-ELEVATING CRANE PLATFORMS "LEPELAAR" AND "KRAANVOGEL"

Harbour improvement

The Netherlands "Rijkswaterstaat" (Engineering Department of the Ministry of Transport and Waterways) is responsible for the planning and the execution of such schemes as the reclamation of the Zuyderzee and the Delta Scheme, for damming off the sea arms in South-Western Holland.

This department has in the past adopted novel methods which later became general practise elsewhere.

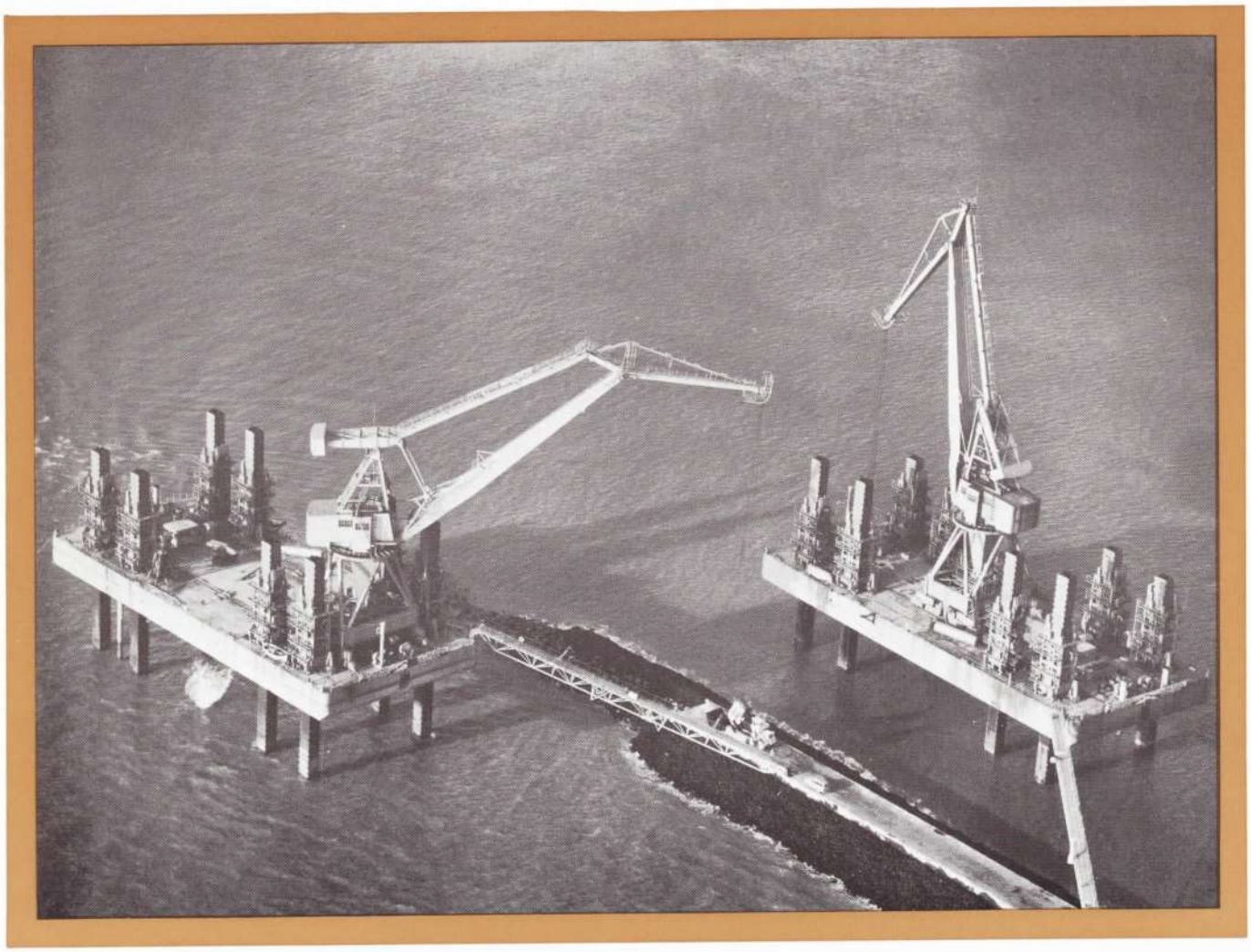
The same may happen to another innovation of these governmental hydraulic engineers: they asked I.H.C. Holland to build two self-elevating pontoons, each equipped with an electrically driven travelling grab crane with a hoisting capacity of 25 tons at a reach of 56 m (184 ft).

The modernization of the port of Amsterdam necessitated improvements to the harbour entrance at IJmuiden, which had to be made accessible to ships of 80.000 tons.

The harbour was symmetrical in form, with piers extending 1,400 m (4,600 ft) into the sea. The depth of water at the new harbour mouth had to be 14.50 m (48 ft) and the entrance had to have a clear width of 400 m (1,300 ft). This is achieved by extending the piers further into the sea. In the Delft Hydraulics Laboratory various plans were examined and it was finally decided to extend the South pier to a length of 2,800 m (9,200 ft) and the North pier to a length of 2,200 m (7,200 ft), the harbour mouth thus taking on an asymmetrical form.

