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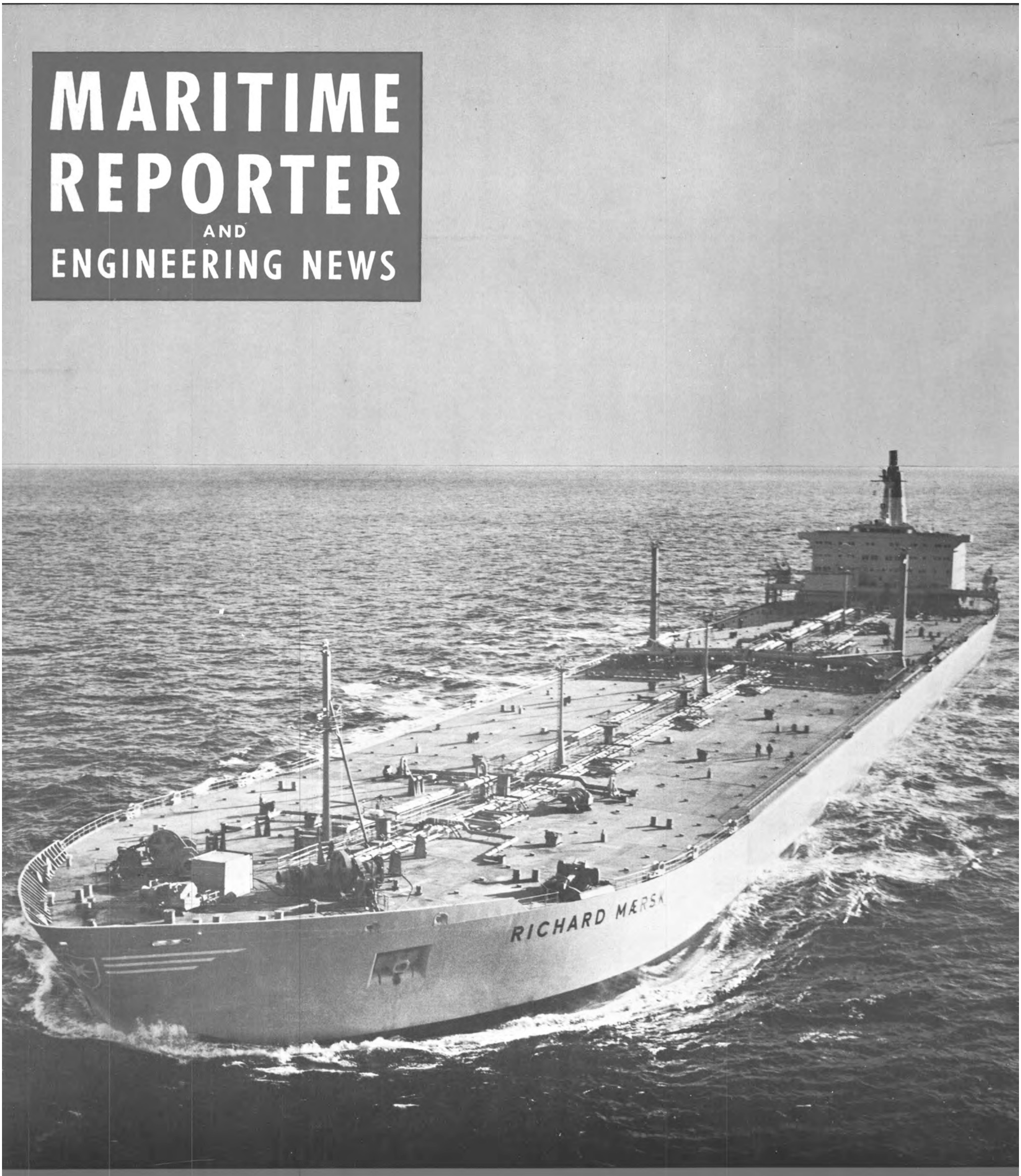

**The Supertanker Richard Maersk—
Fifth 285,000-Dwt Vessel Delivered
By Odense Steel Shipyard In 1972**

(SEE PAGE 7)

JANUARY 1, 1973

"If at first you don't succeed..."

Rear Admiral Robert E. Peary is assuredly not the man who coined the phrase, "If at first you don't succeed, try, try again."

But few men ever applied the axiom with greater determination or under more frustrating circumstances.

It was in 1898 that the great explorer first set out to find the North Pole on his ship the "Windward." He was gone for four years, endured enormous hardships, but could get no closer than 390 miles of the Pole.

This was the farthest north anyone had ever gone in the Arctic but coming close was no comfort to a man of Peary's determination.

In 1905, he set out again, this time on the "Roosevelt," a ship specially built for the voyage.

Result? A new "farthest north" record, this time within 200 miles of the Pole. But once more, the elements forced him to turn back.

Then, in 1908, he set sail again on the "Roosevelt," which had proved itself to be a great ship. This time he made it. On April 6, 1909, Peary, with four Eskimos and a Negro manservant, stood on the exact location of the Pole.

But when he returned he was greeted with little enthusiasm since another American explorer, Frederick A. Cook, claimed to have reached the Pole a year earlier.

However, the Congress of the United States, after investigating Cook's claim, found it fraudulent and gave to Peary the credit he deserved.

Today, Admiral Robert E. Peary is recognized not only as the first man to reach the North Pole, but as one of America's greatest, and most important, explorers.

His achievements were many and his honors were great.

This advertisement, prepared by Gulf Oil, a leading supplier of quality marine fuels and lubricants, is one of a series paying tribute to the great explorers of the sea. It is published in the interest of the shipping industry and those associated with it.

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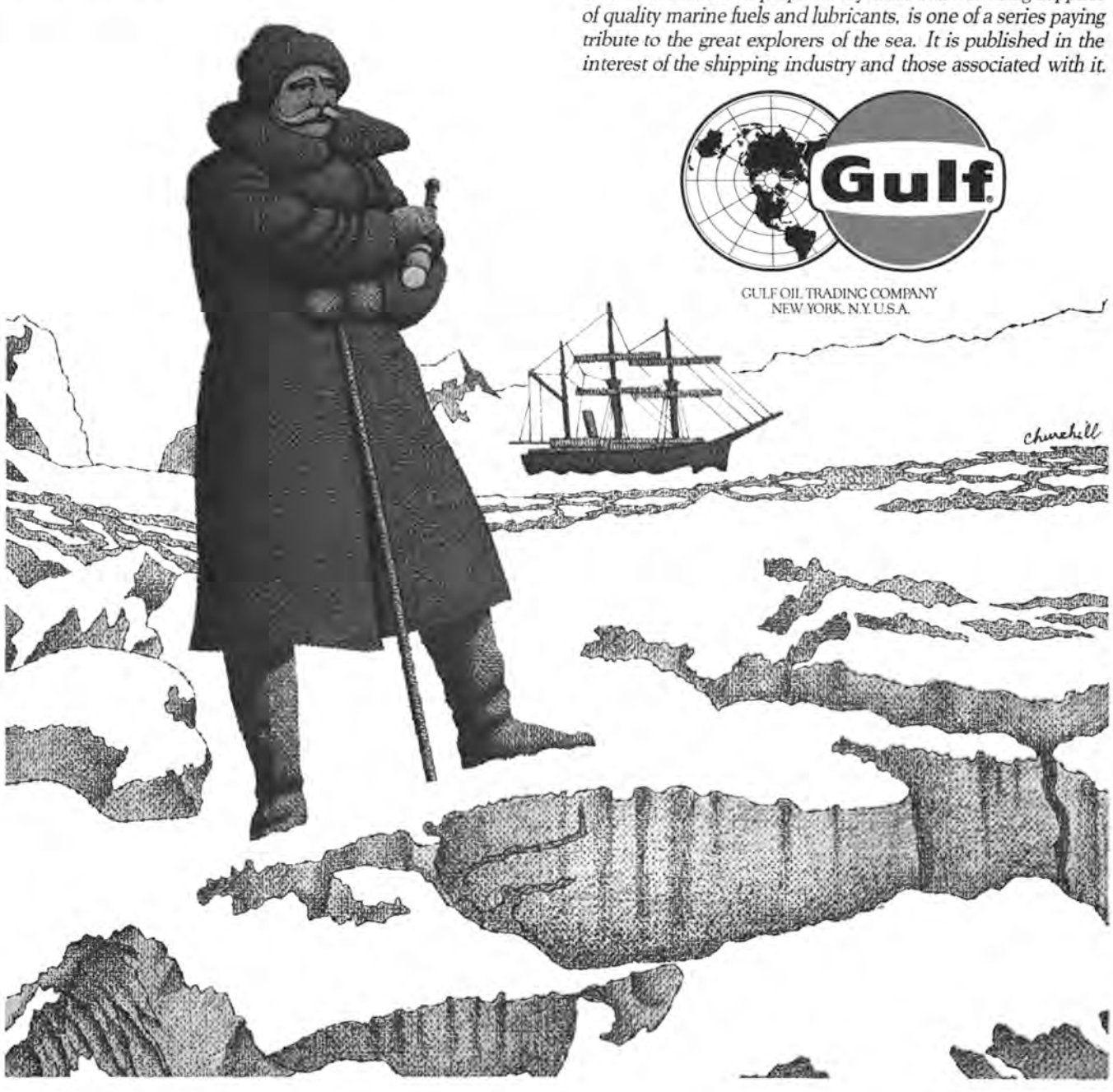

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Houston Firm Secures Title XI Commitment For Four Barge Rigs

A 20-year, $5 million financing commitment, subject to approval by the Maritime Administration, has been secured by Crutcher Resources Corporation, Houston, Texas, for a subsidiary, Mallard Well Services, Inc.

The financing, under Title XI of the Merchant Marine Act, is for the addition of four new barge rigs for Mallard. Three of the rigs, scheduld for completion before September of this year, will each have a workover capability of 20,000 feet.

Spain's Shipbuilding Shows Six Percent Production Increase

The Spanish shipbuilding industry delivered a total of 637,954 gross registered tons in the first nine months of 1972, a 6 percent production increase on the same period for 1971.

But, according to the Association of Spanish Shipbuilders, the only new orders that were booked in the nine-month period were for 81 fishing vessels with a total of 28,749 gross tons and 28 merchant vessels totaling 208,000 gross tons. On October 1, 1972, the order book had shortened by 9 percent on the 1971 figure to 397 ships with a total of 2.4-million gross tons ordered by foreign buyers.

These orders should keep the Spanish shipbuilding industry busy for the next three or four years and in addition, negotiations are under way to book Russian orders under the recently signed trade agreement.

Philadelphia Port Directory Available

The 1972-73 edition of The Philadelphia Maritime Exchange Port Directory is now available according to an announcement from the publisher.

The directory contains over 1,500 listings representing the full range of facilities, services and organizations associated with the administration and operation of the Ports of Philadelphia.

Copies of the new Port Directory can be purchased directly from the office of The Philadelphia Maritime Exchange, Bourse Building, Philadelphia, Pa. 19106, at a cost of $1.50 each. Mail orders will be filled based on a cost of $1.90 per copy. Mail orders will be filled based on a cost of $1.90 per copy.

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HUD

Lindo Shipyard In Denmark Delivers Five 285,000-Dwt Supertankers In 1972

This broadside shows the Richard Maersk at the outfitting dock at the Lindo Shipyard.

When the 285,000-dwt Richard Maersk was recently taken over by her owners, the A.P. Moller Shipping Companies in Copenhagen, it marked the fifth supertanker of this size to be delivered in 1972 by the Lindo yard of Odense Steel Shipyard Ltd.

The Lindo yard has additional orders for seven tankers of 285,000-dwt and 11 in the 310,000-dwt class. The Richard Maersk, second of a three-ship series for the A.P. Moller interests, has the following main characteristics: length overall, 1,139 feet 1½ inches; breadth, 170 feet; depth, 93 feet 3 inches; draft, 72 feet 11¼ inches; capacity of cargo tanks, 12,490,000 cubic feet; propulsion machinery, 32,450 shp, and speed, 15.25 knots.

The keel for this vessel was laid July 3, 1972, floating took place September 29, and delivery was made a little more than four months after keel-laying.

The Richard Maersk was named by **Miss Felicity McFadzean,** daughter of **F.S. McFadzean,** chairman of Shell Tankers and Trading Company, in ceremonies at the Lindo yard.

Among those attending were the British Ambassador to Denmark, the chairman of Danish Shell, representatives from Lloyd's and business associates of the Shell organization. The owners were represented by **Maersk Mc-Kinney Moller,** who is also chairman of the Odense Steel Shipyard Ltd. The yard was represented by **Erik Quistgaard,** managing director.

The vessel is chartered by Shell and will go the route North Europe, South of Capetown to the Persian Gulf.

Pictured during the naming ceremony are, left to right: **Maersk Mc-Kinney Moller,** who represented the owners and is also chairman of Odense Steel Shipyard Ltd.; **Miss Felicity McFadzean,** sponsor; **Mrs. Maersk Mc-Kinney Moller,** and **F.S. McFadzean,** chairman of Shell Tankers and Trading Co.

Alabama Dry Dock To Build $17-Million Vessel For Diamond M

The Maritime Administration has approved in principle a request by Diamond M Drilling Co., Houston, Texas, for construction loan and mortgage insurance to assist in financing the building of a semisubmersible drilling vessel.

To be constructed by Alabama Dry Dock & Shipbuilding Co., Mobile, Ala., at an estimated cost of about $17 million, the vessel is to be used worldwide, except for the winter season in the North Sea and the Gulf of Alaska.

Patton Named As First American Director On Cunard Board

Richard B. Patton, president of Cunard Line Ltd. in North America, who has been named director of commercial operations worldwide for Cunard, is the first American to serve as a director on the 132-year-old Cunard board.

Announcement has been made by The Trafalgar House Group that Mr. **Patton** has been appointed to both the board of directors of the Cunard Steam Ship Co. Ltd., and to the Cunard-Trafalgar Hotels Ltd.

Aeronca, Inc. Receives $3-Million Subcontract From Litton Industries

A subcontract for approximately $3 million has been received by Aeronca, Inc., Middletown, Ohio, from Litton Industries' Ingalls Shipbuilding Division for nonstructural bulkhead panels and doors on five U.S. Navy general purpose amphibious assault (LHA) ships. This was announced by **Roy J. Benecchi,** Aeronca Aerospace Group president.

Aeronca production deliveries are scheduled to begin next month and continue into early 1974. The bulkheads and doors for the LHAs will be made of bonded aluminum honeycomb sandwich panels, faced with vinyl covering of various colors and patterns.

In the initial phase of the program, Aeronca honeycomb panels were subjected to comprehensive testing for critical performance and safety requirements. In addition to improved installations procedures, the Aeronca honeycomb panels provide substantial economies in maintenance manhours, and improved working and living areas aboard ship. Mr. **Benecchi** said the Ingalls concept for the LHAs includes color harmonized bulkheads, doors and furnishings for crew living quarters.

"Aeronca's extensive experience in the design and fabrication of honeycomb sandwich structure has provided an entry into an exciting new application of those materials for shipboard use," Mr. **Benecchi** stated. "Bonded panels are being considered for use in several other marine programs, and we expect considerable growth of this product line."

OSG Orders Three Tankers From Hitachi

Overseas Shipholding Group, Inc. (OSG), New York, N.Y., has announced that it has placed orders with Hitachi Shipbuilding & Engineering Co. Ltd. of Japan for the construction of a 262,500-deadweight-ton tanker, and two 80,000-deadweight-ton tankers, for delivery in 1975. The 262,500-dwt tanker will be 50 percent owned by OSG.

The company also announced that it has purchased a 76,100-dwt bulk carrier built in 1967, and a 74,750-dwt tanker built in 1965. Both vessels will enter service under charters upon delivery. These two acquisitions and the recent delivery of a new 25,650-dwt geared bulk carrier will raise OSG's operating fleet to 34 bulk carriers and tankers, aggregating in excess of 1.5 million deadweight tons.

By year end 1975, when the last of 15 new ships now on order is scheduled to be delivered, OSG's fleet will total 4 million deadweight tons, including six 50 percent owned and two 60 percent owned vessels. Approximately half of the more than 2.4 million deadweight tons on order has already been chartered for periods of 10 years or more.

Joseph Ingham Named General Manager Beth-Baltimore Yards

Joseph D. Ingham

The promotion of **Joseph D. Ingham** to general manager of Bethlehem Steel Corporation's Baltimore ship repair and conversion yards was announced in Bethlehem, Pa., by **Walter F. Williams,** vice president, shipbuilding.

Mr. **Ingham,** who has been general manager of Bethlehem's Hoboken, N.J., shipyard, succeeds **Walter E. Shade,** who retired at the end of November after 31 years of service at the Baltimore yards.

Mr. **Ingham** previously served as assistant manager of the Baltimore yards from January 1, 1969, until his transfer to Hoboken in 1970. From mid-1963 through 1968, he was assistant manager of Bethlehem's San Pedro, Calif., yard.

A native of New York City, Mr. **Ingham** has been with Bethlehem since mid-1941, when he joined the Hoboken yard as a draftsman. During World War II, he served nearly four years with the United States Coast Guard and later studied at Columbia University, graduating with a bachelor's degree in general science and a master's degree in industrial engineering.

After serving in the Coast Guard, where he attained the rank of lieutenant, senior grade, he worked in various capacities at the corporation's former Brooklyn 27th Street and Brooklyn 56th Street shipyards. In May 1963, he was transferred to the San Pedro yard as assistant to manager and little more than a month later was named assistant manager of that yard.

Mr. **Ingham** is a member of The Society of Naval Architects and Marine Engineers, the American Society of Naval Engineers, The Propeller Club and the Sparrows Point Engineers Club.

MarAd Approves Aid For Construction Of Offshore Drilling Rig

The Maritime Administration has approved construction loan and mortgage insurance for the Western Co. of North America, Fort Worth, Texas, to help finance a new semisubmersible offshore drilling vessel.

The estimated cost of the vessel is $21,235,000, and no builder has been named as yet. The semisubmersible will be used in North Sea operations.

Fred W. O'Green Named President Litton Industries

Fred W. O'Green has been named president and chief operating officer of Litton Industries. The announcement was made by **Charles B. Thornton,** chairman of the board and chief executive officer of Litton.

