

# Trailing dredger "Maas"

built by IHC Holland for Belgium\*)

Photo's by fotobureau C. Kramer, Rotterdam.

The trailing-suction hopper dredger *Maas*, built recently for the Algemene Baggermaatschappij 'S.G.D.' of Brussels, may be said to be among the most up to date vessels of her type afloat. She has an overall length of 94.50 m and a beam of 16.00 m, and her hopper has a capacity of 3,000 cubic metres. The single suction pipe is mounted on the starboard side and is suitable for dredging at depths to 33.00 m. Three Diesel engines, each of which develops 1,800 hp at 500 rev/min., are installed — two for propulsion purposes and the third for driving a generator and a number of hydraulic pumps.

The total output of the machinery is 6,000 hp. The lay-out of the machinery, controls and scanning and alarm systems is such that the vessel may operate with an unattended engine room.

Three important features distinguish the *Maas* from earlier dredgers of a comparable type:—

1. The dredge pump is not installed in the hull, but on the draghead, with the result that the suction pipe in fact becomes a delivery pipe. The pump is driven by a number of hydraulic motors which together produce 1,200 hp.
2. The sliding bottom valves, of which there are 18, are of the new IHC type. They are arranged in two rows of 9, each row being actuated by two hydraulic rams — one

for opening and the other for closing. The ram units are situated fore and aft of the hopper compartment. The advantage of sliding valves, in comparison with the conical type, or bottom doors, is that no parts project beneath the hull during spoil discharge.

3. The deckhouse, which is situated aft, is flexibly mounted on the hull in order to minimize the transference of vibration to the crew's quarters. The vessel has accommodation for a crew of 22.

## Draghead-mounted dredge pump

Normally, the dredge pump is installed at the lowest possible level in the ship's pump room. This is done because the attainable vacuum is limited to about 7.5 m W.G. by the cavitation characteristics of a centrifugal pump. This vacuum of 7.5 m W.G. must be sufficient to:—

- accelerate the water through the aperture in the draghead;
- overcome the resistance of the mixture in the suction pipe, which is caused by friction losses and eddies arising in the bends, etc.;
- overcome the static component i.e. the differential in specific gravity of the dredged mixture and water, multiplied by the differential between the suction depth and the distance from the centre of the pump to the out-board water level.

\*) concensed from *Ports and Dredging* No. 79, a IHC publication.

It will be clear that when the dredging depth increases, the attainable specific gravity (or concentration) of the dredged mixture will decrease, since the total pressure differential required to dislodge and accelerate the sand and to transport it to the dredge pump will increase.

Consequently a smaller portion of the vacuum remains to overcome the static component; in other words, the attainable concentration is lower.

The only solution to this problem is to install the dredge pump far enough under water. This has already been done aboard cutter suction dredgers where the pump could easily be installed in the cutter ladder.

However, installing the pump on a draghead is not as easy as doing so on a cutter ladder, because whereas a cutter ladder is rigid, a suction pipe is flexible.

Moreover, there was the problem of transporting the energy required to drive the pump along the suction pipe down to the draghead.

This was realized on the trailing dredger *Maas*. Here a hydraulically driven draghead pump with a suction inlet of 800 mm dia. and capable of absorbing 1,200 hp at 235 rpm has been installed. It is also possible to use electrically driven submerged pumps.

During the trials of the dredger equipped with this draghead pump, an average specific gravity of 1.4 ton/cu. m was achieved.

Summarizing:—

- the installation of a draghead pump results in a much higher attainable concentration of the dredged mixture;
- the concentration becomes independent of the dredging depth;
- theoretically, unlimited dredging depths can be achieved;
- cavitation of the dredge pump does not occur.

#### IHC sliding bottom valves

For some considerable time now users and builders of dredging plant have been searching for a method by which spoil could be discharged from hopper vessels via the hopper bottom in shallow water without risk of striking the moving parts of the discharge system on the bed. A number of systems have been devised viz.