This solution proved to be the best as regards both shipping and current factors.

It has been calculated that the saving on transport and material costs, together with the saving represented by the reduction in the number of unworkable days, exceeds the cost of maintenance and depreciation. So the self-elevating pontoons paid more than for themselves during the work at IJmuiden.



Characteristics of the crane pontoons

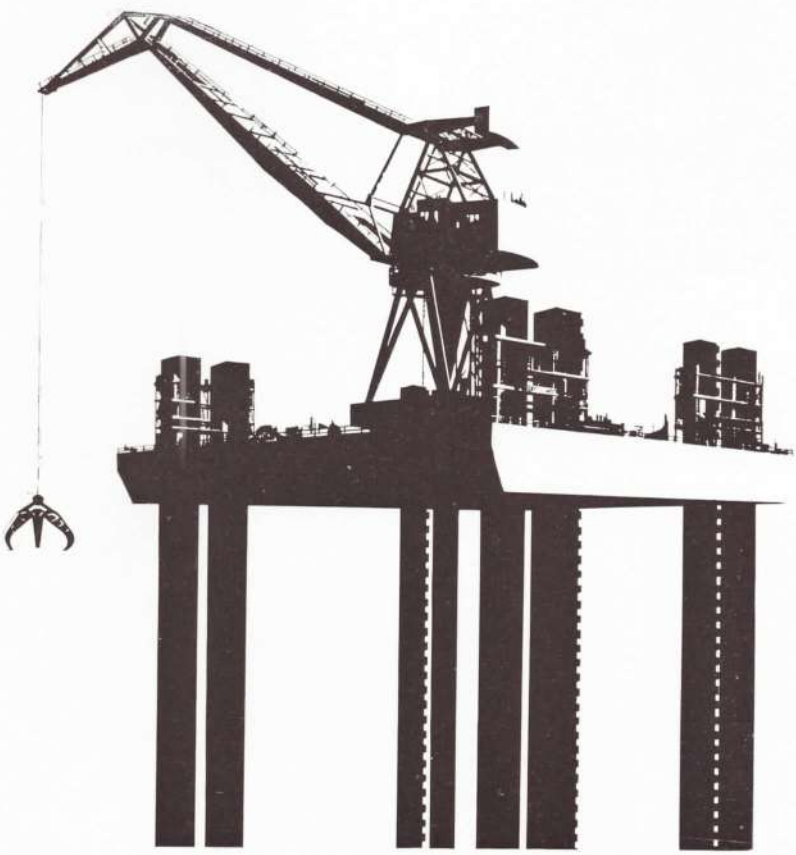
The dimensions of the pontoons, who accomplished this job are 70 x 25 x 4,3 m (230′ x 82′ x 14′).

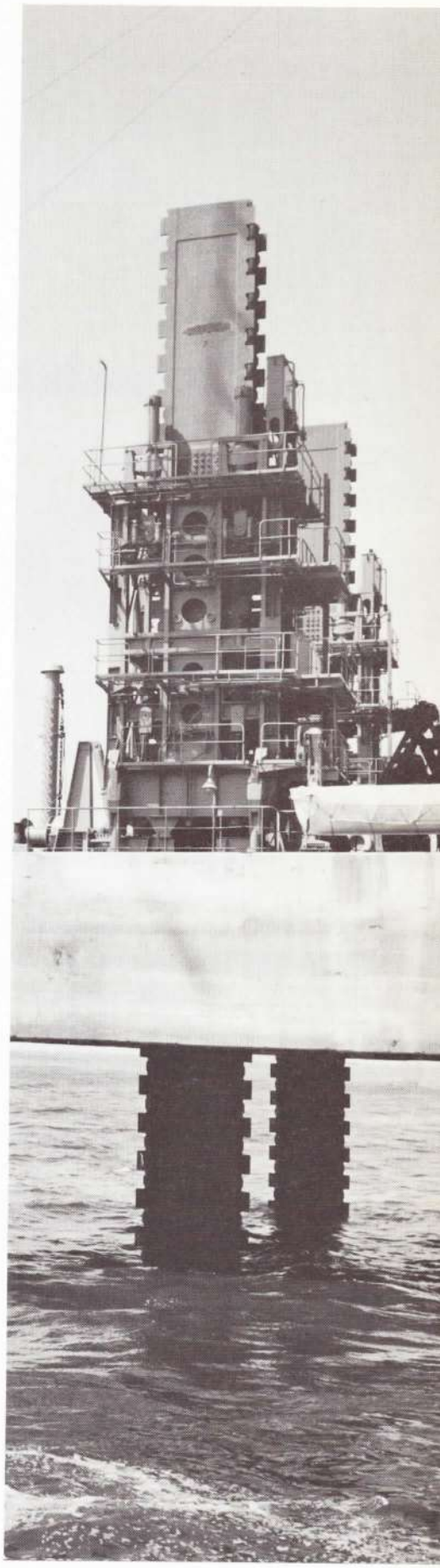
To make the self-elevating pontoons useful for as many other purposes as possible, the distance between the inner spud centre lines has been made on the ample side, namely 33 m (110′). Trimming-tanks ensure that the pontoons float in good trim.