Mr. **O'Green,** who is a director of Litton, has been an executive vice president with responsibility for navigation and control systems, communications and electronic data systems, marine engineering and production and electronic components.

He succeeds **Roy L. Ash,** who resigned December 9 to join the staff of President **Richard Nixon** as assistant to the President and director of the Office of Management and Budget.

In announcing the new Litton president, Mr. **Thornton** said: "**Fred O'Green** brings to the job a proven record of over 20 years of broad operating management experience, more than half of which has been at Litton in division and group management positions with increasing responsibility. We plan to work closely together as a team with the other members of Litton's senior executive management to build a bigger, stronger and more profitable operating company in the coming years."

Commenting on the appointment of Mr. **Ash** to President **Nixon's** staff, Mr. **Thornton** said: "**Roy Ash's** tremendous abilities will be missed at Litton, but one of his key contributions has been his participation in the development and training of a strong management team to carry on.

Fred W. O'Green

"**Roy's** brilliant talents will make a major contribution to the new Administration and the President's program. We at Litton wish him every success in his new responsibility."

Mr. **Thornton** and Mr. **Ash** formed Litton Industries in 1953. Since then, it has grown from a small electronics company into a major diversified industrial corporation with annual sales of $2.5 billion and major manufacturing facilities in 32 countries of the world.

Mr. **O'Green** joined Litton in 1962 as general manager of the Guidance and Control Systems Division. He became division president two years later and assumed responsibility for the division's worldwide production and sales activities. He was elected a corporate vice president in 1965 and was named a senior vice president later the same year. He has been an executive vice president of Litton since 1967 and a member of the board of directors since 1968.

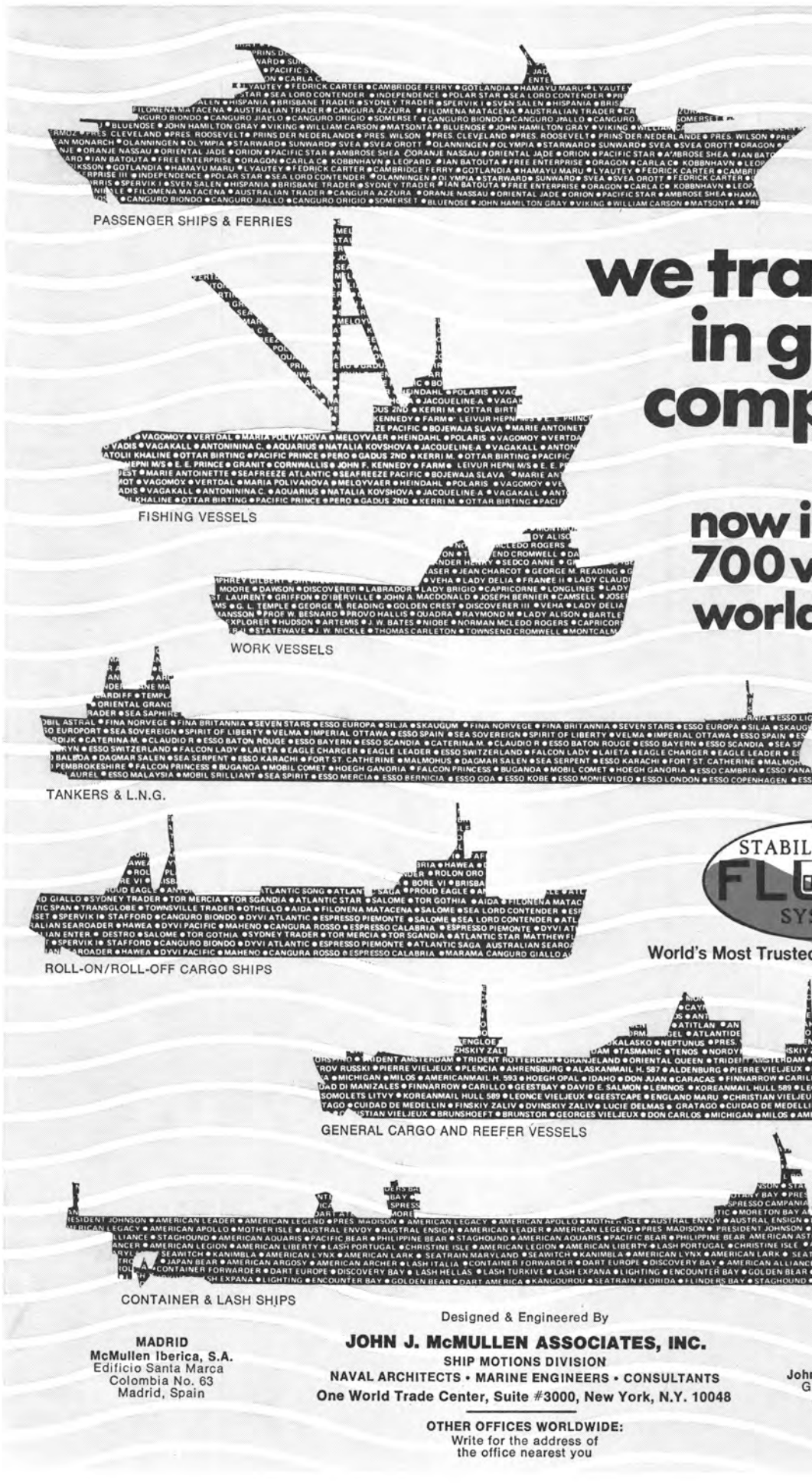
Prior to joining Litton in 1962, Mr. **O'Green** had been technical director of space programs and assistant general manager of Lockheed's Space Division. He was graduated from Iowa State University in 1943, with a bachelor of science degree in electrical engineering. He received a master of science degree in electrical engineering from the University of Maryland in 1949.

Mr. **O'Green** is a member of the American Institute of Aeronautics and Astronautics, Athenaeum (California Institute of Technology), University of Southern California Board of Councilors—School of Engineering, and the Newcomen Society of North America.

Avondale Appoints Edward Windstein VP

According to **J. Melton Garrett,** executive vice president in charge of Avondale Shipyards' divisions, **Edward Windstein** has been appointed a vice president, as well as retaining his position as general manager of the Steel Sales Division.

The Steel Sales Division specializes in the sale of steel and aluminum plates and shapes, and is one of Avondale Shipyards' eight divisions.



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Two Companies File For Subsidy To Build Two LNG Tankers

In a joint project, Amoco International Oil Co., a subsidiary of Standard Oil of Indiana, and the Natural Gas Pipeline Co. of America, a subsidiary of Peoples' Gas Co., have filed an application with the Maritime Administration for subsidy to cover the construction of two liquefied natural gas (LNG) carriers to bring fuel from Trinidad to the United States Gulf Coast.

The ships are to be equipped with the first U.S.-developed LNG containment system.

Provision is made for the Government of Trinidad to participate in the ownership of the 125,000-cubic-meter vessels, an unusual feature of the planned venture.

The spherical tank cryogenic containment system is one recently developed by the Chicago Bridge and Iron Co. French and Norwegian-developed systems have been used so far in existing LNG projects.

Newport News Shipbuilding & Dry Dock Co., which has three LNG carriers for El Paso Natural Gas Co. under contract now, will build the ships for an estimated $97 million each. That is close to $99.2 million average for the three El Paso vessels which will be equipped with Moss-Rosenberg spherical containment systems developed in Norway.

The two LNGs will be operated by new companies—LNG Carrier Company No. 1, and LNG Carrier Co. No. 2.

The participation for the Government of Trinidad in the 400 million cubic feet a day importing system is to be at that government's option and will be limited to 20 percent of the ownership of the vessels, the application said.

The importation will be from Lisas, Trinidad, to the U.S. Gulf.

The Federal Power Commission which must approve such projects, said it had not as yet received an application for the required authority.

The applicants said they estimated a construction subsidy of "slightly more than 25 percent" of the contract price of the ships would be required.

The bid for subsidy for the two new LNGs raises to 26 the backlog of applications for this type vessel.

MarAd Approves Prudential-Grace Lines' LASH Ship Sale Plan

The Maritime Administration has approved in principle a proposal by Prudential-Grace Lines in which that company will sell its five lighter-aboard-ship (LASH) vessels and bareboat charter the vessels back for operation. Under the proposal, a new wholly owned subsidiary, Prudential Lash Lines, Inc., will be formed to sell the ships to a trust formed by Chase Manhattan Bank N.A., and Marine Midland Bank-New York.

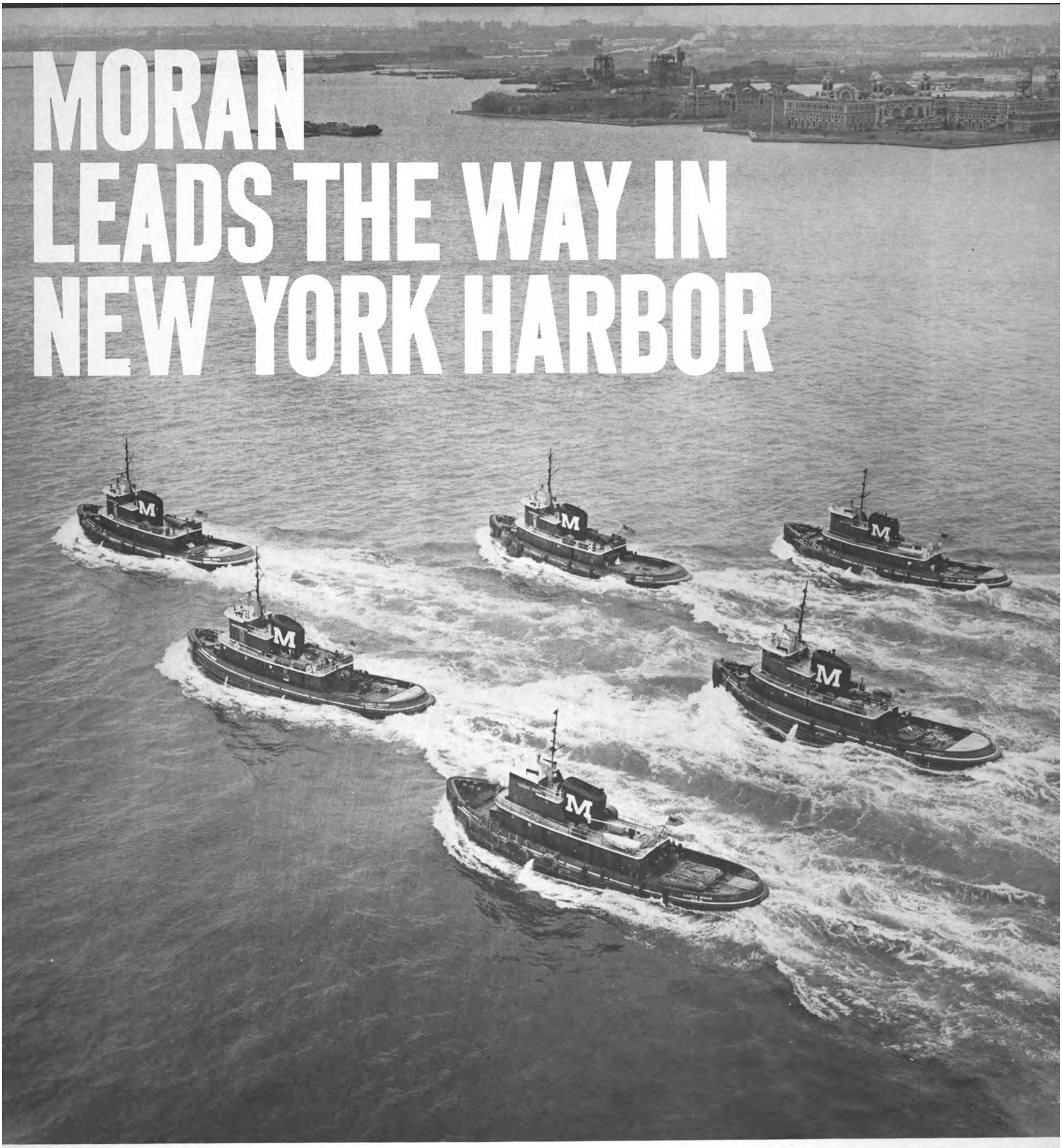
The Government agency said the sale price of the five vessels will amount to about $99.2 million, with the new subsidiary assuming the outstanding Title XI mortgages of approximately $40.4 million.

After the sale, the owner-trustee formed by the two banks will assume the Title XI mortgage, with Prudential Lash serving as the guarantor, and take title, subject to the assumption by a Chase subsidiary, of a $26.8-million second fleet mortgage held by Prudential-Grace. Prudential Lash will charter the ships for 25 years, paying $4.6 million in the first installment for all five vessels semiannually. The second payment will total $6.4 million per year semiannually, beginning 5½ years after closing, the total charter figure coming to $11 million per year.

New Exploration Consulting Firm Formed In Houston

Exploration Associates International, a new firm which will offer management of exploration programs and consulting services to oil companies and independent operators, has established offices in Houston, Texas.

Two seismic data processors and two geophysical consultants comprise the four principals in the new company.



Moran Towing & Transportation Co., Inc., One World Trade Center, Suite 5335, New York, N.Y. 10048

Robert J. Blackwell Predicts Bright Future For U.S. Shipbuilding

Speaking at a recent Shipbuilders Council of America board of directors luncheon, Assistant Secretary of Commerce for Maritime Affairs **Robert J. Blackwell** predicted that "American Shipyards will have available through 1980 the largest, most sustained shipbuilding marketing opportunity since World War II."

Particularly, he sees increasing demand for bulk carriers, liquefied natural gas (LNG) ships, and very large crude carriers (VLCC) to handle U.S. energy and dry bulk imports.

He said, in part: "In terms of oil tankers, we would require (by 1985) 112 vessels in the 80,000 deadweight ton range, plus 284 very large crude carriers (VLCC) in the 250,000 ton range. Additionally, 92 LNG carriers of 125,000 cubic meters capacity would be needed. To handle our dry bulk imports, 75 vessels of 120,000 deadweight tons also would be necessary. . . .

"Whatever policies and programs that may emerge from the President's initiatives, I believe that large volumes of imported energy will be needed to augment domestic supplies well into the 1980s. Even if substantial increases of domestic energy supplies are brought on line over the next 10 or 15 years, their impact will be blunted by the fact that domestic consumption will have doubled within that same time frame. Accordingly, we see near-term opportunities to build at least 30 LNG ships with a contract value of $2.5 billion by 1980—and this may prove to be an overly conservative figure. . . .

"Within the next six months, we believe that another five LNG ships and two large OBOs will be contracted for under the (Nixon Maritime) program, and that our fleet of modern bulk carriers will continue to expand in the years ahead."

With regard to research and development, Secretary **Blackwell** had this to say: "As you know, President **Nixon's** maritime program called for an expansion and restructuring of MarAd's research and development program to put primary emphasis on the development of near-term technological advancements with high benefit to cost ratios. As compared to the $3.5 million per year average expenditures by MarAd for non-nuclear R&D prior to the 1970 Act, we have allocated $30 million for such purposes during the current year.

"Among the projects under way are several to improve shipbuilding productivity which are being conducted under cost-shared contracts with major shipyards.

"Within the past two years, MarAd has allocated $8 million to such projects, and the shipyards have contributed, or earmarked, an additional $4 million to these endeavors.

"A number of important projects, which hold the promise of particularly significant gains in shipyard productivity, are well under way in conjunction with member yards of the Shipbuilders Council.

"They are centered on a wide range of shipbuilding operations which account for a major share of the cost of constructing a ship. These projects involve the development of improved welding equipment and procedures, more efficient methods for the surface preparation and coating of steel plates and structures, adaptation of optical laser technology to shipyard erection methods, and other activities.

"We are gratified by the progress that is being made in carrying forward these projects. Within the next six months we expect to have much of the hardware and prototype equipment developed by these projects under test and evaluation.

"The improved productivity and attendant cost savings that can evolve from these efforts is conservatively estimated to be in the tens of millions of dollars annually. And these are not one-time dividends, but should accrue for many years." Mr. **Blackwell** also mentioned that at least five shipyards have adopted the Autokon computer system, developed in Norway, "that automates countless ship design and construction procedures."

KTMI Names Coleman General Manager Of New Korean Shipyard

Korea-Tacoma Marine Industries Ltd. (KTMI), an affiliate of Tacoma Boatbuilding Co. Inc., is rapidly proceeding on the construction of a new shipyard at Masan, Korea. The new facility is now past 35 percent completion stage and will be completed and in operation by April 30, 1973.

Joseph J. Ewing, executive committee chairman of Tacoma Boat and president of Associated Venture Capital Inc., parent firm, reported on the progress of the new Korean joint venture and also announced the election of the KTMI board of directors.

Mr. **Ewing** announced the appointment of **John I. Coleman,** recently active in business in Tokyo, Japan, as executive vice president-general manager of KTMI operations in Seoul.

Mr. **Coleman** was previously vice president-general manager of Recognition Equipment (Pacific) Ltd. based in Tokyo. From 1967 to 1970, he was chief financial officer for the PAC marine operations in the South Pacific-Southeast Asia area. PAC has its large new operating base in the Port of Tacoma Industrial Yard, with head office in Seattle, Wash.

Prior to joining PAC, Mr. **Coleman** served in management capacities for various international agencies and has a broad background in computer systems, foreign trade marketing and international finance. He speaks Japanese fluently, and has lived in the Orient for 18 years.

John I. Coleman

The following two groups of directors of KTMI were elected at the Seoul meeting—AVC/Tacoma Boat directors: **Joseph J. Ewing,** AVC president and chairman of Tacoma Boat executive committee; **Arnold J. Strom,** executive vice president AVC and president of Tacoma Boat; **Paul C. Vertrees,** executive vice president, Tacoma Boat; **John I. Coleman; Warren Shimeall,** Tokyo law firm partner; **Donald E. Vaughan,** Tacoma Boat vice president, **S.K. Kim,** director of finance, Yong Chemical Co., a joint venture of Getty Oil, Skelly Oil, Swift & Co.

