

Scaffolding-wreathed bow of a supertanker takes shape in Mitsui Dockyard.

New Shipbuilding Techniques

Low-cost, high-production innovations give Japanese world lead in field.

Japan has won international acclaim and an enviable reputation for ingenious engineering for its key industry—shipbuilding.

Because of technological skills, the Asian nation is leading the world for the twelfth straight year in shipbuilding. Tonnage this year will account for about 47 percent of the global total, in contrast to 44 percent a year ago. Japanese shipyards have received orders for well over 9.5 million tons of ships for domestic and overseas construction. Tonnage launched in 1966 eclipsed the 8,140,000 tons actually launched in 1965 and total amount of ship orders will soar beyond 10 million tons in 1967.

Highlights in the order list are bookings for mammoth tankers, and Japan has to its credit the world's largest ships afloat—three times straight: the 131,000 dead-weight-ton Nishho Maru, the 150,000-d.w.-ton Tokyo Maru, and the 210,000-d.w.-ton Idemitsu Maru.

Dockyards are now being expanded or freshly built to an enormous size, capable, it is said, of handling individual ship tonnage up to half a million.

One good reason for Japan's 12-year lead in world shipbuilding in this high-profit-earning export industry is low cost; another is quick delivery of superior ships.

Chief reason, however, is technical innovation; exciting new techniques of welding, building, launching, blueprint-

ing, designing, automating, and powering.

Innovations have been coming hot and heavy:

- Mitsubishi Heavy Industries has announced success in joining and welding on water two floating halves of a tanker hull. Developed over a five-year period the technique consists of connecting two seaborne halves of a tanker, sealing the line of junction with a wide synthetic rubber band, removing the water in compartments where hulls join, then welding.

- Kawasaki Heavy Industry claims development of the world's first sidethruster. This uses a jet-propulsion technique to bring a big ship along side a dock or to maneuver it away from its moorings without conventional tugboat help. This technique involves ejection of a powerful stream of seawater pumped from the vessel's bow or stern. It may well eliminate the need of a mooring crew and enable self-piloting, with resultant economy.

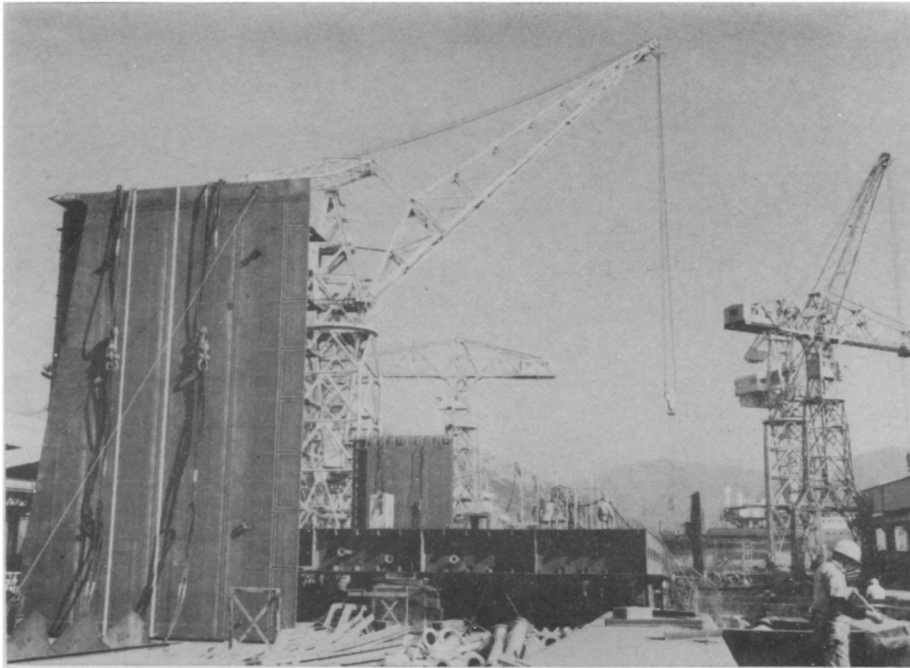
- MHI's Kobe dockyard has to its credit research on equipping ships with parachutes and fins to act as emergency brakes to guard against sea disasters. Small ships, too, can be stopped, literally, by slamming on the brakes. In cooperation with the Maritime Safety Agency, Japan Steel & Tubing (NKK) too has successfully tested what it calls "a revolutionary type ship brake." This consists of a pumping unit, split rudder, and control panel, the split

being made of two leaves hinged together at the rear vertical edge. In emergencies, the leaves are opened to form a flat vertical surface at a 90-degree angle to the keel, impeding forward motion. Braking effect is enhanced by a stream of water forced against the flat rudder by the propeller.