Comfortable accommodation for two shifts of eight men and the engine-room also are located below deck to leave ample working-space on deck. The engine-room contains three diesel engines, each developing 250 hp and three generators of 160 kW, 200 kVA, which supply current for the electric pump motors driving the hydraulic jacking-system and for crane operation.

The cranes of the *Lepelaar* and *Kraanvogel* are electric grab cranes of the travelling portal type. They each have a lifting-capacity of 25 tons at a radius of 53 m (184′). At a radius of 25 m (82′) the maximum lifting-capacity is 50 tons. The cranes are provided with a special plotting installation, which enables the crane-driver to dump each load on exactly the right place, registering each load dumped automatically.

The cranes can travel over the entire length of the pontoons.
they can continue work in wind forces of up to 7 Beaufort.





3 1 SINGLE BUOY MOORING SYSTEMS (S.B.M.)

A simple and economical solution to the loading and discharging problems is provided by the SINGLE BUOY MOORING SYSTEM. This special buoy has been developed by Shell Group specialists, in close co-operation with the Gusto Yard of I.H.C. Holland and has been thoroughly tested both in model and in actual conditions.

Ingenious and simple

On top of the buoy there is a turntable, to which the ship is moored with nylon hawsers. From the shore tanks the oil is routed to the ship as follows:
1. submarine pipeline 2. underwater hoses 3. buoy-borne turntable 4. floating hoses 5. manifold of tanker.

The system whereby the ship is moored to a single buoy has several advantages over multi-buoy moorings:

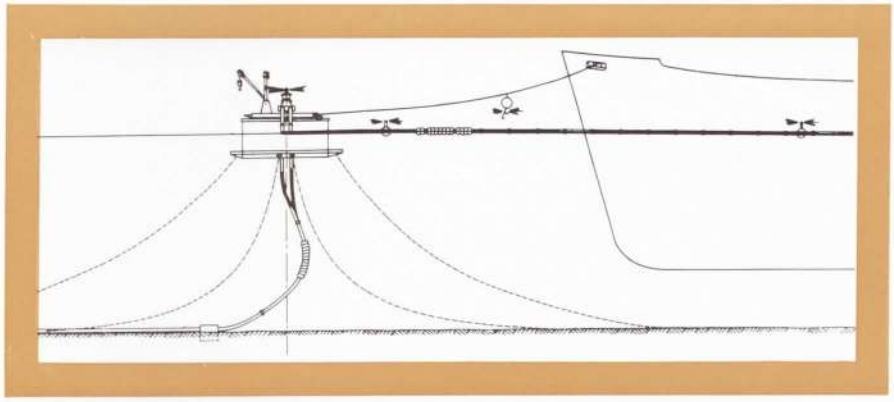
- The buoy can be reached by the biggest tankers without the aid of tugs.
- It reduces costly delays, since the tankers do not have to wait for favourable conditions of sea and wind.
- Moored to the buoy by its bow, the ship swings freely as it meets the forces of tide, wind and current. The buoy is consequently subjected to relatively light mooring loads.
- The vessel can remain at berth in more adverse conditions than would otherwise be possible.

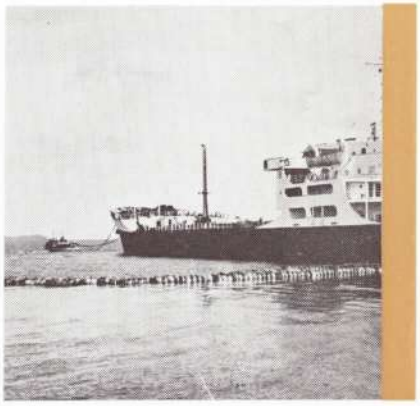
The buoy is anchored by a number of chain cables attached to heavy anchors or piles.