Korean directors are: **J.N. Kim,** brother of Prime Minister **Kim Jong Pil**; Adm. **Y.K. Kim,** Fourth Chief of Naval Operations; Adm. **W. Sohn,** First Chief of Naval Operations of the modern Korean Navy; Commodore **K. Lee,** formerly executive vice president of Korean Airlines and president of KTMI, Captain **Kwan,** director of shipyard operations, KTMI, and **B. Hyen,** director of finance, KTMI.

Lufkin Industries Builds Record 12,000-Hp Gear For Fairbanks Morse

Lufkin Industries, Inc., Lufkin, Texas, has broken its own record for multiple engine applications with a 12,000-hp marine propulsion gear for a 28,000-dwt sugar ship that will ply the waters between Hawaii and the East and West Coasts.

The Lufkin CSQ16222S marine gear was built for Fairbanks Morse Power Systems Division of Colt Industries, Inc., Beloit, Wis. It left the Lufkin manufacturing plant for delivery to Seattle, Wash.

Weighing more than 150,000 pounds, the CSQ16222S is driven by two 6,000-hp Colt-Pielstick diesel engines, with a single output of 12,000 hp. The huge unit will drive a power take-off with a demountable coupling from the starboard engine torque shaft through a step-up gear to a generator rated 450 kw AC at 1,200 rpm.

Lufkin Industries, Inc. is a manufacturer of marine and industrial gears, oil field pumping units, and truck trailers.

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Armco 5% & 9% Nickel Steels can offer significant cost savings for LNG vessels

For cryogenic construction involving transportation, processing, storage and distribution of liquefied natural gas, Armco has the steels and the specific information you need for economical materials selection.

Armco 9% Nickel Steels provide toughness, strength and ductility at temperatures down to −320 F (ASTM A 353 or A 553 Grade A). But they are just two of the Armco steels for use in LNG process vessels and storage tanks.

A recent addition to this family is Armco CRYONIC 5 Steel. Basically, it's a 5% nickel steel with toughness properties for all LNG applications. The ASME Boiler and Pressure Vessel Code includes the addition of SA 645 with an allowable stress of 23.7 ksi at temperatures 150 F and below. But the real advantage of CRYONIC 5 is its lower cost (approximately 20%) due to the reduced nickel content. CRYONIC 5 is designed specifically for containment of ethylene at −155 F and liquefied natural gas at −258.6 F.

Because Armco 9% Nickel Steel and CRYONIC 5 Steel are both designed for LNG containment, either land-based vessels, tanks or ocean-going tankers, you can be assured of an economical selection of steel. For complete information, just mail the coupon.

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Flat Membrane LNG Tanks

Plane-Surface Dual Semi-Membrane LNG Tanks Combine The Advantages Of The Membrane Tank And Pressure Vessel.

Katsuro Yamamoto*

The basic concept for a flat membrane-type LNG tanker originated from experience gained by the Bridgestone Liquefied Gas Co., Ltd. in the construction of LPG and LEG tankers and shore tanks, under the firm's design.

The general concept of the system is shown in Figure 1. It consists of a dual-membrane tank, the inner semi-membrane being the primary tank and the outer semi-membrane forming the secondary barrier. Sandwiched between the two membranes is a buffer layer of plywood panels. The primary tank and secondary barrier are composed of flat walls, cylindrical edges and ball corners, and are enclosed in a load-bearing insulation structure.

The only point of fixation of the dual-membrane tank to the supporting structure is at the dome part of the tank. The rigid dome is supported by the ship's deck structure. There are several variations possible in this system, depending on the size and shape of the ship hold, i.e., the thickness of the membranes, radius of the cylinders and balls, type of load-bearing insulation structure, and the fabrication method of the tank.

As shown in Figure 2, if a primary tank is fabricated of 9% Ni steel plate to the same size at ambient temperature as that of the inside surface of the supporting structure and is enclosed in and supported by a load-bearing insulation structure, and when loaded with liquid at the same temperature, then all plane walls and bottom cylinders (hereinafter referred to as leaning parts) are kept in firm contact with the surface of the load-bearing insulation structure through the plywood buffer and the secondary barrier.

However, all vertical cylinders, top cylinders, and ball corners (hereinafter referred to as free parts) are freely self standing because of different radii of the primary tank, plywood buffer and secondary barrier.

When the above tank, which is sized at normal temperature, is cooled to a low temperature, it will shrink and a clearance will take place between the tank and the load-bearing insulation. If this tank is now containing a liquid at a low temperature, then the pressure of the load will distend the plane surface sides until they contact the rigid load-bearing insulation. Consequently, the free parts and the areas of the plane surface near the free parts will be subjected to bending stress as well as the normal hoop tension. Due to the fact that excess bending stress in the membrane will cause a fatigue fracture, it is most desirable to eliminate this stress.

Therefore, the primary tank is to be constructed to an over-size which is equal to the amount of thermal contraction. In this way, the thermal contraction brings the primary tank to right size at the cargo temperature and under these circumstances, the tank is subjected only to hoop tension. Thus, in this system it is possible to give known stress design to the primary tank, the order of which can be made to be far below the allowable stress limit of the material used. From this fact, it can be readily understood that the design has similar characteristics to the pressure vessel, requiring no secondary barrier.

The secondary barrier of 3-mm stainless steel is also fabricated to oversize, the shape being similar to that of the primary tank. Under loaded conditions, the leaning parts transmit cargo load to the supporting structure, but the free parts of the secondary barrier are in no way affected by the cargo load. For this reason, the secondary barrier is not subjected to hoop stress under cargo condition.

It may not be necessary to have the plywood buffer sandwiched between the primary tank and the secondary barrier. But in order to maintain a better autonomy of the primary tank and secondary barrier, a 20-mm thick continuous plywood sheet having 2-m radius in the free parts is sandwiched between them. This plywood buffer provides a protection to the primary tank and the secondary barrier against possible damage. It also prevents the primary tank and secondary barrier from interfering with each other.

In general, any insulation structure can be accepted, should it be designed to support the cargo load and to provide the insulation effect, and also it can be closely related to the fabrication methods of the tank.

The primary tank is a completely impermeable metal tank and is enveloped in a completely impermeable metal secondary barrier. Both the primary tank and secondary barrier are independent of each other, with the only point of fixation between the two at the flange of the dome portion.

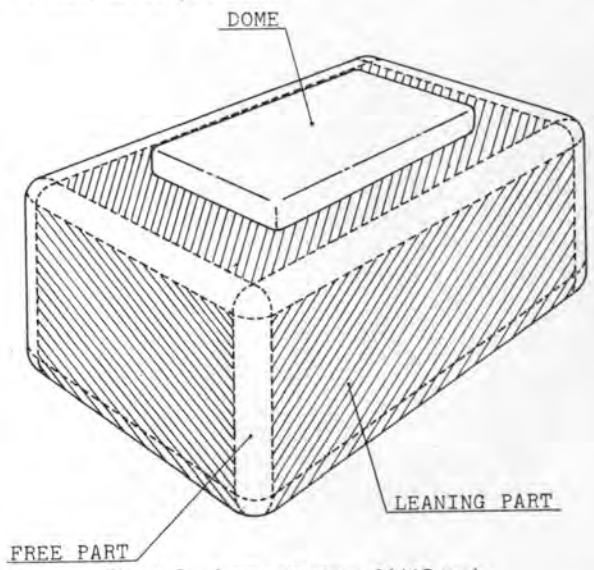


Figure 2—Isometric view of LNG tank.

Under service conditions, the primary tank is designed to come under pure hoop stress, but the secondary barrier is free from stress. Accordingly, the stress levels in each will be entirely different. Therefore, under any circumstances, there is no possibility of a damage occurring simultaneously in the primary tank and the secondary barrier.

The shape of the dual-membrane tank when there is no load is maintained by the stiffness of the cylinders and ball corners of each individual component, primary tank, plywood buffer, and secondary barrier, because of their respective degree of rigidity. But at the same time, they are sufficiently flexible to accommodate the deformation caused by pre-compression. In other words, the primary tank, plywood buffer, and secondary barrier are all individually self supporting.

Some sagging of the top plate, because of its own weight, when there is no gas pressure inside, may be considered relative to the size of the dome. For this, a top hanger extending from the dome toward the cylinders may be installed.

In general, the construction of LNG ships is said to involve a tremendous amount of expensive materials, much time and labor, thus incurring a high cost. However, such problems can be overcome to a great extent by the use of the plane-surface dual semi-membrane system.

This system has combined all advantages of the membrane tank and the pressure vessel with respect to the safety requirements, thus making this system far more practical.

*Mr. **Yamamoto,** senior managing director, Bridgestone Liquefied Gas Co. Ltd., Tokyo, Japan, presented the paper condensed here before the recent Third International Conference and Exhibition on Liquefied Natural Gas in Washington, D.C.

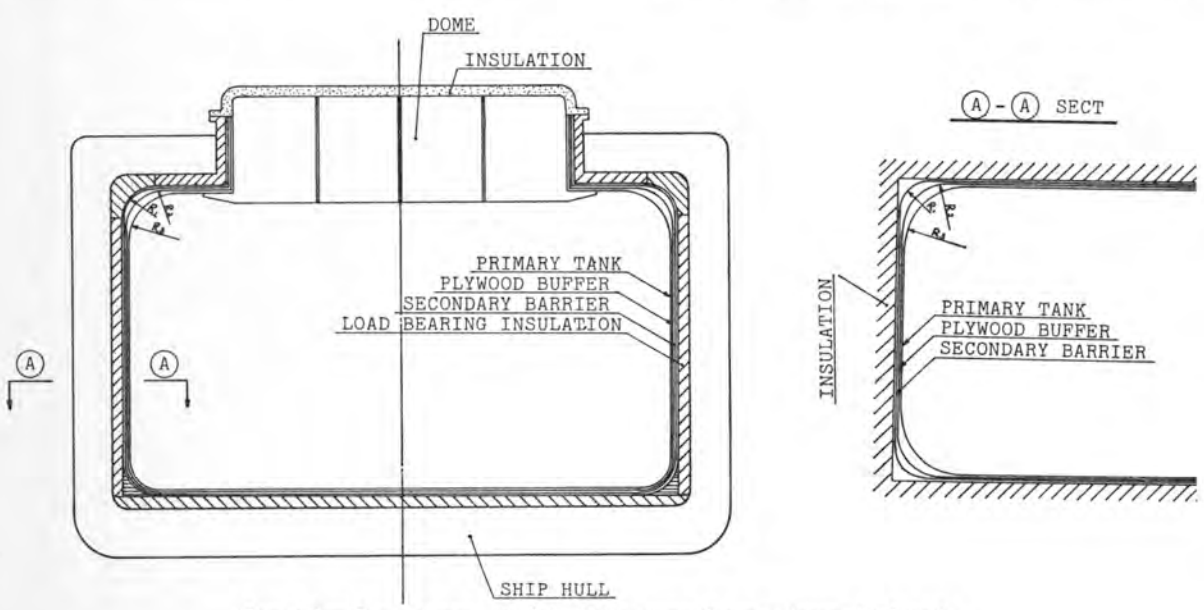
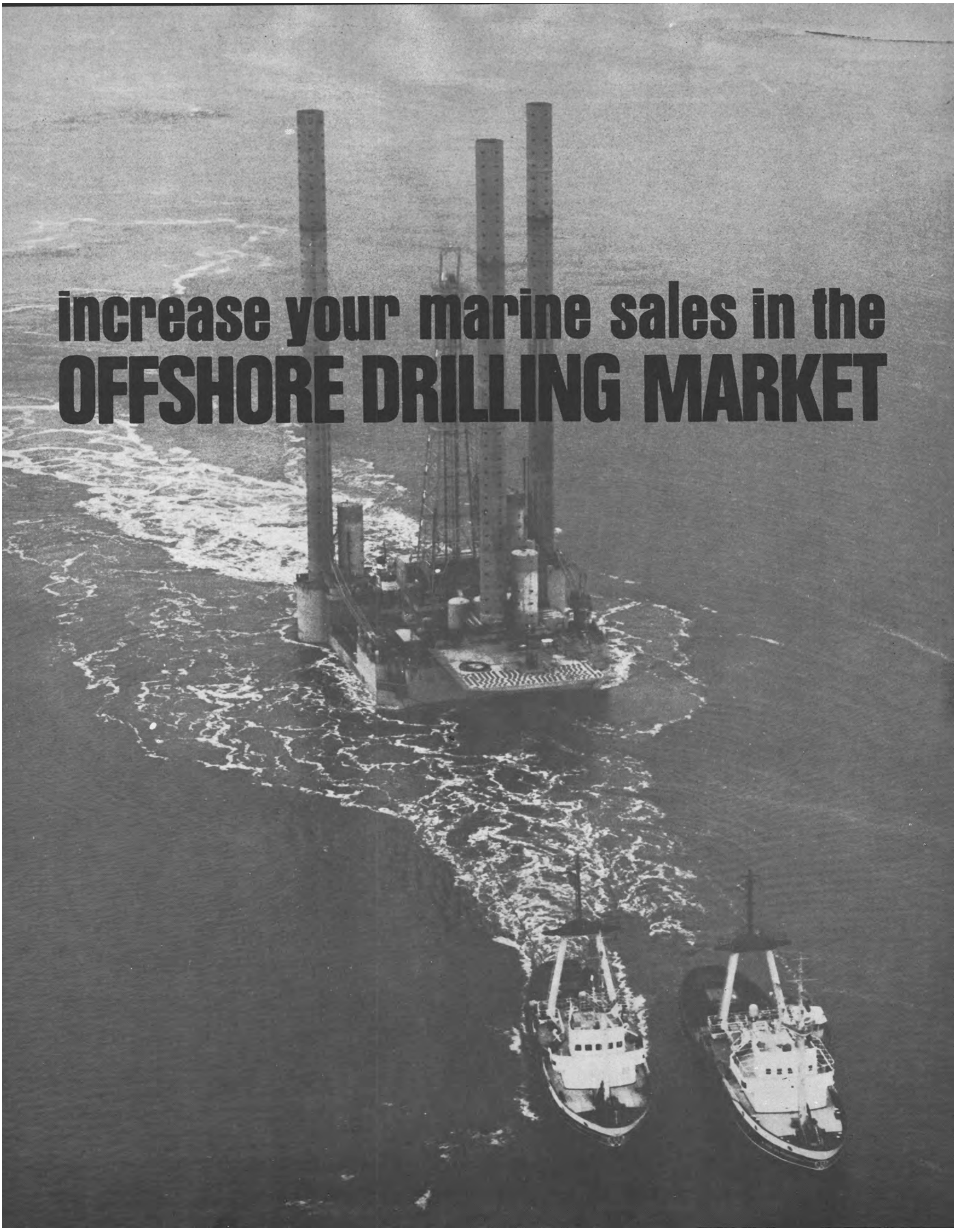


Figure 1—General concept of the Bridgestone flat-membrane LNG tank.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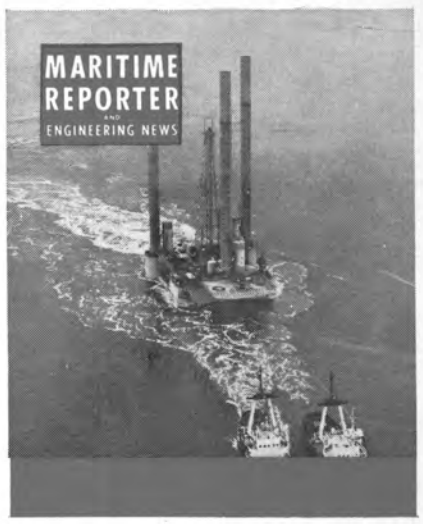

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Seek Aid To Build Ten Hydrofoils For N.Y. Area Commuters

Brucker International Inc. (formerly International Hydro Lines Inc.) of New York City has applied to the Maritime Administration for construction loan and mortgage insurance in connection with the building of 10 hydrofoils, each capable of hauling 72 passengers, for commuter and excursion service in the Greater New York City area. The company estimated in the application that each of the 65-foot-long craft would cost some $550,000.

Although the Maritime Administration provided little detail, company officials disclosed that the craft will be ordered from Whittaker Corp., Los Angeles. Service with the 40-mile-an-hour vessels is scheduled to begin in late 1973, according to **Ira Dowd,** International Hydro Lines' president, and **James P. Casey,** president of Tri-State Hydrolines Inc., which will actually operate the craft.

Routes are planned, they said, up and down the Hudson and East Rivers, with connections between Manhattan Island and Connecticut, as well as points in Westchester County, Long Island on the sound, and between Manhattan, Staten Island, and the Jersey shore.

Mr. **Dowd** noted his previous hydrofoil experience at the New York World's Fair in 1964, and more recently with two Russian-built craft among U.S. and British Virgin Islands.

Ultimately, Mr. **Dowd** said he saw a market for 50 such craft in and around major coastal cities.

B.J. (Ben) Gross Named President Of New Firm SOFEC, Inc.

B.J. (Ben) Gross, formerly vice president of marketing with AFC Industries Incorporated in New York, N.Y., and its W-K-M Valve Division in Houston, Texas, has taken an early retirement to become president of a new company, SOFEC, Inc., with headquarters in Houston. The firm will engineer, manufacture and install proved advance design, single buoy mooring systems principally for loading and unloading oil tankers. The SOFEC design is labeled SALM, for Single Anchor Leg Mooring, and will be built and installed anywhere in the world by SOFEC. Van Houten Associates, New York-based consulting engineers, will support the technological and engineering needs. SALM installations have been made in the Middle East and Far East. Development of other offshore facilities are planned.

Mr. **Gross,** graduate of the University of Missouri-Rolla, was president of the Key Company in 1955, when he merged it with W-K-M. In 1967, he was promoted to vice president of marketing by the parent ACF Industries and he transferred to New York. His entire background has been in furnishing engineered products to the petroleum and chemical industries.

In addition to Mr. **Gross,** SOFEC, Inc., has the qualified experience of engineers and installation supervisors. SOFEC is presently located at One Greenway Plaza East, Houston, Texas 77046.