- a. Lyster valves, the disadvantages of which are high initial cost and a significant loss of hopper space;
- b. recessed valves, which exert an unfavourable influence on stability and are costly in buoyancy, necessitating an unnecessary large hull;
- c. transverse sliding doors, which have the disadvantage of requiring a complicated actuating mechanism. More-

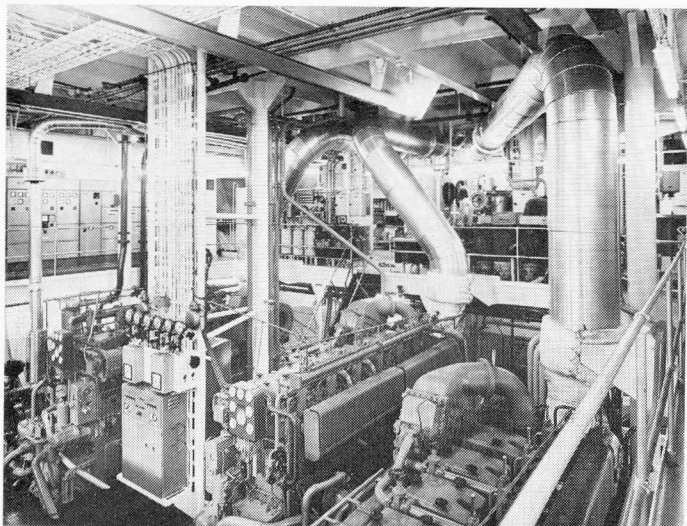
over, the (transverse) mechanism occupies so much space that only one row of apertures can be provided, so that the discharge area is disproportionate to the hopper capacity. Systems of this type built so far have also proved less than watertight, particularly during the pumping of spoil or water from the hopper.

The new sliding valve system designed and patented by IHC Holland overcome all these disadvantages. The system consists of a number of longitudinally sliding valves which are linked to each other and actuated by a single mechanism. Two rows of these valves can be incorporated in a hopper. The mechanism is such that, in addition to longitudinal opening and closing movements, each valve moves vertically over a short distance and can thus be pressed against the seal to give added watertightness.

The most remarkable advantages of this bottom valve system are:—

- In the closed and open positions, the mechanism is entirely within the hull plating and thus enables the hopper to discharge in shallow water without risk of damage. This can contribute significantly to the optimum utilization of a nearby dumping ground, reducing steaming time and enabling many loads to be dumped in a day. On beach restoration or extension projects, it enables the vessel to come much closer inshore.
- Although the area of the discharge aperture is somewhat smaller than, say, those allowed by hinged bottom doors or pyramid valves, the useful aperture is relatively larger because of the complete absence of rods, chains, fins, etc. inside the opening, or a valve underneath. Because the system enables two rows of apertures to be employed, the discharge area is larger than that of systems with transversely operating valves.
- Because the movement of the valves at the end of the stroke is small and purely vertical, the seals are well and evenly compressed. Leakage through the sliding valves is negligible, and they remain tightly closed during emptying of the hopper by suction, in which circumstance the pressure in the hopper is lower than that of the surrounding water.
- The absence of chains, rods, etc. — and supporting

The MWM main engine room installation of the 'Maas'.



The dredge master control position.





beams for these — enables a completely 'clean' hopper design to be employed.

This not only benefits the settling process, but also reduces maintenance on parts exposed to the soil.

- In the discharge systems with which many hopper vessels are equipped, particularly those systems with conventional bottom doors suspended from chains or chains and rods, it is the weight of the spoil which causes the doors to open. Often the chains become stuck in the soil so that the door opens only with difficulty. If then the doors on one side open easily while those on the other side stick, the vessel lists. With the sliding valve system, the opening operation is positive and controlled and no such circumstances can arise.

- The centre of gravity is low in comparison with that of deckmounted actuating mechanisms and so contributes to the vessel's stability.

The technical trials of the *Maas* showed that both the unconventionally positioned dredge pump and the sliding bottom valves more than fulfilled the expectations. Both the loading of the hopper (with sand) and the subsequent dumping of the spoil by means of the valves were completed very rapidly.

#### The power transmission equipment.

The hydropump is driven by a Lohmann & Stolterfoht distributor drive, which has one input- and six output shafts. Total five gears case hardened and ground have been used.

The input speed is accelerated from 500 to 1200 rpm. The input power is 1800 hp. Center distance between output shafts 2 x 1000 mm. An intermediate shaft is used between input shaft and diesel motor, and is supported by a Lohmann & Stolterfoht RadiLus journal bearing, type LRL 19, bore  $\varnothing$  180 mmH7. The bearing is equipped with an incorporated tube cooler of seawaterproof material.