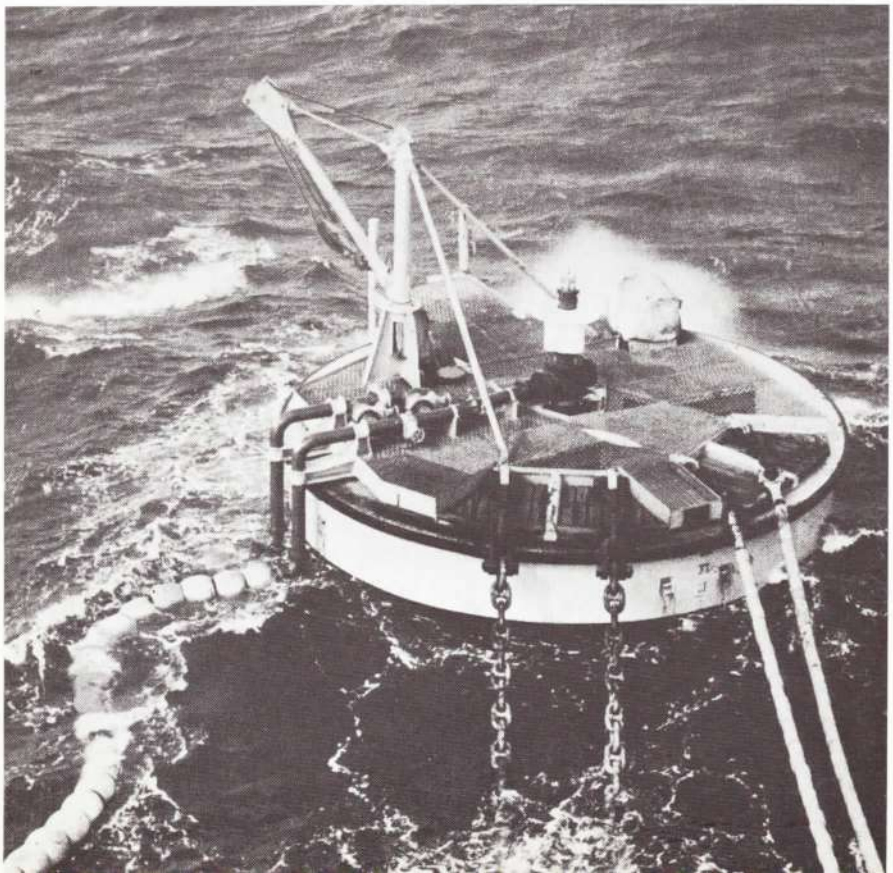
The hoses connecting the tankers with the turntable on the buoy are fitted with p.v.c. floats.

Several floating hoses may be joined to a group of hoses by means of special connectors. These are designed to absorb the heavy forces exerted by the sea, which tend to separate such groupes of hoses.

Buoys with a capacity of 60,000 barrels per hour have been installed, but a higher capacity is of course feasible where hoses with a larger bore are employed.







Various uses

The S.B.M. can be used as:

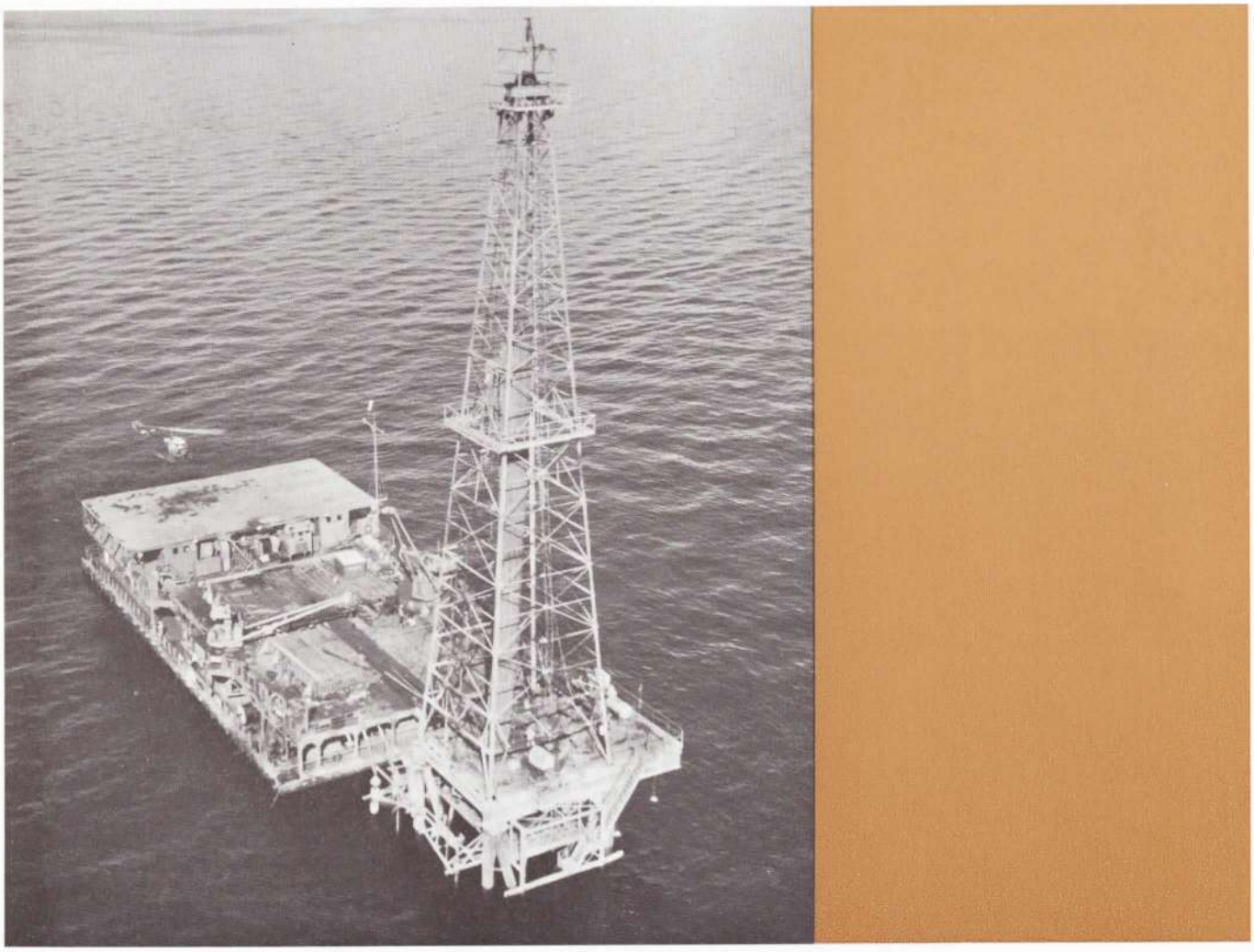
- a loading terminal for out-going crude oil from fields located on land or off-shore.
- discharging terminal for incoming crude oil to refineries.
- a bunkering station for all types of vessels.
- a loading and discharging terminal where crude oil is brought in and refined products are sent away.