Captain S.J. Wise Joins Staff Of Schmahl And Schmahl

Capt. **Siegmar J. Wise** has resigned his command of the German super cruise liner Boheme to join the staff of the well-known Floridian marine surveying organization of Schmahl and Schmahl, Inc., with headquarters in Fort Lauderdale. The affiliation of Captain **Wise** with the underwriters' surveying and classification firm was announced by **Horace W. Schmahl Sr.,** president of the company.

Capt. **Wise,** one of the youngest masters of a large passenger liner, will devote himself to the International Division of the surveying firm which represents most of the European insurance clubs, the Liberian maritime interests, and the classification society, Germanischer Lloyd, as well as the German Merchant Marine Safety Bureau. Captain **Wise** has made Miami his residence.

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Zim Container Service Appoints Robert Partos

The appointment of **Robert G. Partos** as director of interline operations for Zim Container Service has been announced by **Jeffrey M. Driesen,** the line's senior vice president for marketing and sales.

A veteran of 18 years in the transportation field, six of them in container operations, Mr. **Partos** will be responsible for coordinating Zim's inland transportation rates and operations.

Before joining Zim Container Service, Mr. **Partos** had been general manager, government services, for United States Lines, Inc. He has also served as traffic manager for Pride Transportation and assistant general sales manager for Associated Transport, Inc. In addition to spending two years in the Far East in container operations, he has served with the U.S. Army in Korea.

A native New Yorker, Mr. **Partos,** who attended the City College of New York and the Academy of Advanced Traffic, is a past president of the Steamship Operators Intermodal Committee.

Huge Texaco Tanker Built By Kockums Christened At Malmo

The Texaco Sweden, a 255,250-deadweight-ton mammoth tanker, was christened at Malmo, Sweden, on December 7, 1972, in ceremonies at Kockums Mekaniska Verkstads A.B. Shipyard. Sponsor of the very large crude carrier (VLCC) was **Mrs. R. Howard Wilson,** wife of the senior vice president of Texaco Inc. for worldwide refining and supply and distribution, of New York City.

With a deck area large enough to accommodate five regulation-sized ice hockey rinks, the Texaco Sweden is one of the largest vessels in Texaco's international fleets. She has an overall length of 1,116 feet, a beam of 170 feet, and a maximum draft of 66 feet. Standard service speed of the new tanker will be 15.5 knots.

The Texaco Sweden is the largest tanker ever built for Texaco in a Swedish yard. When delivered, she will be the ninth mammoth tanker owned by Texaco Overseas Tankship Ltd., London. The new vessel will join 30 other mammoth tankers, all over 200,000 deadweight tons, which are owned and operated by Texaco's international fleets. The aggregate capacity of the 31 such vessels will total approximately 7.1-million deadweight tons.

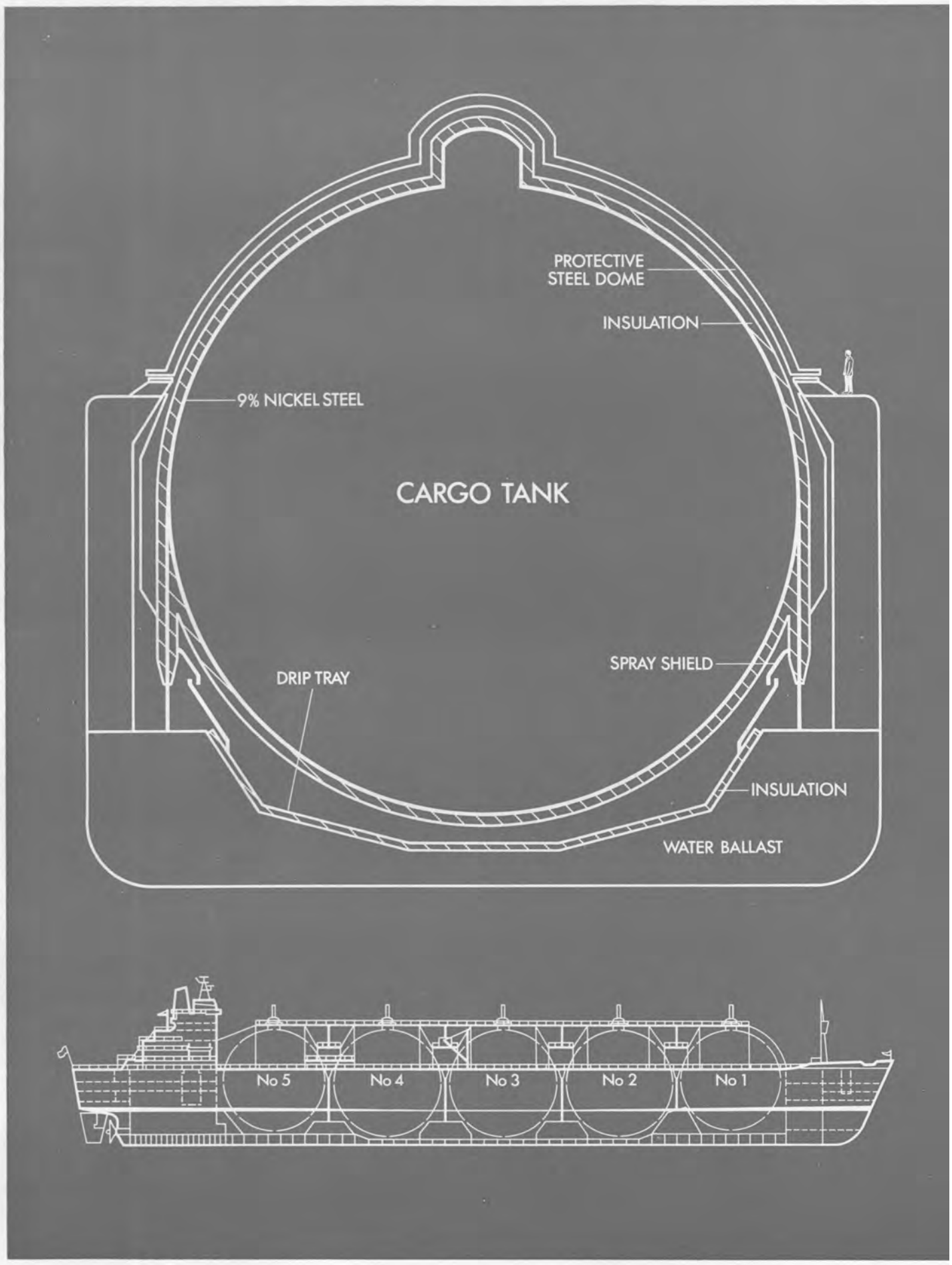
The name of Texaco's newest tanker commemorates Texaco's 52 years of providing petroleum products to Sweden. Today, Texaco Oil Aktiebolag, a wholly owned Swedish subsidiary of Texaco Inc., operates a nationwide network of retail outlets serving Sweden's motoring public. The company also supplies fuels and lubricants to Sweden's transportation, manufacturing, marine and other industries.

In addition to its marketing activities, Texaco Oil A.B. owns a 19.9 percent interest in Skandinaviska Raffinaderi Aktiebolaget Scanraff, a Swedish corporation currently engaged in constructing a refinery and related facilities on the Lyse Peninsula on the western coast of Sweden. The refinery is scheduled for completion in 1974, and will have an initial processing capacity of at least 140,000 barrels of crude oil per day, with special capabilities to manufacture low-sulfur fuels and low-lead gasolines.

The Texaco Sweden could carry enough crude oil in a single voyage to provide for the operating needs of a 140,000-barrel-a-day refinery for approximately two weeks.

The new Texaco tanker will be equipped with the latest electronic navigational aids, including a sonar/doppler system which is designed to assist docking operations. Texaco has been an industry leader in the installation of this system on all its owned mammoth tankers.

The Texaco Sweden is also fitted with special tanks for the onboard retention of oil residues. This procedure is required on all Texaco tankers in order to maintain the company's policy of prohibiting the discharge of oil at sea.



Sun Oil Study Shows Expanding Tanker Need Throughout The 1970s

It took a lot more oceangoing tankers last year to transport oil from areas of the world where surpluses exist to areas which depend upon imports. And the need for new tankers will continue to expand sharply throughout the decade of the 1970s.

According to a Sun Oil Company study, the minimum tank ship capacity required for inter-regional shipments went up from 106.7 million deadweight tons in 1970 to 124.2 million dwt in 1971, or an increase of 16.4 percent.

By 1980, the minimum requirement will be 302 million dwt, the study indicates. The study assumes that by then the United States will be dependent upon imports for 11,500,000 barrels per day, compared with 3,600,000 in 1971.

The United States will be the principal shortage area in the Western Hemisphere, the study shows. In the Eastern Hemisphere, the areas with the greatest shortages will be Western Europe and Japan. The principal area of surplus will be the Middle East.

In its 15th annual world tanker study, Sun found that at the end of 1971, the world fleet consisted of 4,183 vessels totaling 191,748,000 dwt, up 181 vessels and 23,808,000 dwt from the previous year.

The carrying capacity of the world fleet rose in 1970 from the equivalent of 10,925 standard T-2 tankers of World War II vintage to 12,438 in 1971, or 13.8 percent. Thirty vessels equal in carrying capacity to 35 T-2s were scrapped and 218 new ships equal to 1,556 T-2s were added to the world fleet.

At the end of 1971, the average oceangoing tanker was of 45,800 dwt, had a speed of 15.8 knots, and was 7¼ years old. The Japanese fleet was youngest, averaging only 4⅓ years of age and the U.S. fleet was oldest, averaging 16 years and five months.

Japan again led the world in building new tankers, and more than 40 percent of all the tankers under construction in the world were being built in Japanese shipyards as the year ended. Altogether, there were 773 tank ships under construction or on order in the world at that time, or 124 more than was the case a year earlier. The average size grew in just one year from 116,300 dwt to 129,700 dwt.

Speer & Associates Names Godlewski

Carl Godlewski

Philip C. Speer and Associates, Inc., 4 Weed Circle, Stamford, Conn. 06902, U.S. sales agents for Hi-Press International / Nordisk Ventilator Co. of Naestved, Denmark, has recently employed **Carl Godlewski** as sales engineer and service consultant.

Mr. **Godlewski** has a specialized technical background in the marine air-conditioning field, and will consult with owners and yards regarding new construction or retrofit.

Hammer Joins AIMS As Operations Coordinator

The American Institute of Merchant Shipping (AIMS) has announced that **Paul M. Hammer** joined the organization January 1 as coordinator of operations, succeeding the retiring **O. Lincoln Cone.**

Mr. **Hammer,** a Kings Point Academy graduate and tanker deck officer, was associated with American Petroleum Institute where he worked for 12 years on committees of ship, barge and terminal operators engaged in technical and regulatory matters. More recently, he was retained as a marine consultant by the Coast Guard's Office of Merchant Marine Safety.

Transcontinental And El Paso Sign Agreement For Delivery Of LNG From Algeria To U.S.

Agreements were announced in Houston under which 750 million cubic feet per day of Algerian liquefied natural gas would be delivered by El Paso Natural Gas Company to Transcontinental Gas Pipe Line Corporation for eventual use in the eastern and western parts of the United States. The companies stated that 375 million cubic feet daily of the gas would be used by Transco in serving its eastern U.S. market area. Transco will redeliver the remaining 375 million to El Paso at a point in south Texas for use in El Paso's western U.S. markets.

It is anticipated that deliveries to Transco will commence in mid-1977. The LNG will be delivered by El Paso to Transco at a mutually agreeable point on the Eastern Seaboard. Contractual arrangements are through subsidiaries of the two companies.

G. Montgomery Mitchell, president of Transco, said that the LNG will constitute one segment of its multiphase program to maintain Transco's gas supply for its customers in the face of the energy shortages that are confronting the country.

Howard Boyd, chairman of the board of El Paso Natural Gas, said the new agreement would also provide—for the first time—benefits of imported LNG to the western third of the nation presently served by his company.

El Paso said it plans to construct a 450-mile large-diameter pipeline from a point on Transco's pipeline in south Texas to west Texas, where its portion of the gas will be delivered into the company's existing system.

El Paso will purchase the LNG from Sonatrach, the Algerian national oil and gas firm, at the port of Arzew in western Algeria.

Applications will be filed in the near future with the Federal Power Commission for approval of importation of the additional volumes of gas.

Transcontinental Gas Pipe Line Corporation owns and operates an interstate pipeline system for the purchase, sale, and transportation of natural gas. Its main pipeline system extends from the Texas and Louisiana Gulf Coast through the southeastern states to the Pennsylvania-New Jersey-New York metropolitan areas. Essentially all of its sales are to utility customers in eastern and southeastern states.

McAllister Towing Inaugurates Container Barge Service

A new container barge feeder network for incoming and outgoing containerships that will link Philadelphia with Baltimore and Norfolk has been announced by **Roderick McAllister,** a vice president of McAllister Brothers towing and transportation company.

The McAllister Lighterage Line, Inc. service will make necessary only one port call when containerized cargoes arrive at Philadelphia but are bound for all three cities. The containers are unloaded, and McAllister barges them to their separate destinations.

Containers will also be picked up at all three cities and delivered to any of the ports for export shipment.

The new service will provide U.S.-flag and foreign-flag carriers with considerable savings in time and ship movement costs. For example, McAllister Lighterage will offer round-trip movement for containers between Norfolk and Philadelphia for $75 for a 20-foot container, and $81 for a 40-foot container. The new service will also make possible greater shipping flexibility by enabling a ship to service three ports with a single port call, either on a regular or nonscheduled basis, the company notes.

McAllister also maintains a container operation, Caribbean Sea-Road Service, Inc., for roll-on/roll-off cargo destined for San Juan and the Virgin and Leeward Islands. A complete feeder service is offered, including a wide variety of trailers available in an international interchange agreement with major worldwide ocean carriers.

TWO FOR STATE BOAT FROM HALTER: State Boat Corporation, Houston, Texas, has accepted from Halter Marine Fabricators of New Orleans, La., delivery of two 180-foot class combination rig tender/research vessels. The State Diamond (shown above), and the State Treasure, are classed by American Bureau of Shipping for Hull, Machinery & Equipment—Maltese Cross A-1E and AMS. They carry an International Loadline and were built with U.S. Coast Guard Inspection Certificates. Main engines are two Caterpillar D-398s driving stainless steel propellers through Caterpillar 3.95:1 reduction gears. Generators are two General Motors 671Ns driving Delco 220/115-volt AC units totaling 150 kw. Electronic equipment includes loran, radar, Fathometer, S.S.B. high-seas radiotelephone and autopilot. Spacious air-conditioned quarters comfortably accommodate crew and research personnel. A large walk-in refrigerator/freezer is convenient to the large, modern stainless steel galley. State Boat Corporation is an independent contractor providing, on a charter basis, seagoing offshore vessels of all types to major oil companies, drilling and pipeline contractors, diver and U.S. Government agencies, for operations worldwide.

Santa Fe To Spend $60 Million For Worldwide Drilling And Construction Equipment

Edfred L. Shannon Jr., president, Santa Fe International Corp., Orange, Calif., has announced that the company expects to file a registration statement with the Securities Exchange Commission covering the issuance of approximately $20 million worth of common stock.

Mr. **Shannon** said these funds and some additional straight debt financing will be used for continued expansion of the company's worldwide drilling and construction business.

Mr. **Shannon** said Santa Fe is currently committed to spending more than $60 million for new drilling and construction equipment, the highest level of capital expenditures in the company's history.

Ameron Corrosion Control Division Announces Formation Of Amercoat do Brasil

Lucien L. Miner, vice president, international operations, Ameron Corrosion Control Division, has announced the formation of Amercoat do Brasil Industria e Comercio Ltda. with offices and manufacturing facilities at Rua Aurora, 983, 6° Andar, Conj. 65/66, Sao Paulo, S.P., Brazil.

A wholly owned affiliate of Ameron, Inc., the company will manufacture a full line of protective coating systems and cements for Brazilian and other South American markets. Familiar trade names include Amercoat®, Dimetcote®, and Nukem®—all of which have been marketed for many years by Ameron and its affiliated companies in Mexico, the Netherlands, Japan and Canada, and a worldwide distributor organization. In addition, Amercoat do Brasil will handle the importation and distribution of Bondstrand® fiberglass reinforced pipe; T-Lock® and Nob-Lock® polyvinyl plastic sheetings for the protection of concrete sewer pipe and underground concrete structures.

General manager of Amercoat do Brasil is **John Richardson,** formerly vice president of Amercoat Japan, Ltd.

Single Anchor Leg Mooring Licensed To Swiss Firm By Esso Research & Engineering

Licensing of the Single Anchor Leg Mooring (SALM) to Single Buoy Moorings, Inc., has been announced by Esso Research and Engineering Company's Patents, Licenses and Technology Sales Division, Linden, N.J.

Single Buoy Moorings (SBM), Inc. will utilize Esso-developed technology and patents for the design, construction, and installation of single anchor leg moorings throughout the world to load and unload tankers. SBM, Inc., a division of IHC Holland, is a major designer and contractor of mooring systems with headquarters in Fribourg, Switzerland.

The first SALM was installed in 1969 by Esso Standard Libya, Inc. at Brega, Libya, to load tankers up to 300,000 deadweight tons in water 140 feet deep. A second SALM was installed at Nansei Sekiyu K.K.'s Okinawa Refinery in 1971 to unload tankers up to 250,000 deadweight tons. The two installations have demonstrated that the single anchor leg mooring is a safe, economical, and practical system to moor and load or unload oil tankers at offshore locations.

Extensive design, model testing, and analysis over the past five years by Esso Research and Engineering Company resulted in the development of the SALM system. Preliminary designs simulating tankers up to 500,000 deadweight tons in 20-foot-high seas were model tested. Research and development was conducted by the company's Marine Engineering Section, Florham Park, N.J., and by the affiliated Esso Standard Libya, Inc.

The SALM basically consists of a surface mooring buoy attached by a single anchor leg to a heavy base resting on the sea bottom. The anchor leg is attached to the base and buoy by universal joints and consists of anchor chain and an underwater swivel assembly which permits 360-degree rotation of the buoy and moored tanker.