The intermediate shaft has at one side a flange, which is mounted directly to the flange of the input shaft of the gearbox. A Lohmann & Stolterfoht highly elastic coupling, type KJR 220 has been mounted on the other end. This coupling connects the shaft with the flywheel of the diesel engine. The engine speed is reduced to propeller speed by means of two Lohmann & Stolterfoht NaviLus Marine reduction gears units of the type GUH 560. Marine gears of the design rows GUH are single stage reduction gears with case-hardened and ground single helical spur wheels.

The shafts are placed side by side and are carried by well dimensioned antifriction bearings. The gearboxes are equipped with an integrated oilcooler. A splashpan encloses the bull gear in a way that a pumping effect is achieved. The input shafts are bored in longitudinal direction, for the airsupply of the Lohmann & Stolterfoht highly elastic double cone pressair controlled friction couplings, type KAC 260 M. An intermediate shaft is used between the coupling and the diesel engine. The intermediate shafts are supported by a Lohmann & Stolterfoht RadiLus journal bearing, type LRF 23, bore  $\varnothing$  220 mm, H7. The bearings are equipped with an incorporated tube cooler of seawaterproof material.

#### Vibration proof deck house.

The deckhouse is flexibly mounted by means of two longitudinal rails on to which the rubber flexibles are connected. These rails are designed to take shearing and pressure stresses. With increasing load the shearing load is converted into a pressure load thus achieving a high lateral flexible rigidity. Safety devices are fitted between the individual dampers. These protect the flexibles against overload and also secure the superstructure against coming loose from its mountings in case of fire damage to the rubber flexible mountings.

The design of the construction allows the shipyard to completely finish the deckhouse and install it after launching of the ship.

#### Equipment on board the 'Maas'

(partial list)

**Avio Diepen, The Hague:** vibration free suspension of deckhouse  
**AVT, The Hague:** 'Janel' sand pump gear/transmission box  
**Bakker Rubberfabriek (bv), Ridderkerk:** rubber seals  
**Bodewes, Nieuwerkerk a/d IJssel:** deck machinery  
**Bruinhoff (bv), Rotterdam:** L&S couplings and main gear boxes  
**Davit Company (bv), Utrecht:** 2 sets gravity davits type N.T.C.  
**Duyvendijk & van Overbeeke, Rotterdam:** compressors  
**Econosto, Rotterdam:** valves and fittings  
**Ericsson Telefoonmaatschappij (bv), Rijen:** automatic telephone system, talk-back and loudhailer system.  
**Heemaf (bv), Hengelo:** electrical equipment.  
**Heinen & Hopman, Spakenburg:** ventilation and heating  
**Keyzer, de, Rotterdam:** masts  
**Kleine, J. P. B., Hoogezand:** ventilation equipment  
**Lagersmit, Kinderdijk:** Sublime propeller shaft seals  
**Leun, v. d., Sliedrecht:** Dornhoff power pack for windlass  
**Maters, Beverwijk:** hydrophore installation  
**Mulder & Rijke, IJmuiden:** life boats  
**MWM, Mannheim:** main and auxiliary engines, generating set  
**Observator, Rotterdam:** nautical equipment.  
**Rietschoten & Houwens, Rotterdam:** electrical installation  
**Ruplaco, Schiedam:** refrigerating equipment  
**SHF, Schiedam:** deck crane  
**Stork-Friesland, Sneek:** telegraph installation  
**Stork-Jaffa, Utrecht:** steering engine  
**Venteville (bv), Rotterdam:** Anschütz — Kiel gyro equipment  
**Voorden, Van, Zaltbommel:** propellers  
**Wabco Westinghouse, Capelle a/d IJssel:** pneumatic remote control equipment.  
**Westfalia, Lünen:** lube oil separators  
**Wijk & Boerma, Rotterdam:** pumps

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## PLANOX-clutches with radial airsupplies

Are especially built for direct drive of sand-pumps and propeller shafts by low speed diesel engines, because there is not a free shaft-end for adopting the standard rotor seals.

PLANOX-clutches with radial airsupplies now are available for torques up to 20.000 kgm.

For controlling the torsional system the PLANOX-clutch with radial airsupply is combined with a flexible HOLSET-coupling.

Our engineers like to give you more technical informations. Please don't hesitate to contact them. Remember it's their daily work.

## AVD

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