At the outset the buoys were designed for tankers up to 100,000 tons. Increasing tonnage of supertankers called for greater capacities. The development of a new patented type of turntable made it possible to build buoys for giant tankers up to 300,000 tons d.w.

4 1 DRILLING TENDERS

Offshore drilling tenders have become familiar appearances on today maritime horizon. Oil companies have long since found that the cost of oil drilling service barges is more than offset by the advantages they offer. They work alongside the steel-piled offshore drilling rigs and contain all necessary power units and mud pumps, leaving only a few electric motors on the platforms themselves.
They can easily be moved from one location to another; the drilling platforms can be smaller and cheaper when serviced by drill tenders. And, of course, they offer improved safety to the drilling crews.

These tenders, of which I.H.C. Holland has built a large number, are fitted with a landing platform for helicopters, for easy transfer of operators and equipment. Completely selfcontained, they provide day quarters for the crew, storage space for pipes and other stores, and workshops.



5 1 400-TON FLOATING CRANE "ATLAS"

A logical result of the I.H.C.-experience in the field of crane building was the design and construction of unit movers, such as the 400-ton floating crane *Atlas*.

General

Hoisting capacity 400 tons at 9 m-11.5 m (30′-38′) outreach. Consisting of a steel pontoon and superstructure with electrically driven hoisting winch for hoisting and lowering of the drilling unit with tower.

The top construction of the superstructure is divided and provided with 4 suspension tackles which can be fitted to the girders of the upper platform of the drilling tower.

MAIN CHARACTERISTICS	Length	40.00 m (131′)
	Width	22.00 m (72′)
	Depth	3.96 m (13′)
	Mean draft	1.21 m (4′)
	Draft fore with 400 tons load	3.04 m (10′)
	Freeboard fore with 400 tons load	1.52 m (5′)
	1 Hoisting winch with 4 drums, and 6 hauling winches	
	2 Main dieselmotors, each 120 hp at 1000 rev/min	
	2 Ward-Leonard dynamos, each 38 kW, 440 Volts	
	2 Compound dynamos, each 30 kW, 220 Volts	
	1 Diesel dynamo 15 hp at 1000 rev/min, 10 kW, 220 Volts	
	1 Ballast pump of 200 tons/h	
	1 Bilge pump of 50 tons/h	
	1 Compressor of 15 m^3/h (19.6 cu yd/h)	
WORKING PROGRAMME	4-main hooks, together	400 tons
	Outreach with load of 400 tons	11.6 m (38 ft)
	Hoisting speed, 4 blocks, together 400 tons	0.62 m/min (2 ft/min)
	Hoisting speed, 2 blocks, load 200 tons	1.22 m/min (4 ft/min)
	For loads up to about 25 tons per block or 100 tons in total, as well as for empty hooks, the hoisting speed can be increased to 170% of 4 ft/min = about 7 ft per minute.	
	Tested with 10% overload.	

5 2 250-TON FLOATING CRANE "ARAMCO 136"

An extremely versatile floating crane with hydraulic drive has been delivered to the Aramco Overseas Oil Cy. as auxiliary equipment in offshore drilling operations in the Arabian Gulf.

The crane which has a maximum lifting capacity of 250 tons, can be used for removing complete platforms with drilling towers, for placing jacket structures in deep water, for fitting the anchoring piles of these jackets and for laying pipelines. It can also do service as a drilling tender.

The all-welded crane structure of closed members consists of two main overhead beams with a 15 m (50 ft) clear opening between. Each of the two beams carries two 75-ton main tackles and a track for the overhead travelling crane.

They are so constructed that in longitudinal direction the overhead travelling crane has a reach of 10 m (33 ft) inboard to 21 m (70 ft) outboard from the pontoon side.