Crude oil is transported to the base of the mooring in a submerged pipeline. It is piped through the base to a fluid swivel system surrounding a heavy shaft which carries the mooring load. The fluid swivel system is located below the tanker's keel and out of the active wave zone where chances of damage are minimized. Hoses attached to the fluid swivel system rise to the surface and extend to the tanker side where they are lifted and connected to piping onboard the tanker.

Safety is one of the principal advantages of the SALM system. The possibility of serious damage to either the buoy or the tanker as a result of a collision is minimized since the SALM is small and ruggedly built and its cargo and anchor swivels are submerged below the tanker's keel. Tankers can maneuver close to the SALM and drop anchor without fear of fouling the mooring because the SALM's single anchor chain is located directly beneath the mooring buoy. The SALM is also economical in deep water because of its relatively short single anchor leg.

For more information about Esso Research and Engineering Company's SALM system, write Esso Research and Engineering Company, Patents, Licenses and Technology Sales Division, P.O. Box 55, Linden, N.J. 07036.

$18.7-Million Expansion For Port Of Felixstowe

The 28th Freightliner Terminal to be completed in Britain's network of purpose-built road rail container terminals has been officially opened at the South East England Port of Felixstowe.

The opening of the £200,000 (approximately $470,000) terminal completes the first phase of an £8-million (about $18.7 million) expansion program planned for the port, which will include new roll-on/roll-off berths, additional docks for general cargo handling, development of oil and chemical storage and handling facilities, and a 700-foot extension to the present container dock.

The new terminal is less than 300 yards from the port's main deepsea container berths, which handle traffic for more than 50 percent of operators on the North Atlantic trade, as well as many European lines.

By 1975, Felixstowe, which handled 100,000 containers in the past 12 months, is expected to be handling twice its present annual tonnage of cargo and containers, bringing throughput up to five-million tons a year. Dock officials expect that Common Market entry will create an additonal one-million tons throughput.

Private interests and commercial companies are investing £12 million (about $28 million) in new warehousing and groupage facilities, code stores, guarded truck parking areas and a drivers' motel, bringing total investment in the port and associated enterprises to more than £30 million (approximately $70 million) since 1960.

Daily freightliner trains connect the port with Birmingham, Glasgow, London, Manchester and all other major industrial areas of the U.K., including Northern Ireland and Eire via the "landbridge" at Holyhead.

John Sansing Joins Mainstream Shipyards

John W. Sansing

B.E. Williamson, president of Mainstream Shipyards & Supply, Inc., Greenville, Miss., has announced that **John W. Sansing** has joined the organization as general manager of the shipyard division.

Mr. **Sansing** has been employed by Gulfport Shipbuilding Corp., Port Arthur, Texas, for the past eight years, and for the last three years was manager of marine repairs for Gulfport. Previous to his association with Gulfport, he was marine chemist with the Ingalls Shipyard in Pascagoula, Miss. for six years.

He is a native of Union, Miss., attended the University of Mississippi, and is a member of The Propeller Club, the Marine Chemist Association, and the American Industrial Hygiene Association.

In conjunction with Mr. **Sansing's** appointment, Mainstream Ship will start construction of a gas-free and waste disposal plant to serve the marine industry. This new facility will be located at Mile 534 AHP on the Lower Mississippi River, with facilities to clean, gas-free, and repair all types of tank barges. In addition, the company plans facilities for the discharge of liquid waste for holding tanks aboard marine equipment, the removal of pumps and pump engines midstream for repair and replacement on the northbound trip, delivery of all marine supplies midstream, with particular emphasis on General Motors engine parts and supplies. Delivery and transfer of equipment will be accomplished utilizing a new crane barge constructed for this purpose by Mainstream Ship. Construction of the new facility began last month, with operation scheduled for March 1973.

In addition to his duties as general manager, Mr. **Sansing,** in his capacity as a marine chemist, will issue all gas-free certificates for Mainstream Ship.

Star Shipyards Limited Delivers Second Of Three Offshore Supply Vessels

The offshore supply vessel Nordic VI pictured in Vancouver Harbour after commissioning.

The new offshore supply vessel Nordic VI, built by Star Shipyards Limited, New Westminster, British Columbia, Canada, for Nordic Offshore Services Ltd., was recently christened and commissioned in ceremonies held in Vancouver. An identical twin to the drilling-rig supply vessel Mary B VI, completed by Star in the spring, but without her special satellite navigation and positioning equipment, the Nordic VI is the second of three sister ships being built by Star to a design by naval architects Wm. R. Brown & Associates Ltd., Vancouver. The third vessel, also owned by Nordic Offshore Services Ltd., is scheduled for completion early in 1973.

The twin-screw Nordic VI measures 171 feet in length, with 38-foot molded breadth and 15-foot molded depth, and is of double chine configuration, longitudinally framed, with additional framing throughout and additional side traverses. The vessel is ice strengthened to the American Bureau of Shipping, Ice Class A, and has forward plating ¾ of an inch in thickness and 1-inch plating in the transom area where the 60-inch diameter stern roller is located.

The vessel complies with the Canadian Ministry of Transport's proposed Arctic pollution regulations and features double-shell and double-bottom construction, with all diesel oil being carried in inboard tanks. The ship has a drilling water capacity of 650 tons, a freshwater capacity of 100 tons and a fuel capacity of 338 tons.

The Nordic VI is a single deck vessel with a break amidships and has an extended forecastle with a steel deckhouse and an aluminum wheelhouse. Accommodation for 23 persons is located in the forecastle area. Protection for the double-drum towing and anchor winch is provided by the port and starboard side houses on the raised forward section of the main deck.

The large, clear, after main deck measures 90 feet long by 28 feet wide and has a deck cargo-carrying capacity of 600 tons. It is full-sheathed in wood and will be used to transport pipe, casing and general cargo. Two bulk storage tanks, one with a capacity of 1,000 cubic feet and the other 600 cubic feet, for the transportation of dry cement and drilling mud are located below deck, forward of the engine room, and are equipped with a Gardner-Denver cyclo blower for discharge purposes.

Principal Particulars

Length o.a.	171 ft. 0 in.
Length b.p.	161 ft. 0 in.
Breadth mld.	38 ft. 0 in.
Depth mld.	15 ft. 0 in.
Deadweight	945 tons
Gross tonnage	695.54
Net registered tonnage	378.63
Engines	Twin General Motors EMD 16-cylinder Type 567 diesel engines
B.H.P.	1,640 each @ 800 R.P.M. each
Propellers	3-bladed, stainless steel
Nozzle	Kort design
Auxiliaries	Two 150-kw generators driven by two diesel engines
Towing winch	Diesel powered double-drum
Steering gear	Hydraulic
Anchor windlass	Hydraulic
Bollard pull	42.5 tons
Classification:	A.B.S. + A-1(E) Foreign going vessel and home trade 1. A.B.S. Ice Class A

. The main propulsion machinery consists of twin 16-cylinder General Motors diesel engines, Type 567, each developing 1,640 bhp at 800 rpm. Each engine is flexibly coupled to a Lufkin 3:1 reduction gearbox and drives a three-bladed stainless steel propeller, 88 inches diameter x 94-inch pitch, in a Kort-design fixed nozzle. The vessel achieved a free-running speed on trials of 14 knots. The Nordic VI is also equipped with a 250-hp bow thruster, providing 4,500 pounds thrust. The engine room is of the "manned" type, although engine operation will normally be handled by the bridge controls.

Auxiliary power is supplied by a 365-hp Dorman diesel engine, Type 6 QTZ, and a 250-hp Ruston, Type 6 LDTCW, driving 150-kw generators. All other auxiliaries are driven off the 450 V 3-phase 60-cycle supply system. Pumps include 4-inch cargo discharge for diesel oil and drilling water, and a 3-inch pump for potable water. There are also fire, general service and bilge pumps.

The Nordic VI has a Swann hydraulic anchor windlass capable of handling two sets of anchors controlled from the bridge for speed and direction of rotation, and has Wagner hydraulic steering gear. The double-drum Swann winch used for towing and anchor handling has a stall rating of 300,000 pounds and carries 2,500 feet of 2-inch steel cable. A line load indicator on the bridge is operated by a hydraulic load cell in the braking system.

The modern wheelhouse affords excellent visibility and is equipped with Marconi SSB, VHF and FM radios, two Kelvin Hughes radar sets, Eckolite sounders and an Anschutz automatic gyro steering compass.

Lifesaving equipment consists of two 12-man lifeboats, two 20-man Beaufort inflatable life rafts and a 14-foot workboat with an outboard engine.

The Nordic VI left Vancouver for eastern Canada, where she will enter service as a supply vessel for oil drilling platforms off Canada's Eastern Seaboard.

$30-Million Deepwater Supertanker Terminal To Be Built In Bahamas

Burmah Oil Tankers and the Bahamas Industrial Co., the joint venture corporation, have signed a formal agreement for the establishment of a $30-million deepwater petroleum terminal for supertankers.

The terminal will be built on an industrial estate on the Island of Grand Bahama and will be 51 percent owned by the Bahamas Development Corp. and 49 percent by Seabulk International.

The terminal has been designed to accommodate tankers up to 350,000 tons bringing crude oil from the Middle East for transshipment. The initial capacity of the terminal will be 100-million barrels per year, with provision for expansion to 150-million barrels annually.

KNOWN 'ROUND THE WORLD

THE BOSTON METALS CO.

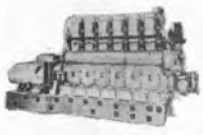
313 E. BALTIMORE ST. • BALTIMORE, MD. 21202

Main Office: (301) 539-1900 Marine Dept.: (301) 355-5050

DIESEL GENERATOR SETS

250 KW DIESEL GENERATOR SET

1



ENGINE: Enterprise 12 x 15 DSG-6—6 cyl.—450 RPM crank No. 50J. GENERATOR: Westinghouse 250 KW—120/240 DC—1040 amps—450 RPM. Typical serial No. 3S-10P-913. Complete with switch gear.

EMERGENCY GENERATOR SUPERIOR 75KW 120/240 VOLT D.C. DIESEL GENERATOR SET

2

With switchgear. ENGINE: Radiator cooled Superior GBD-8—6 cylinder—1200 RPM GENERATOR: Electric Machinery Co.—120/240 volts DC—316 amps—1200 RPM—stab. shunt.

UNUSED 10 KW SUPERIOR DIESEL GENERATOR SET

3

GENERATOR: Delco 10 KW — 120 VDC — 83.3 amps—1200 RPM. ENGINE: Superior diesel—2 cyl.—4½x5¾ — 15 HP — heat exchanger cooled.

500 KW— 120/240 VOLT DC DIESEL GENERATOR SET

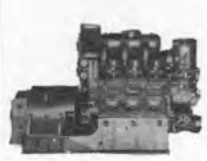
4

GENERATOR: Allis Chalmers—Compound wound. Has Class "A" insulation. Output 500 KW—120/240 volts DC—2080 amperes—720 RPM—drip-proof—self-cooling. Ambient 50°C—temperature rise 40°C. ENGINE: Model GM 8-278—2-cycle—Vee type—8½"x10½"—air starting—720 RPM. Complete with switchgear. Condition very good. Still aboard naval vessel.

TURBO GENERATOR SETS

300 KW DIESEL GENERATOR SET

5



ENGINE: G.M. 6-278—6-cylinder—2 cycle—8¾"x10½"—750 RPM—with oil and water Ross Shell and Tube Heat Exchangers, instrument panel, pyrometer, etc. Vibro Isolators. GENERATOR: G.E. 300 KW—120/240 volts DC—1250 amps—shunt wound—continuous overload rating 375 KW—2 hours—55° Weight of unit approximately 26,000 pounds. Complete with shock mounts. Unit 13' 2" long, 64" wide, 8' high.

UNUSED 300 KW—240 VOLT DC WESTINGHOUSE LOW-PRESSURE TURBO-GENERATOR SET

6

GENERATOR: 300 KW—240 VDC—1250 amps—1200 RPM. GEAR: 5286/1200—frame 6x15—serial 10A-2612-4. TURBINE: Frame C-325—225 PSI—397° TT—5286 RPM—Serial 10-A-2611-4. Wt. 16,700 lbs. —complete in original fatcory crate.

WESTINGHOUSE 440/3/60 200 KW UNIT

7

GENERATOR: Westinghouse 200 KW—250 KVA—450/3/60—1200 RPM—80% PF—with 40 KW—120 VDC on same shaft. GEAR: 9989/1200 RPM—double helical. TURBINE: Westinghouse—540 PSI—superheat 322°F. Test 930 PSI 800°TT. Also operates 615 PSI—850°TT.

6 EQUAL-TO-NEW LATE TYPE 500 KW SHIPS SERVICE TURBO GENERATORS

8

1962—DeLaval. Very little use. Completely preserved with rotors and diaphragms crated separately. TURBINE: DeLaval —585 PSI — 840°TT—6-stage—6391 RPM—class CD — Also suitable 440 lbs.—740°TT—25" vac. GEAR: 6391/1200 RPM. GENERATOR: Allis-Chalmers—450/3/60. Totally enclosed, with static exciter and voltage regulator system. Weight 17,665 lbs. Complete with latest dead front switch gear. Also available are the condensers, circulating and condenser pumps. All very up-to-date, compact construction. Turbines will easily handle 600 KW if up-grading is desired.

UNUSED 300 KW—120/240 VOLT DC G.E. TURBO-GENERATOR SET

9

GENERATOR: 300 KW—120/240 VDC—1250 amps—1200 RPM. REDUCTION GEAR: 8.344:1 — 10012/1200 RPM—type S-182. TURBINE: DOR418N—449 H.P.—10012 RPM—working pressure 180/220 PSIG.

1250 KW G.E. 10-STAGE TURBO GENERATOR SET

10

TURBINE: 525—615 PSI—850°TT—7938 RPM—10-stage—type FSN. GEAR: Single helix—7938/1200. GENERATOR: 1250 KW—450/3/60/3600—.80 PF—type ATB with surface air cooler. Overload 25% —2 hours—1563 KW.

AP2 VICTORY WORTHINGTON-MOORE CROCKER-WHEELER 300 KW UNIT

11

TURBINE: 440 PSI—740°TT—28½" vacuum—type S4 — 5-stage — 6097 RPM — serial 7547 & 7548. GEAR: 6097/1200. GENERATOR: 300 KW—120/240 volts DC—1250 amps—compound wound—973643—999759. Armature flange 8½"; B.C. 7"—12 holes. ALSO NEW ARMATURES IN STOCK & 300 KW SHUNT ARMATURES.

VICTORY 300 KW WESTINGHOUSE TURBO GENERATOR SET

12

440# — 740°F — 5930 RPM — 2A-9794-15-16-17 — coupling non-recessed on steam end of pinion—5¾". GENERATOR: Westinghouse 300 KW—120/240 DC—1250 amps—1200 RPM—C.B. 208.4.

UNUSED

CROCKER-WHEELER

500 KW

GENERATOR ENDS ONLY

120/240 VOLTS D.C.—1200 R.P.M.

FORMERLY USED WITH WORTHINGTON-MOORE TURBINES & GEARS

13

Upgraded by U.S. Navy—rewound in glass. Generator Frame and Armature—Marine 500 KW type 3-1200 — dripproof enclosure — base mount. Modified from Crocker-Wheeler generator frame 152HD — 240/120 volts DC — 2083/521 amps — 1200 RPM. Ambient temperature 50°C. APPLICATION: For C-4-SA1;C-4-SA-3;T-AP-134 vessels, using Worthington-Moore Turbine—Form S-6 and generator Form 14 x 10.

TURBINES & ROTORS

MAIN PROPULSION

14

19 STAGE WESTINGHOUSE H.P. ROTOR FOR AP2 VICTORY

Reconditioned — balanced—with ABS. Serial 4A-2079—type B — 19 stage reaction blades. Excellent — just out of shop. 13" Flange diameter with 14 bolts.

SPECIAL !

1 WESTINGHOUSE COMPLETE T-2 MAIN TURBINE

15

PROFILE (UNSHROUDED)

6600 HP—435 PSI—750°F

28" VAC.—3720 RPM

Instruction Book 6893—Serial #2A-9361-21. The turbine rotor blades, stationary blading, diaphragms and nozzles are all in unusually good condition.

IMMEDIATE DELIVERY—WITH ABS

8500 H.P. G.E. TURBINE

16

G.E. Instruction book GEI16263—from ex-Navy Victory. L.P. — 8-stage — 3509 RPM — 77943 H.P.—8-stage—6159 RPM—77942.

WILL INTERCHANGE WITH INGALLS C3 HULL—442 CLASS AND SUN-BUILT C4 VESSELS

NEW L.P. BLADE RINGS

17

for large 8500 H.P. Victory

Joshua Hendy Westinghouse

NEW 8500 H.P. G.E. TURBINES

Large Victory or Ingalls C3

18

L.P.—8-stage—3509 RPM—#72271
H.P.—8-stage—6159 RPM—#72272

ALSO AVAILABLE

U.S.M.C. RECONDITIONED SET

H.P. & L.P.

L.P.—8-stage—#77987—3509 RPM
H.P.—8-stage—#77994—6159 RPM
Interchange Ingalls C3

19

T2-SE-A1 MAIN PROPULSION ROTOR — G.E.

Large Schenectady — serial 77418—reconditioned Bethlehem Steel 1970—all stages magnafluxed.

2 COMPLETE G.E. TURBINES

20

#61818 and #61834—large Lynn—all stages magnafluxed.

WILL INTERCHANGE WITH ELLIOTT MAIN TURBINE

21

8500 H.P. G.E. — C-3 OR VICTORY

H.P.—8-stage—6159 RPM—serial 62043
L.P.—8-stage—3509 RPM—serial 62042
G.E.I. 16263

22

6000 H.P. G.E. — NORTH CAROLINA C-2

H.P.—8-stage—serial 78040
L.P.—7-stage—serial 78043
G.E.I. 16262

23 **VICTORY SHIP AP2 H.P. & L.P. TURBINES**
NEW — UNUSED — 6000 HP SETS
G.E.—H.P. & L.P.—with throttle valve
Westinghouse—L.P.—with throttle valve
Allis-Chalmers—H.P. & L.P.—with throttle valve

AUX. GEN. ROTORS AND ARMATURES

24 **250 KW & 300 KW ALLIS-CHALMERS ROTORS**

Typical serial No. 3067—will Interchange with most 250 KW & 300 KW Allis-Chalmers as Installed on Victory's and Moore C2-C3 vessels.