- NKK had earlier revealed an improved anti-rolling system perfected by its shipbuilding division, judged the best in five systems tested jointly by the Netherlands Ship Model Basin at Wageningen and the Dutch Ship Research Center at Delft University. This featured the addition of an airtight compartment atop and connected with the fluid compartment, with an airflow regulating system in the airtight chamber regulating the flow of air within the system and providing added force to anti-rolling. This is called the "transfer phase difference principle."

- The same firm has disclosed a new automatic welding process which enables the five-fold speed-up of welding operations in shipbuilding. It is called the "consumable nozzle electroslag welding" system, and it automatically accomplishes vertical welding of butt and fillet joints. In a recent project, for example, welding time for 320 welds was cut from 992 to 320 man-hours.

- Mitsui Shipbuilding & Engineering has perfected a "new barge-line system" that rationalizes coastal transportation by separating and standardizing cargo



Giant cranes speed Japanese shipbuilding, bring quick delivery, low cost.

and propulsion units. Interchangeable, specialized barges may be hooked up according to logistic requirements and serve as floating warehouses while "pushers" perform other tasks. At work



Majestic vessel takes to her element.

are 1,700-d.w.-ton bottom-dump barges propelled by 1,240 horsepower pushers.

Unique, too, is a tracing process that draws blueprint tracings on steel plates and other shipbuilding steel materials by means of photo-conduc-

tive chemical powders. It was jointly developed by Fuji Photo Film and Konan Camera Research Institute.

The new techniques use fine photo-conductive chemical powders, chiefly composed of zinc oxide, instead of photo-conductive paint hitherto used in such draft drawings. The common method was to coat steel plates with photo-conductive paint and cast enlarged photographic images of the blueprint by a projector. The new method features negative electric charging of the fine chemical powders and attaching them to the surface of plates or other materials by using the pull of static electricity and then casting enlarged photographic images of blueprints. This produces a latent image on the powder-covered surface because the static electric charge of the powders vanishes when illuminated by the projector's light. Blowing away needless powder, followed with spraying of some solvent on the surface, thereafter produces a clear surface image. Drawing efficiency is boosted 50 percent, with a corresponding cut in cost.

• A new shipbuilding method in halving output at Kure Shipbuilding & Engineering—the one and a half construction system. Builders build one ship's stern in the same dock in which an entire vessel is under construction, so that when the completed ship is finished, the stern already being built is merely slid to the yard's rear and the bow built on. Simultaneously, the stern of another bottom is begun at the dock's front.

• An MN system anti-rolling tank has been developed at Tsurumi, near Tokyo. Unlike orthodox types of anti-

rolling devices such as bilge keels, gyro-stabilizers and fin stabilizer units, this system features no motive power but utilizes a u-shaped tank. Water flow in this tank is automatically regulated by a valve at the bottom. The system can cut the rolling to one-third when waves are with the ship, one-half when against it.

• **The yards that pioneered** successfully in bulbous bows, that forge ahead with underwater tankers and hinged-pin ships (segmented for easier wave buoyancy) also gave the industry unique launching techniques using ball-bearings, introduced hullblock building time- and fund-saving, did research into "economy vessels" which are broader built to absorb more freight even while cutting steel weight for construction, unveiled such recent types of oceangoing carriers 50,000 dwt liquefied methane gas tankers, and "Panamax" standard-design ships of 65,000-d.w.-ton class bulk carriers—maximum size of tonnage allowed through the Panama Canal with while the 1966 Load Line convention is in force.

• Ishikawajima-Harima Heavy Industries developed a unique steam turbine for a ship's generator, driven by exhaust gas from a ship's diesel engine. Overall fuel consumption has reportedly been pared four percent.

Other firms are constantly turning out new marine power units, of greater power, with lower operating costs.

• Kawasaki Dockyard, Kobe Steel, Yawata Iron & Steel and Osaka Transformer Mfg have combined to perfect the latest automatic welding technique, consisting of nine welding processes, that has enabled shipyard workers to weld a ton of steel plate in seven hours, half the time once required.

They have devised solutions to welding drawbacks: the fact it was hard to weld a ship's bottom, because of spark showers and the fact that workers had to weld twice, outer side and inside, no job for a novice.

Three years' joint research has now finally perfected nine automatic welding processes. Included are one-side automatic welding electroslag and electrogas welding, automatic welding of curved shell plates and automatic gravitational welding.

Japan forges ahead, more slowly, with nuclear as opposed to conventional power plants, though plans call for stepped up research into nuclear-driven tonnage. A project is pushed, with difficulty, for building a 6,980-ton ocean survey and training ship by 1971, 390 feet long, 62 feet wide and 33 feet deep, powered by a pressurized water reactor, for a top speed of 18 knots.

Stuart Griffin