The main hoist consists of 4 six-part tackles, each capable of lifting 75 tons. However, when working in concert, the lifting capacity of each tackle is 62.5 tons, i.e. 250 tons equally divided over the four tackles.

The fore and aft tackles have a reach beyond the pontoon side of 5.40 m (18 ft) and 18.85 m (62 ft) respectively.

The hoisting reach is 10.50 m (35 ft) below to 25.80 m (85 ft) above water level.

The four main hoist winches are driven by hydraulic motors developing 50 hp. The hoisting speed without load is 3.60 m/min (12 ft/min). These winches can be operated independently or rigidly coupled in any desired combination.

The 25-ton overhead travelling crane for lifting pipes 60 m (200 ft) in length, consists of a box girder bridge, travelling in longitudinal direction on tracks inside the forked jib.

The maximum hoisting height of this overhead crane is 40 m (134 ft) above water level.

5 3 1000-TON FLOATING CRANE „PM 24"

A crane of revolutionary design with a hoisting capacity of 1,000 tons has been built for the Italian firm Micoperi S.A.

As a slewing crane, the unit can lift 500 tons. An ingenious pivoting arrangement in the lower part of the jib enables this to be "jack-knifed" and rested on supports on deck, thus creating a fixed crane capable of handling a load of 1,000 tons. Patents have already been applied for in respect of this design.

Such enormous lifting capacity is of particular value for the rapid positioning of jackets, both for static drilling installations and also well-protectors.

Patented pivot bearing

A pivot bearing is situated between the conical tower of the crane and the upper platform, and it is on this that the whole of the revolving part of the crane and the load are bearing. The horizontal stresses of the revolving part are thus transmitted to the fixed part. This bearing, which is of patented I.H.C. Holland design, has already been incorporated in many constructions.

Electric power units

Four complete units each consisting of an electric motor and twin gearboxes are employed for slewing. Electro-hydraulic disc brakes are fitted. A separate topping winch powered by two electric motors is installed. The two 500-ton hoisting winches, each of which are powered by a pair of electric motors, can be operated separately or as one. Two electrically-driven auxiliary winches, are also installed.

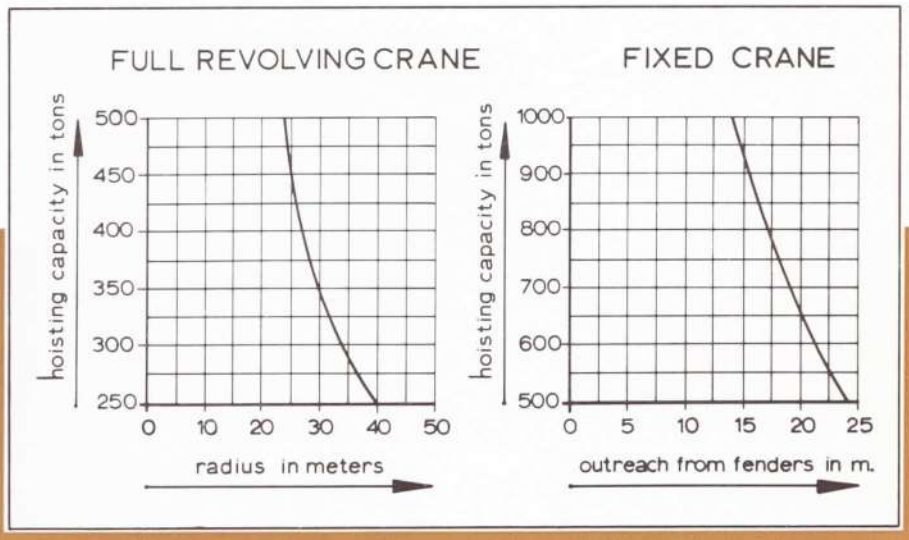
All winches are equipped with Lebus grooved drum sleeves.