25 **300. KW 5965 RPM JOSHUA HENDY**

Turbine—3H-69	Gear—52269
Turbine—3H-52	Gear—52252
Turbine—3H-62	Gear—52262

AUX TURBINE ROTORS AND ARMATURES

UNUSED—4 UNITS AVAILABLE
26 **T2 AUX. T2 TURBO GEN. ROTORS**

DORV — 325M — 5645 RPM—for 525 KW G.E.

27 **ARMATURE**
Allis-Chalmers 300 KW armature — 120/240 volts DC—type MCW-213 (#138511-13819) generators).

28

G.E. 8500 H.P. REDUCTION GEAR FOR LARGE AP3 VICTORY & C3
MD-48A—8500 HP—6159/3509/763/85 RPM.

29 **ALSO 6000 H.P. VICTORY AP2 REDUCTION GEAR**
Westinghouse 4A-1640.

PUMPS

30

WORTHINGTON 16"x14"x18" VERTICAL DUPLEX STRIPPING PUMP
1400 GPM @ 110 PSI—suction lift 11.5 ft.—steam back pressure 15 lbs. 14" Suction — 10" Discharge — 2½" Steam — 4" Exhaust. Overall width 6'8"—Overall height 9'11½"—depth 3'9½"—wt. approx. 10,000 lbs.

31

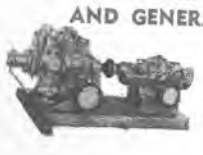
NEW BLACKMER FUEL OIL TRANSFER PUMP
Rotary—50 GPM—50 lbs.—2"—5 HP—440/3/60—with starter & spares.

32

UNUSED BLACKMER VERTICAL ROTARY PUMP
4"—100 GPM—100 PSI—15 HP — 440/3/60 — gear head.

UNUSED AURORA PUMP
33 300 GPM—37' head—5 HP—120 volts DC Centrifugal Pump. Bronze—size 5x4—flanged. MOTOR: Reliance—super T.D.C. Electric Motor—5 HP—120 VDC—36.8 amps—1750 RPM—Frame L216A—with control by Cutler-Hammer. Excellent condition. Latest USN surplus.

NEW TURBINE DRIVEN FIRE AND GENERAL SERVICE PUMP
34



Allis-Chalmers 6x5 pump, type SKH—1200 GPM—125 PSI—3500 RPM. Coppos turbine type TF-22-2½ — 3500 RPM. 273#—50° superheat.

NAVAL VESSEL SECTION
FOR FLETCHER CLASS DESTROYERS

35

UNUSED DELAVAL 24.5 H.P. LUBE OIL PUMP
Turbine-driven main lubricating oil pumps — vertical rotary with horizontal worm geared turbine drive. 575# Steam pressure—5000 RPM—15# back pressure. GEAR: 5000/1035 RPM. PUMP: 550 GPM at 50 PSI—suction lift 10.0". Suitable for Fletcher Class Destroyer.

36

UNUSED SIZE 4 BUFFALO FEED PUMPS
Terry Turbine—BM—273 HP—550 RPM—exhaust 15 lbs—590 PSI—superheat 0°—425 GPM Buffalo Pump—discharge pressure 750 lbs—5" x 4"—built for USN DD destroyers.

37

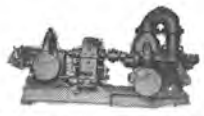
UNUSED STEERING GEAR FOR ALL TYPES OF DIESEL & STEAM DESTROYER ESCORTS
Mfg by Hyde Windlass Co. Two 10 HP 440/3/60 1750 RPM gear motors driving 1500 PSI hydraulic pumps. TORQUE: 1,005,000 lbs.—7½" diameter plungers—two power units with hand gear attachments—replenishing tank—6-way valve—differential control, etc.

ENGINE ROOM COMPONENTS
SUITABLE FOR BETHLEHEM SPARROWS POINT HULLS SERIES 4400/4500

COMPLETE TURBINE OR ROTORS ONLY
38 For Sparrows Point Hull 4518 — 29,000 GTDW — 13,600 HP @ 109 RPM; 15,000 HP @ 112 RPM—585 lb. 840°TT—28½" vacuum **H.P. TURBINE**—4688 RPM—Mfg Bethlehem—1630-H-9—**L.P. TURBINE** 2625 RPM—Mfg Bethlehem—#1630-L-9.

WESTINGHOUSE 400 K.W. SHIPS SERVICE GENERATORS
39 400 KW (500 KVA)—80% PF—1200 RPM—450/3/60. TURBINE: 585 lbs—840°TT—28½" vacuum—9018 RPM—serial 10A4462-3 & 10A4462-4. GEAR: 9018/1200 RPM. A.C. GENERATOR: 500 KVA—400 KW—450 volts—641 amps—80%PF—3 phase 60 cycle—1200 RPM—CR 40°—excitation amps 41—excitation voltage 120. Instruction book 5442. Switchgear available.

40



2 TURBINE DRIVEN CARGO PUMPS
WESTINGHOUSE C-25 TURBINE—Ingersoll-Rand 10GT pumps—500 HP—single-stage impulse turbine—455 lbs—590°TT—4 PSI exhaust pressure—frame C-25—Westinghouse 4540 RPM. Rotation CC when viewed from governor end. GEAR: 4540/1750 RPM: 4500 GPM at 125 PSI head—type 10 GTM—bronze 2-stage—14" suction—12" discharge.

COFFIN CG-4A FEED PUMPS
41 Max. 325 GPM—1760' head or 750 lbs. Steam inlet 575 lbs.—540°TT—exhaust 20 lbs.—speed 760 RPM.

FIRE & BUTTERWORTH PUMPS
42 Warren Pump—450 gallons Per Minute—449 ft—71 HP—type 3-TL-2. TURBINE: 71 HP—545 PSI—540°TT—15 lbs G exhaust—3500 RPM.

SHARPLESS LUBE OIL PURIFIERS
43 350 GPM—75 ft discharge head—20 ft suction lift—type AE 15 V. 1½ HP—440/3/60—3450 RPM—40°C temperature rise.

44 **ANCHOR WINDLASS**
Hyde 2-11/16" — 12x14 — 100 PSI — steam — 54,100 lbs.

45 **INQUIRE FOR ALL OTHER ITEMS**
Forced draft blowers, reduction gear parts, bilge and ballast pumps, main circulators, general service pumps, F.O. transfer pumps, lube oil service, standby feed pumps, condensate pumps, aux. circulating pumps, feed water heaters, wash water pumps, etc.

46

ALLIS-CHALMERS WINCH CONTROL PANEL
50 HP—230 VDC. Consists of motor control, magnetic breakers and resistor bank.

MISCELLANEOUS

47

3-TON SLYDE DOUBLE DRUM WINCH
3-ton double drum winch—10 HP—115 VDC—declutchable drums—with controls.

48

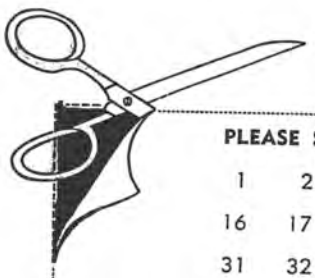
UNUSED 1135 SQ. FT. C.H. WHEELER CONDENSER
20" Ex. inlet—⅝" Cu-Ni tubes—with or without air ejector.

UNUSED 70 HP McKIERNAN-TERRY WINDLASSES
49 2¾" Chain and two 10640 lb anchor & 30 fathoms chain @ 30 FPM. 70 HP—230 volts—shunt DC motors—233 amps—550 RPM—55°C rise. Wildcat centers 47½". Base 9'5" wide x 11' long. Weight 36,000 lbs.

NEW—UNUSED LINK BELT WINDLASS
50 1⅝" and 7000 lb. anchors. 56" Centers—50 HP—230 VDC—spares.

IDEAL WINDLASS—UNUSED
51 1-5/16" Chain—36" Centers—15 HP—115 VDC—1750 RPM—6000 lb. line pull.

DOUBLE INPUT—SINGLE OUTPUT DIESEL REDUCTION GEARS
52 Farrell-Birmingham — 3200 SHP. Reduction gear: 1.81:1—handles two 1600 HP diesels @ 720 RPM. With hydraulic couplings & Fawick clutch. Port and starboard. Gear output 400 RPM. Suitable for Dredge Pumps.



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46	47	48	49	50	51	52								

NAME..... COMPANY.....

ADDRESS..... POSITION..... PHONE.....

CITY..... ZONE..... STATE.....

Marconi Marine Names David Bowker As North American Rep.

The Marconi International Marine Co. Ltd., a GEC-Marconi Electronics company, has announced the appointment of **David Bowker** as its representative in North America. He succeeds **John Older,** who has returned to the United Kingdom on leave prior to taking up another appointment with the company.

Mr. **Bowker** is no newcomer to the United States, having served as Marconi Marine's representative there from 1967 to 1971. He recently returned to the United Kingdom from Oslo, where he held the position of marine director of the Norsk Marconikompani.

Mr. **Bowker,** who was born in Milford Haven, where his father was well known as the manager of Marconi Marine's local depot until his retirement in 1968, was educated at Milford Haven Grammar School and began his career with Marconi Marine as a seagoing radio officer in 1960. He served at sea until 1964, when he transferred to the company's shore staff as a technical sales assistant in the export sales division. He later became assistant to the export sales manager until his North American appointment in 1969.

Mr. **Bowker** will be based in the offices of Kaar Electronics Corporation, Rahway, N.J.

Herbert To Present Sterngear Design Paper To N.Y. Port Engineers

Colin W. Herbert

The Society of Marine Port Engineers New York announces that on January 17, 1973, at the Downtown Athletic Club, **Colin W. Herbert** will deliver a paper entitled "Sterngear Design for Maximum Reliability — The Glacier-Herbert System."

Mr. **Herbert** received his early education at the Constantine College of Technology where he was awarded the Higher National Diploma in Mechanical Engineering in 1944, serving his apprenticeship at Smith's Dock Co., Ltd. in London. For two years, he was employed in the engineering department of A/B Gotaverken in Sweden, returning to Smith's Dock Co., Ltd. where he was engaged as chief estimator and eventually became engineering manager.

Mr. **Herbert** has presented a paper to the Institute of Marine Engineers on "The Application of Free Piston Gas Turbine Machinery," and within the past year delivered before the Institute the same paper scheduled for January 17 at the Downtown Athletic Club.

Presently, Mr. **Herbert** is employed as a consultant and adviser to the Glacier Metal Co., Ltd. in the continuing development of the Glacier-Herbert Sterngear System.

He is a fellow of the Institute of Mechanical Engineers, and a member of the Institute of Marine Engineers.

Mr. **Herbert** will be in New York for several days following the meeting of the Society of Marine Port Engineers and will be available at the offices of E.L. Post & Co., Inc., 233 Broadway, New York City, for any further technical discussion of sterngear bearing problems.

Largest U.K.-Built Tanker Delivered To Onassis Group

Belfast shipbuilders Harland and Wolff have completed the 268,890-ton tanker Olympic Banner, and the vessel has been handed over to her owners, Carlow Maritime Panama S.A., following successful completion of sea trials.

The Olympic Banner is the first of two ships ordered from Harland and Wolff by member companies of the Onassis Group. The second vessel of similar size is at present under construction for Lakeport Navigation Company, Panama.

The Delaware Bay Terminal —An Environmental Plus!

Capt. Robert I. Price, USCG*

The lower Delaware Bay is quite possibly the most desirable location on the East Coast of the U.S. for development of a deepwater terminal. From such a terminal oil could be readily delivered by pipeline to the complex of seven major oil refineries along the Delaware south of Philadelphia, for convenient distribution to the belt of fuel-hungry industries stretched from New York to Baltimore. Taking advantage of natural canyons which extend into the bay from offshore, it is feasible, according to the Army Corps of Engineers, to create a channel for the entry of deep-draft bulk cargoships to a terminal located inside the bay on the Delaware side.

Aside from the economies involved, which are considerable, a properly designed and controlled terminal at the entrance to the channel is fully justified on the grounds of ship and environmental safety. Without a terminal, there is only the prospect of an enormous extension of the present methods of delivering oil to the Delaware River refineries. The consequence of refusing the terminal is intensified marine traffic with increased likelihood of casualties and spillage of oil.

The Delaware River ship channel has a project depth of 40 feet at mean low water. This channel was dredged in World War II when a deep-draft ship was one drawing 30 feet. The channel is 800 feet wide in the narrowest reaches and 1,600 feet in the broadest reach. It is subject to silting and its depth is under continual survey by the Corps of Engineers. The project depth of 40 feet has not actually been fully attained. There is a rock pinnacle at one side of the channel at Marcus Hook which must be avoided. The depth at that point is 35.8 feet. The channel also has several anchorages along its length—sidings into which ships can be diverted in the event of delays in the channel or lack of pier berths. However, only two of these anchorages have been dredged to the project depth of 40 feet and then, not over their entire area. Although these anchorage projects had Congressional approval 10 years ago, they have yet to gain the priority required for appropriation and action.

Tankers with saltwater drafts of up to 54.8 feet now enter Delaware Bay and anchor. If necessary to reduce draft to transit the Delaware River channel, they transfer some of their oil cargo into a fleet of barges in the open roadstead of the bay. Several barge loads may be required to reduce a tanker's draft sufficiently for the river run. To change the saltwater draft in one of these tankers one inch can require removing about 200 tons of oil. This lightering represents added operating expense of itself and in delaying movement of the tanker. Each lightering event entails a risk of spillage, while coupling, during cargo pumping and while uncoupling barge from tanker. The tanker must then negotiate the river to the refinery to discharge the remainder of the cargo. In order to do this safely, knowledge of the timing and range of the tide is vital. The tidal range in the Delaware River from mean low water to mean high water is about six feet. The tidal differential can be greater or less and can be delayed or advanced depending upon the force of the wind and its direction, amount of rainfall, and the phasing of sun and moon. The effect of these variables must be anticipated by the pilots of the Delaware River and Bay, to whose competence a commendable safety record can be ascribed.

Ships with drafts close to the 40-foot channel depth lie at anchorage in Delaware Bay awaiting the rise of the tide, then transit the channel "on the tide," taking advantage of the increased depth. The movement occasionally involves close timing to put a ship at the refinery terminal so that the cargo can be discharged ashore, lightening the ship before the fall of tide. Ships entering on the same tide come upriver relatively close together; it is 12 hours till the next favorable tide. If blockage of the channel were to occur when a number of vessels had started upriver on the same tide, the lack of full depth in the anchorages could very well prove a significant deficiency.

If deeper draft ships attempt to navigate the Delaware, there are many problems that they encounter. These nautical facts reveal the finely balanced state of present operations of large ships in the Delaware:

—Reducing draft simultaneously increases freeboard, exposing more structure to the force of the wind and making a tanker less controllable.

—If the ship does not maintain good speed, the tide could begin to recede before reaching the refinery, but there may be a limiting condition. Higher speed in a channel, say—to make up for a late start—leads to a hydrodynamic phenomenon called "squat," which can cause a ship to run deeper and perhaps to strike bottom.

—The channel has several pronounced bends. A ship does not "corner" like an automobile but slides rather like a skier. Longer, larger ships obviously will have difficulty staying in the channel.

—If the course is held close to the side of the channel, a ship can become difficult to steer. Passing close to another ship can also cause problems of ship control.

—The river current averages 1.8 knots ordinarily. In adverse weather conditions, currents may attain 3.7 knots.

—In obedience to Archimedes's law, ships increase in draft as they go into freshwater—gaining one foot per 35 feet of the saltwater draft. The freshwater transition point in the Delaware is near Marcus Hook, 80 miles from the ocean, in the center of the refinery complex.

If these problems exist, why not simply dredge the channel deeper? Why! —because it is impractical to do so. In a recent address before the Port of Philadelphia Maritime Society, Maj. Gen. **R.H. Groves,** U.S. Army, Division Engineer, Corps of Engineers, stated: "Deepening this channel to 45 feet would involve the removal of 190 million cubic yards of material at an estimated cost of $300 million. If we were to take it to 50 feet, we would have to remove some 330 million cubic yards at a cost greater than ¾ of a billion dollars. Of course, we would have to find suitable disposal areas for all this material and, as many of you know, we are fast running out of places where we can put the relatively small amounts of material we are presently excavating to maintain this channel at 40 feet."

Not only is the cost prohibitive, there is the effect upon the natural water table to consider. Deepening the channel will move the salt/freshwater interface upriver and inland, to the detriment of the aquifers supplying the agricultural economy of southern New Jersey.

Presently, most oil reaching U.S. East Coast ports by sea comes from either Texas, Louisiana or Venezuela. However, there are well-documented predictions of a deficiency of oil to satisfy the steadily increasing energy demand in the U.S. in the next 10 to 15 years. National Petroleum Council (NPC) projections show oil demand rising by about 4 percent annually. Foreign oil will be imported to cover these demands. In 1970, foreign oil was 23 percent of domestic demand. Projections by NPC indicate oil imports rising to 39 percent of demand in 1975, 47 percent in 1980, and 57 percent in 1985. This will equal 25 percent of total U.S. energy use and much of it will come from the Middle East.

This oil will be delivered by tankers of much greater size than heretofore seen in U.S. ports,

(Continued on page 31)

*Capt. **Robert I. Price,** U.S. Coast Guard, is Captain of the Port, Philadelphia. The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Commandant or the Coast Guard at large.

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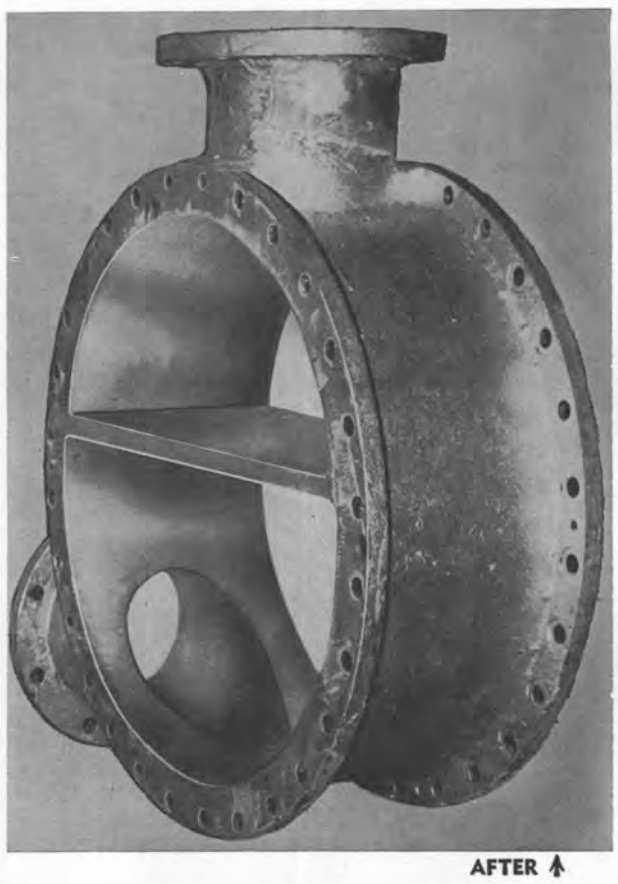

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Delaware Bay Terminal—

(Continued from page 29)

as it is far less economical to run small vessels over so long a voyage. It takes nearly the same crew to man a large as a small tanker. The approximate dimensions of tankers of various cargo capacities follow:

Deadweight Tons (DWT)	Length (Ft)	Beam (Ft)	Draft (Ft)
16,000	503	68	30 (T-2)
80,735	818	125	43
124,379	870	138	52
249,360	1,085	170	65 (VLCC)

The T-2 listed above was a deep-draft ship when the Delaware River channel was prepared. By the end of 1971, there were 162 oil tankers of 200,000 dwt or upward and many on order. Generally speaking, smaller ships are older and less reliable. They will also become fewer, retiring for age and inefficiency as the construction effort continues toward larger vessels.

According to the Philadelphia Maritime Exchange, 2,157 oil tankers delivered oil to the Delaware River refineries in 1971. About 22 tankers per month lightered in Delaware Bay, requiring up to four barging operations each. None of these tankers could be considered "deep-draft" ships today.

If the size of delivering tankers were to remain unchanged, with oil demand rising, the number of arriving vessels could triple by 1985. It is almost inconceivable that present operating methods previously described could be safely expanded to accommodate this number. If traffic in ships and barges with their associated transfer operations increase in this proportion, one can foresee groundings, collisions, and spills from Delaware Bay to Philadelphia.

A deepwater terminal, permitting delivery of oil in greater quantity per tanker using these Very Large Cargo Carriers (VLCC), would sharply reduce tankers in Delaware Bay to perhaps three per day. There would be no rise in lightering nor river traffic—all discharge occurring into the terminal end of a pipeline.

Though it seems obvious that a deepwater terminal is essential for the best interest of the Delaware Valley area, there is much opposition to the idea. The deepwater terminal has been vehemently opposed by the citizenry of the lower Delaware Bay area, and the state of Delaware has enacted interim legislation prohibiting industrial use of the Delaware side of the bay. However, a special study group has been set up by Governor **Peterson** to consider the matter further.

The environmentalists in opposition hold that the problem should be solved in other ways. For example, at some time in the future, man must find other and less polluting sources of energy to supplant the oil he is using at an accelerating rate. Since oil reserves are not unlimited, more efficient use should be made of the oil available. Environmentalists see alleviating the problems in satisfying oil demands as postponing the need to dedicate serious efforts to solar energy or to harnessing the tides or the winds. (Nuclear power does not turn the environmentalist on.)

The environmentalists may very well be right, but even if the effort began today, there is a great time lapse before the desired new energy sources could reach practical utility. Meanwhile, the American public shows no sign of giving up the automobile, the air-conditioner or any of the hundreds of appliances that are now totally accepted. Oil will likely remain a prime source of energy throughout the rest of the century.

Another objection raised is that the quantity involved in a single large ship is a hazard. Aside from reducing the exposure of the same quantity delivered in smaller lots, there is some validity to that criticism. However, it is not generally known that to offset such risk, an international agreement was reached two years ago compelling limitations on the size and arrangement of individual tanks in supertankers to limit, assuming severe damage from collision or stranding, the amount of oil that might be released.

There are also those who would have the deepwater terminal located elsewhere. The New Jersey side of the Delaware Bay has been mentioned as an alternative site, but is actually rather shallow and tremendously more dredging would be required. Only a few other locations on the East Coast are practical for preparation of an adequate channel. Some of these other locations also involve extensive transshipment of the product from terminal to point of industrial use, with attendant expense and increased environmental risk.

An arrangement proposed lately is to locate the terminal offshore in the open ocean. The writer is of the view that this is prompted by desperation. It is perhaps possible to accomplish such a project if enough money and time are expended. However, the physical forces to be faced there are tremendous and man's knowledge of the sea and seabed imperfect.

One scheme which is receiving considerable attention calls for the creation of an artificial island eight miles out in the ocean "behind" a 12,000-foot breakwater. Aptly dubbed the "Way Out Port" (Newsweek, July 31, 1972), the cost seems underestimated at one billion dollars. Assuming some rudimentary proportions for this breakwater, say 120 feet high with sides sloping at 45 degrees, the magnitude of this undertaking can be discerned. It is comparable to moving the Great Pyramid of Cheops twice—approximately two billion cubic feet of material, provided that each load is so precisely positioned before dumping that there is no wasted effort. The artificial island is an equally substantial structure with storage tank areas, berths for small tankers, pipelines underwater, and a "permanent" deepwater pier.

How the seas would deal with such a man-made obstruction is not given to precise determination, although computer technology and model testing may offer insight. Silting might occur at an accelerated rate requiring continual dredging to maintain the depth, or the "harbor" might be subject to heavy wave action in some sea states. Against the uncertainty, certain assumptions would have to be made that hopefully would never be exceeded, and the engineering predicated upon that estimate.

Not only is the first cost likely to be exorbitant, but the operating expense as well. Operations offshore in this location would be hazardous for the personnel employed there and for the ships and aircraft required to support them, as the wage level would reflect. There would be a built-in collection of problems due to the inaccessible location. To name a few: accommodations; personnel to clean accommodations; food storage, preparation and service; replenishment and transfer during heavy weather and periods of low visibility; maintenance personnel in residence; components to endure continued exposure to the corrosive salt atmosphere. These problems, involving a 24-hour watch on isolated duty, would be virtually eliminated in a location permitting personnel to drive to and from work daily, maintenance crew to be available on call, and provisions to be delivered to the galley door.

The site mentioned would restrict other shipping entering and departing the Delaware, increasing the chance of collision.

A terminal is essential to the future of the nation and of the Delaware Valley area, but to put it offshore is to invite a host of undesirable conditions that ought to be avoided. Those who regard an offshore location as an environmental benefit or a financially practical choice should be compelled to spend next January on a North Atlantic weather station to develop a little respect for the energy of the sea.

Some local opposition can perhaps be ascribed to an indiscriminate use of terms. What is most required is a "terminal" or "reception facility," not a deepwater "port," as it is often called. "Port" conveys the idea of a maritime/industrial complex drawing seamen of all nations. The resort towns along the shore certainly do not relish such a prospect. The supporters of the "terminal" might do well to avoid "port" and clarify the true scale of the required activity—essentially a funnel into which oil cargoes will be delivered.

The opposition should realize that a deepwater terminal in the Delaware Bay could be readily designed to enclose the entire vessel during the transfer of cargo ashore. Any spillage would be confined to the terminal basin, which could be fitted with skimming devices or other means of precluding any release of oil to the waters of the bay.

The number of deep draft arrivals would be few enough to permit compelling other vessel traffic to stand well clear while the giants make their entrance. A modern harbor control facility to insure these ships stay in the deep channel or to deny them entrance during periods of adverse weather or limited visibility would be part of the operation.

To have some insight to the risks involved, opponents of the deepwater terminal should examine the Bantry Bay terminal, on the west coast of Ireland, made practical by the natural depths in that location. The Gulf Oil Company has, over the past three of four years, successfully moved some 300 million barrels of oil in ships of 326,000 dwt in and out of Bantry Bay, without incident.

Summing up. The system under which way the oil is being delivered now in the Delaware is the consequence of constraints imposed by a channel insufficient to today's ships and which cannot realistically be deepened. If that system must continue, with rising demands for oil, the chances for error are certain to increase. The only real prospect of relieving the situation is a deepwater terminal, and the most plausible location is inside the bay.

It would therefore be tragic if a well-meant but misguided attempt to protect the natural state of the Delaware Bay should, by opposing the deepwater project, actually increase the likelihood of pollution casualties. It would be folly to reach the wrong answer for the right reasons.

The citizens of Delaware and New Jersey should, instead of opposing, support the concept. However, approval should only be given when the particulars have been fully developed covering the safe movement of vessels and the transfer of their cargoes, minimizing the pollution risk. Overall, a modern deepwater terminal in the protected waters of Delaware Bay offers the most effective means of having the oil and of improving the environment of the Delaware Valley.

Shell International LPG Ship Insulation Approved By Lloyd's

Lloyd's Register of Shipping has approved an insulation system and cargo barrier for LPG ships proposed by Shell International Marine.

The system is based on the use of foamed polyurethane sprayed on the interior surface of the inner hull of a double-hulled ship. The foam thus acts as both the primary barrier and the insulation of the LPG cargo.

The secondary barrier will be the inner hull itself, and it is proposed to construct this of Lloyd's Grade E quality steel. This is a fine grain notch tough structural steel which can be used in this application for cargo temperatures down to —50° C. It is claimed that this design could reduce the cost of an LPG ship considerably.

Surveyors of Lloyd's Register collaborated with Shell International Marine Ltd. during a comprehensive test program. The program was designed to prove the performance of the foam under normal operating conditions.

Following successful laboratory tests and tests on a model tank, the system was then tested in two 100-ton capacity LPG tanks fitted in the No. 1 center cargo hold of the S/S Aulica, an 18,000-ton general products tanker.

The results of the tests have shown that the system is suitable for the carriage of LPG at a minimum temperature of —50° C.

Huron Cement Div. Appoints J.L. Greer

Jed L. Greer

The Huron Cement Division of National Gypsum Company has announced the appointment of **Jed L. Greer** to the newly created position of director of distribution carrying the overall responsibility for the operations of the vessel and distribution plant departments. At present, the Huron fleet is made up of six active cement carrying vessels, and the distribution plants are located in 14 different major marketing areas around the Great Lakes.

Mr. **Greer** is a graduate of the University of Missouri and has been employed by Huron in various responsible capacities during the last nine years. His most recent assignment was superintendent of plants.

E. Canadian SNAME Hears Paper On Doppler Sonar Products

Guest speaker **William Otis** (right) of Sperry Marine Systems Division, Sperry Rand Corporation, is shown with **R.C. Truax,** chairman of the Eastern Canadian Section.

The Eastern Canadian Section of The Society of Naval Architects and Marine Engineers held its second meeting of the current season in Quebec City, following the precedent established last season.

The guest was **William Otis** of Sperry Marine Systems Division, Sperry Rand Corporation, Charlottesville, Va., who read the paper titled "Doppler Sonar Products for the Marine Industry." The paper was prepared by **Morton Howard** of the same company, who was unable to attend due to previous commitments.

The paper highlighted the recently introduced new products, using the doppler principle, and their application to the marine industry. The presentation was followed by a discussion from the floor, ably handled by Mr. **Otis.**

United States Lines Names Weigele, Carey And Gundling

Raymond J. Weigele

James J. Carey II

Kenneth W. Gundling

Edward J. Heine Jr., president of United States Lines, has announced the appointments of **Raymond J. Weigele** as vice president of terminal operations, **James J. Carey II** as vice president of European operations, and **Kenneth W. Gundling** as vice president of marine operations for the containership company.

Mr. **Weigele,** who joined United States Lines in 1947, had previously served as vice president for marine operations, a post he was named to in 1969. In his newly created position, he will supervise the activities of the company's terminals throughout the world.

He began his career with United States Lines as an administrator in the operating department. Later he was named to assistant to the general manager for operations at Chelsea Piers, and in 1958, he was named assistant manager for terminal operations.

Mr. **Weigele** is a graduate of Fordham University. He served with the United States Navy in the Pacific during World War II and received four battle stars and the Presidential Unit Citation for service aboard a fleet minesweeper.

He belongs to The Society of Naval Architects and Marine Engineers and holds membership in Maritime Associates.

Mr. **Carey** joined United States Lines in September of 1971 as general manager of operations in Europe.

He previously was a vice president with Seatrain Lines. Prior to that, he held executive positions with Sea-Land Services, such as manager of the Oakland Terminal and later operations manager for the Alaskan Division.

Mr. **Carey** is a graduate of San Francisco State College. He is also a veteran of the United States Air Force. He now lives in London with his family.

Mr. **Gundling,** most recently the company's general manager for marine and terminal operations, joined United States Lines in 1945. He served in various administrative positions before being elevated to the position of assistant to the general manager of operations in 1952.

He is a graduate of the Traffic Managers Institute of New York City.

He is a veteran of the United States Coast Guard and received the Navy Unit Commendation for participating in eight first landings in the South Pacific during World War II.

United States Lines operates a fully containerized tri-continent service between Europe, the United States, Hawaii, Guam and the Far East, utilizing an all-modern fleet of 16 high-speed high-capacity containerships.

MINESWEEPER GETS A LIFT: The U.S.S. Thrush, U.S. Navy minesweeper, is shown being raised by a new 1,000-ton capacity drydock put into service recently by TRACOR/MAS Shipyard, Port Everglades, Fla. The conventional floating drydock, built by the U.S. Navy and leased by TRACOR/MAS, augments the yard's 4,200-ton capacity Syncrolift drydock and transfer system, itself one of the largest in the U.S. TRACOR/MAS officials believe this new drydock will justify a larger, more stable work force and allow more effective work scheduling and work force utilization.

West Berlin Builds Biggest Ship Tank

A monumental ship-testing tank recently began to churn in Berlin. The tank is the ultimate in nautical testing equipment — the world's largest tank for conducting trials on stationary ship models. It is part of the ship construction and hydraulic engineering division of West Berlin's Technical University.

Located on an island lying in the middle of the Spree River in downtown Berlin's Tiergarten Park, the new tank and the structure which houses it cost $2,800,000 to build. The tank propels water against stationary models—rather than vice versa as is usual—and thus offers several advantages over conventional methods.

First, since the water flow can be increased or decreased at will, it allows ship models to be tested at higher speeds and for longer continuous periods of time. In addition, the 40-foot tank permits maneuverability tests to be conducted on scale-model vessels. This means problems can be solved during the design stage. Finally, the tank allows trials which would normally require a day's towing to be completed within an hour or two.

For the Berlin installation, the time-saving factor is vital. Berlin's ship-testing unit has orders from shipbuilders around the world, and the added speed with which it can now work is vital to complete these orders.

DOUBLE LAUNCHING FOR MARITIME: November 20, 1972, was an unusually busy day for Maritime Fruit Carriers when two new refrigerated ships were launched on the same day. Both the Newcastle Clipper and the Teaside Clipper came off the line at the Smith's Dock Company Limited, Middlesbrough, England. This was a "first" both for Maritime and for the Smith's Dock Company. Both vessels are fully automated and have a capacity of 365,000 cubic feet. Their trial speed was 24 knots and the ships maintain a temperature of between minus 25 degrees and plus 13 degrees centigrade in their refrigerated compartments. With the addition of these two British-flag vessels, scheduled for delivery in early 1973, Maritime Fruit Carriers now has 37 vessels in its refrigerated fleet.

El Paso Studies Feasibility Of Multibillion-Dollar Project To Supply LNG To West Coast

El Paso Natural Gas Company has announced it has begun studies on the feasibility of a multibillion dollar project which would carry natural gas that would be produced in conjunction with the oil from prolific fields in the Prudhoe Bay area to a South Alaskan terminal facility, where it would be liquefied and transported by specially built tankers to the West Coast of the United States. The project under study, it said, would involve one of the largest private investments in Alaskan history.

Howard Boyd, chairman of the board of El Paso Natural Gas Company, said in Anchorage on December 4, that preliminary studies indicate that it would be economically and ecologically feasible—and that costs should be comparable to the cost of gas delivered by an all-overland route.

El Paso is also engaged in studies of a pipeline which would bring gas to the U.S. via Canada.

Mr. **Boyd** said that the company's studies were based on construction of a 42-inch pipeline which would extend some 790 miles across Alaska from prolific fields in the Prudhoe Bay area to a South Alaskan terminal facility. There, a plant for liquefaction of the gas would be constructed along with related facilities. At this point, a fleet of LNG tankers would receive the liquefied natural gas (LNG) and would transport it to the West Coast, where it would be regasified and used to meet critical energy needs of the western third of the United States.

He said that total investments, based on the preliminary studies, would ultimately involve more than $2 billion in Alaskan facilities and additional investments of more than $1 billion for the tanker fleet and terminal facilities.

Mr. **Boyd,** who spoke before the Anchorage Chamber of Commerce, said that the project would have a number of major benefits to citizens of Alaska. Among them, he said, are:

1. Substantial employment and expenditures in the state during the construction phase of the project.

2. Continuing employment to citizens of the state during the years to come.

3. Related income to citizens not directly connected with the production, liquefaction and transportation of the gas supplies, as a result of operating expenditures in Alaska over the estimated 25-year life of the project.

4. Property taxes which would be paid as a result of the huge investment in facilities. These taxes, he noted, would continue over the life of the facilities.

5. Gas would be made available to the most populous areas of Alaska, including those communities along the route of the pipeline, stimulating economic growth. The pipeline is also expected to traverse an area where there are mineral deposits that require energy supplies for their exploitation.

6. The trans-Alaskan line would be beneficial to the U.S. balance of payments and trade. In addition, profits on all the U.S. project would accrue to U.S. interests, and resulting taxes on such profits would be paid to the U.S. treasury.

Mr. **Boyd** said that the studies now being conducted include attention to cost-saving which might be involved in paralleling a proposed oil pipeline traversing Alaska, and which would redound to the state of Alaska, producers of the oil and gas and to the ultimate consumers.