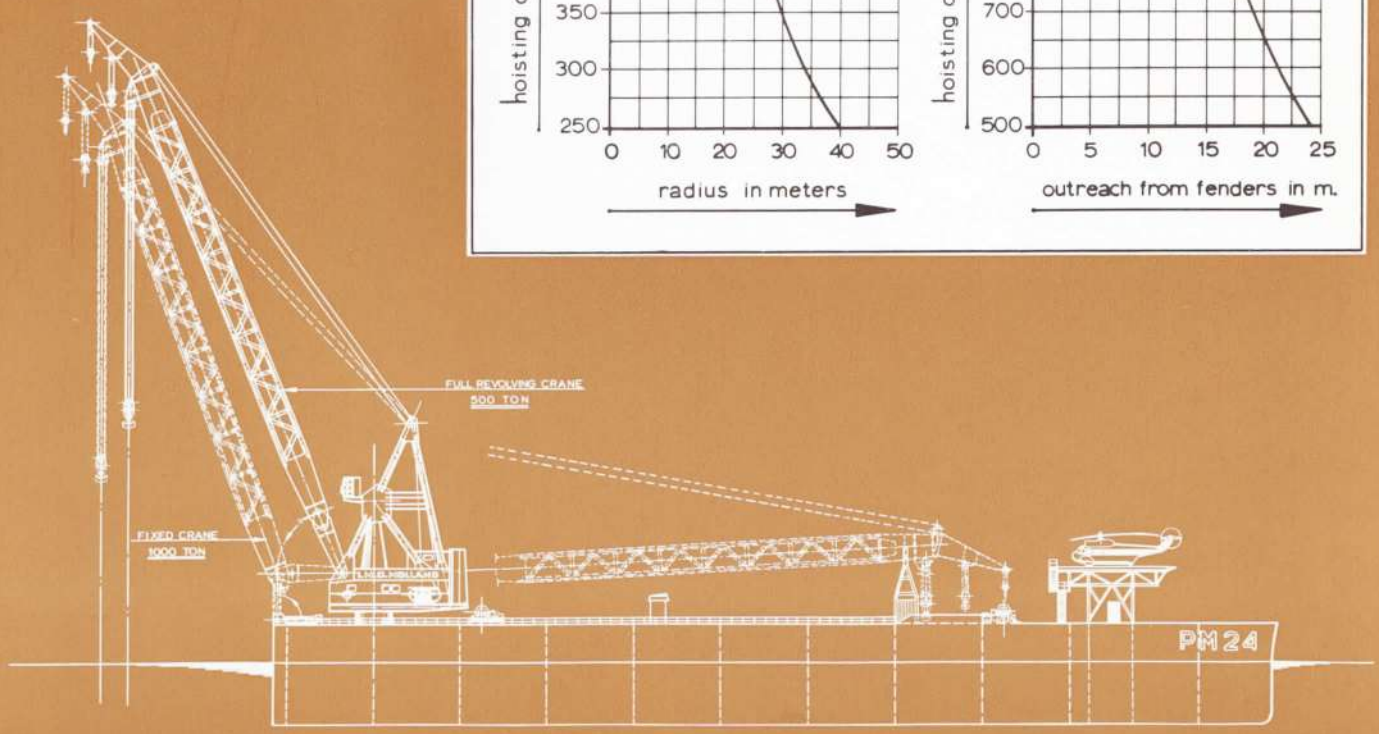
Principal data:

Lifting capacity: the graph reproduced shows the capacity of the crane at various radii.

As a luffing crane it can raise its load to a height of 62.50 m (205 ft) above the waterline, and as a 500-ton slewing crane to 72.50 m (238 ft).

The crane is mounted on the Owners' barge PM 24. Four I.H.C. built, electrically-driven, twin-drum winches form the nucleus of the anchoring installation. The jib is mainly of tubular construction, the upper and lower extremities being of welded steel plate.





6 1 JACKETS

As varied as the range of applications is the range of jacket types: the number of legs varies between three and twelve, and the superstucture from a simple platform carrying the so-called "Christmas-tree" to a comprehensive work area with deck house and helicopter deck.

Like the demands imposed in respect of welds, those concerning the preservation of the jacket structure are very stringent. The tubular components are grit blasted before being treated with special paint.

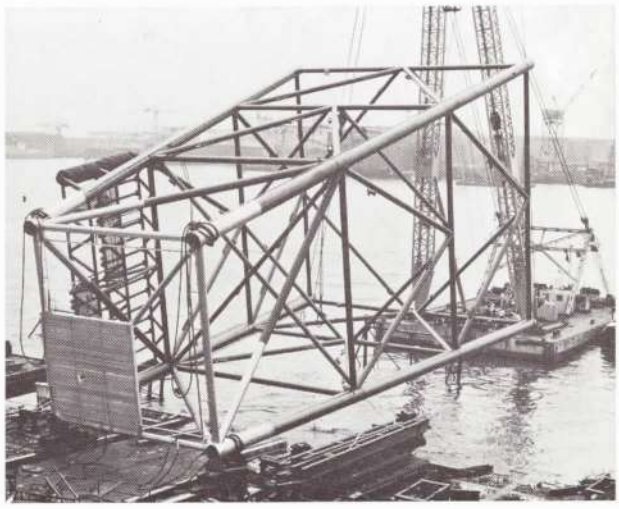
The areas exposed to wind and water are given additional preservative treatment. Zinc or magnesium anodes are used for the cathodic protection of the under water stucture.

I.H.C. Holland has supplied a great number of jackets for varying purposes.

In 1965 a four pile well protector has been constructed in the very short time of 21 working days.

Twenty-six three-pile well-protectors were shipped to the production area in the coastal waters off Cabinda in West Africa.

Other eight- and twelve-pile jackets were built for locations in the North Sea.



7 1 HEAVY DUTY WINCHES

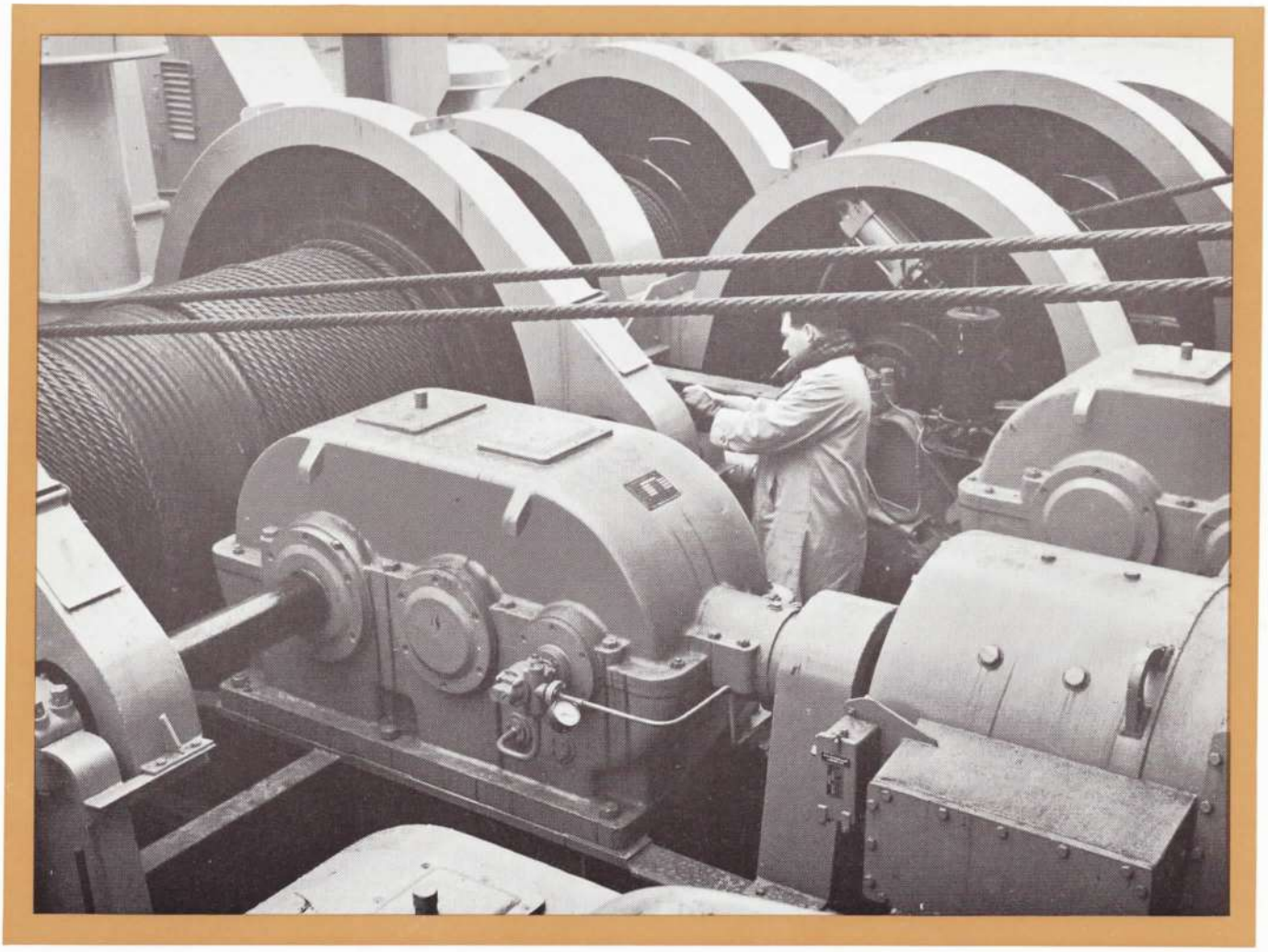
I.H.C. Holland has manufactured more than 5,000 winches for use on dredgers, self-elevating pontoons, floating cranes and other vessels and structures. The vast experience gained in designing and manufacturing these has enabled I.H.C. Holland to adopt a system of standardization extending to every component. Under this, winches can be exactly matched to the requirements of the client and at the same time embody the advantages accruing from standardization.

The range of standard winches now offered covers two main types:

— warping winches and hoisting winches, in capacities from 3.2 to 50 tons

— heavy duty winches in capacities from 50 up to 100 tons.

The heavy duty winches are specially designed for use as warping winches on drilling rigs and self-elevating pontoons.



8 1 MANAGEMENT AND STAFF

The origin of all I.H.C.-activities has been the construction of specialized craft, such as floating cranes and dredging equipment.

All such craft require a large, experienced and versatile designing staff. It is this versatility which pays off so well in the work of I.H.C. Holland for the oil industry.

Frequently I.H.C.-engineers travel far and wide to discuss engineering problems, or to supervize the assembly of knock-down design equipment. They have done so in the artic wastes within the Polar Circle, in the desert of Iraq and in the tropical swamps of West Africa.

Like their colleagues of the oil industry, they feel at home in such regions, where a man is as good as his job.

They welcome your enquiries, and will be truly pleased to make new contacts with the oil industry.

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   I.H.C. Holland
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