El Paso Natural Gas Company is one of the nation's largest pipeline companies, operating over 23,500 miles of lines serving 11 Western states. It is also active in the fields of petrochemicals, plastics, synthetic fibers, textiles, agricultural chemicals, insurance, wire fabrication, oil and gas production, LNG, mining and land development. The El Paso enterprises have net assets of nearly two billion dollars and more than 13,000 employees. The company has been a leader in efforts to alleviate the U.S. energy shortage—through projects for importation of LNG, nuclear stimulation of "tight" gas formations, coal gasification, and domestic exploration.

Moran Tug Reaches Lisbon With First Trans-Atlantic Barge Load Under Public Law

The completion of the first trans-Atlantic voyage of an ocean tug and barge carrying cargo under U.S. Public Law 480 was announced by **Thomas E. Moran,** president of the Moran Towing Corporation.

The American-flag barge Caribbean, towed by the 4,320-horsepower ocean tug Betty Moran, arrived in Lisbon, Portugal, on December 8 with a bulk cargo of 15,944 long tons of yellow corn. The cargo was loaded at Norfolk, Va., in November under the U.S. Government's food aid program.

While Public Law 480 cargoes have been shipped by barge to Caribbean and South American ports—it was pointed out—this 3,187-mile voyage is the first of its kind across the Atlantic.

The 475-foot-long 16,744-deadweight-ton Caribbean is one of the largest seagoing barges ever built in the United States.

The Caribbean was constructed in 1966 for the Caribbean Barge Corporation—a subsidiary of the Moran Towing Corporation—by the Bethlehem Steel Corporation at their Sparrows Point yard in Maryland.

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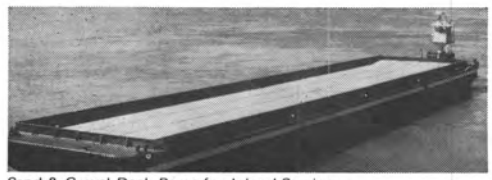
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Kockums Delivers 255,260-Dwt SOCAL Tanker

The S/T Chevron Brussels, shown above, is Kockum's sixth newbuilding for SOCAL, the first four units being 212,000 tonners completed in 1969-70.

Kockums Mekaniska Verkstads AB, Malmo, Sweden, has delivered the Chevron Brussels, second of two consecutive and similar 255,-260-dwt crude oil tankers to be built for Chevron Navigation Corporation, Monrovia, a subsidiary of Standard Oil Company of California. The delivery ceremony took place at Horten, Norway, after successful trials in the North Sea. Contract speed, 15.9 knots, was well attained.

The vessel is number 10 in a series of 20. Her sister ship, the Chevron London, was commissioned just two months earlier.

The Chevron Brussels has been built to Lloyd's Register of Shipping Class +100 A-1, oil tanker, + UMS. Principal particulars are: length overall, 1,117 feet 2 inches; length between perpendiculars, 1,080 feet; breadth, molded, 170 feet; depth, molded, 84 feet, and cargo capacity, 11,962,855 cubic feet.

The cargo compartment is subdivided into 15 cargo tanks and two slop tanks. Clean ballast tanks are arranged only in the forward and aft peaks and as wing tanks in way of the engine room. Fuel oil is carried in forward deep tanks and in one center and two wing tanks adjacent to the engine room.

Propulsion is by a regular set of Kockum-Stal-Laval bridge-operated cross-compound triple-reduction geared steam turbines of 32,000 shp at a propeller speed of 85 rpm. Steam is supplied from two Kockum-built Combustion Engineering type V2M-8 boilers rated at 71 tons/hr.

The engine room is automated for periodically unmanned operation by employment of the four Kockum-designed electronic part-systems: burner control, combustion control, flame guard and boiler safety system.

The bridge features a combined wheelhouse and chartroom equipped with a highly up-to-date range of non-computerized aids to navigation, including all-electric steering system (Sperry-Hastie), loran, Decca navigator, weather facsimile recorder (Nanayo) and two radar sets (Raytheon) with "interswitch."

Caterpillar Expands Commitment To Marine Industry

Reaffirming its determination to become a major supplier of diesel engines to the marine industry. Caterpillar has announced a two-part program. The program expands the widely accepted D343 Marine Engine into a new family of diesel marine engines and includes a new factory for their assembly to supplement existing facilities. This represents the largest investment in corporate history committed to a single purpose.

Steel is already being erected for the 1¼-million-square-foot manufacturing plant near Mossville, Ill. Initital production of the first engine model in the new series is scheduled for mid-1973.

The new engine line includes models and series for the widest possible variety of applications. All engines in the new line, from 250 to 750 hp, are the result of extensive research, development, testing, and on-going field evaluation.

First to become commercially available will be the 3400 Series, consisting of three basic models for heavy-duty service: an in-line 6, a V-8, and a V-12.

Announcement of the 3400 Series comes after Caterpillar's Phase I testing program, in which 17 engines were built and then tested in both laboratory and field. Although durability testing was not an objective of Phase I, the engines accumulated a total of 40,000 hours. Now well under way, Phase II is primarily concerned with performance and durability characteristics.

As noted previously, the success of Caterpillar's 5.4-inch (137 mm) bore D343 served as the basis for many features incorporated into the 3400 Series. Conservative design criteria, both thermal and mechanical, that have made the D343 a durable and dependable engine are also the standards for the new family. The influence of proven concepts can be observed throughout.

The 3400 Series consists of an I-6, a V-8, and a V-12 cylinder engine with common bores of 5.4 inches (137 mm) and strokes of 6.5 inches (165 mm) in the I-6, and 6 inches (152 mm) in the V-8 and V-12. Horsepowers are set conservatively from 250 to 750.

Texaco To Service Rigs From Base In Scotland

Texaco North Sea U.K. Company, a wholly owned subsidiary of Texaco Inc., has announced that construction has commenced on a base in Aberdeen, Scotland, for the supply and servicing of drilling rigs which will be operating on its behalf in the North Sea this year. The base will be located on 1.4 acres of land adjacent to Texaco's existing product distribution depot on South Esplanade East. It is scheduled for completion in mid-April 1973 .

The North Sea is currently an important exploration area in Europe and one of the most important in the world due to its proximity to the huge European market place. At present, Texaco's North Sea holdings total about five million net acres in five separate countries. Of this total, nearly one-half million acres lie offshore Scotland close to proved reserves of major significance.

A new jetty is being constructed at the site and will be capable of simultaneously servicing two offshore supply vessels at all stages of the tide. It will also have the capacity to handle coastal product tankers of up to 5,000-deadweight-tons each, thereby anticipating possible future expansion requirements of the distribution depot.

The yard area at the base will contain pipe racks to accommodate the tubular goods and other equipment used in the drilling operation. A small office will also be built on the site. Additional facilities are planned in the distribution depot to cover the bunkering requirements of the supply craft and oil rigs operating on behalf of Texaco, as well as those of other operators.

Western Gear Names John H. Short To Heavy Machinery Div.

John H. Short

John H. Short has been named manager of engineering for Western Gear Corporation's Heavy Machinery Division at Everett, Wash., according to division manager **Ade Eitner.**

Mr. **Short** has previously been chief design engineer in the company's Precision Products Division at Lynwood, Calif., where he concentrated on commercial and marine equipment for such projects as United Aircraft's turbo trains, gas turbines, destroyer escorts, and surface effects ships.

Mr. **Eitner** said "the appointment of Mr. **Short** is the first in a series of assignments of key personnel planned to strengthen the division's development of proprietary products and systems capabilities, particularly with equipment for the multibillion dollar offshore oil industry."

Born in Bartlesville, Okla., Mr. **Short** was an engineering officer in the Navy during World War II, and during his training program was graduated in mechanical engineering from the University of Washington. He joined Western Gear in 1946 in the Seattle plant as a mechanical engineer, then helped to pioneer the Everett, Wash., growth of the company in 1960, where he handled engineering duties for the Bell Telephone Company cable-laying ship, Long Lines.

Mr. **Short** moved to the Western Gear plant at Lynwood in 1962, where he has worked until his current appointment. He is a member of The Society of Naval Architects and Marine Engineers.

Oil Rig Equipment Ordered From Marconi By Texaco And Amoco

Marconi International Marine Company, Chelmsford, Essex, England, the major supplier of North Sea oil rig communication installations, has received further substantial orders from Texaco and Amoco.

The orders call for the supply of equipment to the rigs Zephyr and Platform 49/27-E. In addition, Marconi Marine, a GEC-Marconi Electronics company, will plan the installations, provide radio officers, administer traffic accounts and carry out service and maintenance when the rigs are on station.

Prudential-Grace Lines Appoints J.J. Mullin

John J. Mullin has been appointed regional controller-Philadelphia for Prudential-Grace Lines, Inc., it was recently announced by **James J. Connolly,** executive vice president-finance.

Mr. **Mullin** has held increasingly responsible financial positions for the steamship line in the Philadelphia area during the past 15 years. He is a graduate of La Salle College and has done graduate work at Temple University.

Mr. **Mullin** will be located at Prudential's recently opened office facilities in the Mall Building, Fourth and Chestnut Streets, Philadelphia, Pa. Also staffing the new office will be **David S. Sweet,** regional sales manager, and **James J. Lyons,** regional operations manager. This office will provide improved service to shippers in the Philadelphia area, which is becoming progressively more involved in trade to the ports served by Prudential-Grace in Latin America, the Caribbean, and the Mediterranean.

Raytheon Literature Describes Transducers For Ocean Vessels

Transducers of different frequencies and varied sizes, configurations, and materials are described in new literature available free from Raytheon Marine Company, 676 Island Pond Road, Manchester, N.H. 03103.

Complete electrical and mechanical specifications are given for five models of low frequency (21 and 24 kilohertz) transducers for use in ocean vessels; eight models of 40 kilohertz devices in keel-mount and thru-hull configurations producing standard or wide beams; and 10 high frequency models operating at 90, 125, and 200 kilohertz, in standard and narrow-beam patterns and in keel, thru-hull or transom mounts.

Important characteristics detailed in the new literature are frequency, sensitivity, impedance, beam width, pulse power cable length and type, and the size and style of the transducer.

The Raytheon transducers are designed to optimize the sensitivity of Raytheon Fathometer depth sounders. They can also be used to improve the performance of sounders produced by many other firms.

Dart Containerline Names New President

Conrad H.C. Everhard has been named president of Dart Containerline, Inc., it was announced by **Jacques Leblanc,** current president of the company. Mr. **Everhard,** who has been director-general for Europe and Africa of the Massachusetts Port Authority since 1966, with headquarters in Brussels, will take over his new post on February 1.

Mr. **Leblanc** said that he will return to Compagnie Maritime Belge (Belgian Line) in Antwerp in July 1973, where he will serve in another executive position. Maritime Belge is one of the owners of Dart Containerline. During the first six months of 1973, he will work with the new president in New York.

Mr. **Leblanc** has served first as vice president and later as executive vice president of Belgian Line since 1964, becoming president of Dart Containerline, Inc. in 1969.

The company is general agent in the United States of Dart Container Line Co., Ltd., jointly operated by the Belgian Line, Bristol City Line, and Clarke Traffic Services.

Mr. **Leblanc** has also served as president of the Containerization Institute, as well as board chairman.

Mr. **Everhard** has previously been connected with United States Lines, and is currently president of the Benelux Chapter of the National Defense Transportation Association.

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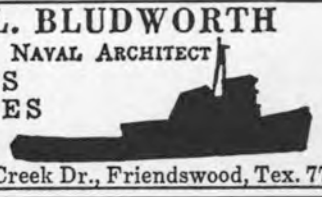
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Modular Systems, Inc. Issues New Brochure On Packaged Fluid Systems

A new brochure, devoted to packaged fluid systems, has been issued by Modular Systems, Inc., 1259 Route 46, Parsippany, N.J. 07054. In the marine field, the applications for these systems encompass oil (fuel, lubricating and hydraulic), water (fresh, salt and potable), vacuum priming and in fact, any piping system that is packageable.

Modular Systems points out that any shipowner or operator can produce his own fluid system but reveals graphically hundreds of operations in the average system on which scores of individuals consume thousands of manhours to do so. These involve costly personnel in the engineering, procurement and production departments. The result, MSI claims, will always be a system that occupies more space and costs considerably more than one engineered and produced by their experienced engineers and skilled craftsmen.

The purchaser's engineering department need only prepare one specification for the performance and functional requirements of the required system and issue only one purchase order. MSI does everything else and finally delivers one integrated package, ready for installation. Most important, should a problem arise with an MSI System, the owner or operator need waste no time in trying to solve it because MSI assumes all responsibility for the entire system.

French Built Ship Carries First LNG Brunei To Japan —Six More Ships To Be Built

The first cargo in the multimillion dollar scheme to export liquefied natural gas from Brunei to Japan was loaded on the new LNG carrier Gadinia at Lumut, Brunei, on December 9. Under the scheme, some 95-million tons of pollution-free LNG will be delivered to Japan over the next 20 years. The delivered value of the LNG will total more than (U.S.) $2.6 billion.

The Gadinia, which loaded some 75,000 cubic meters of LNG, is the first of seven such specialized ships to be built. They will be on charter by Shell Tankers (U.K.) Limited to Coldgas Trading Limited, a company jointly owned by Royal Dutch/Shell and Mitsubishi interests. Coldgas Trading purchases the LNG from Brunei LNG Limited, whose shareholders are the Brunei Government, Mitsubishi, and a Royal Dutch/Shell Group company. Brunei LNG owns and operates the liquefaction plant at Lumut, Brunei. The natural gas for the plant is supplied by Brunei Shell Petroleum Company Limited from its offshore fields.

Tokyo Electric, Tokyo Gas, and Osaka Gas contracted in 1970 to purchase 3.7-million tons of LNG per annum by 1976, and agreement in principle was reached early last year for an additional 1.5-million tons per annum from 1975. The first contractual year starts in April, but meanwhile running-in of the system is taking place.

The Gadinia was constructed at Chantiers de l'Atlantique, Saint Nazaire, France, which will also build three more of the ships. The other ships are also being constructed in France, one at Chantiers Navals de la Ciotat, La Ciotat, and two others at Constructions Navales et Industrielles de la Mediterrannee at La Seyne. All of these ships are expected to be in operation by early 1976.

The approximate measurements and principal characteristics of the Gadinia are: length, 843 feet; beam, 115 feet; draft, 31 feet; shaft horsepower, 20,800, and a service speed of 17-18 knots. The dimensions are approximately those of a 100,000-dwt crude carrier.

The first of the five liquefaction "trains" of Brunei LNG's plant at Lumut was brought on stream in October 1972. The construction of the plant and all related facilities is being carried out under Shell's technical direction. The main construction contractors are Japan Gasoline of Tokyo, in association with Procon Incorporated of Des Plaines, U.S.A. The Air Products and Chemicals Inc. cryogenic design was selected for the liquefaction process.

Two 28-inch lines bring the gas ashore from the southwest Ampa gas field some 12 miles out from shore.

After liquefaction, which is carried out by cooling the gas to minus 161 degrees centigrade, the LNG is piped into storage at Lumut and then loaded over the stern of the LNG carrier moored at the end of a 2½-mile-long jetty, necessary to reach the required depth of water.

On completion of the 2,500-mile voyage to Japan, the LNG is delivered ex-ship to the three customers at their receiving, storage and regasification terminals. When the system is in full operation, there will be more than 150 cargoes per year delivered to Japan.

When regasified, LNG vaporizes into 600 times its liquid volume. The Brunei natural gas has a calorific value approximately double that of the town gas now used in Japan. One cargo of LNG from Brunei would fulfill the needs of well over 100,000 homes in Japan for one year at today's average domestic rate of consumption.

Frank Nemec Steps Up To Vice Chairman Of Lykes Bros.; W.J. Amoss Jr. Named President

Frank A. Nemec

W.J. Amoss Jr.

Joseph T. Lykes Jr., chairman of Lykes-Youngstown Corporation, has announced seven executive appointments made by the board of directors at a recent meeting in New Orleans, La.

George S. Kimmel, of New Orleans, vice president and comptroller of LYC and vice president-finance of its steel producing subsidiary, Youngstown Sheet and Tube Co., was named to the LYC board of directors to fill the vacancy created by the retirement of **Solon B. Turman.**

Frank A. Nemec, New Orleans, president of LYC and chairman and chief executive officer of Youngstown Steel, steps up to become vice chairman of Lykes Bros. Steamship Co., Inc., another principal LYC subsidiary.

W.J. Amoss Jr., New Orleans, succeeds Mr. **Nemec** as president of the Lykes shipping organization. He was formerly executive vice president.

Mac G. Bulloch Jr., also of New Orleans, becomes vice president-operations of Lykes Lines, following the recent death of **R.T. Reckling.** Mr. **Bulloch** was assistant vice president of Lykes.

Jennings R. Lambeth, Youngstown, Ohio, becomes the new president of Youngstown Sheet and Tube Co., succeeding Mr. **Nemec** in this post. Mr. **Nemec** retains his post as chairman and chief executive officer. Mr. **Lambeth** was senior vice president-marketing.

R.C. Rieder, Dallas, senior vice president-manufacturing of Youngstown Steel and president of its Continental Emsco Division, was one of two executive vice presidents named to Youngstown Sheet and Tube Co.

Thomas A. Cleary Jr. of Youngstown,Ohio, was the other executive vice president of Youngstown Steel named. He was formerly senior vice president-operations.

Ocean-Oil International Announces Expansion Plans

Hector V. Pazos, P.E., president of Ocean-Oil International Engineering Corporation, has announced that Ocean-Oil is entering the marine brokerage activity on an international basis in addition to its present services.

For the past two years, this company has been primarily engaged in naval architecture consultation, with emphasis on the application of computers. Its expertise also includes marine salvage operations; marine loss prevention; safety analysis and design for towing operations; stress analysis, as well as vibration analysis.

As marine brokers, Ocean-Oil has compiled an extensive listing of vessels for sale: fishing boats, tugboats, barges, coasters, ferryboats, tankers, etc.

Mr. **Pazos** emphasizes that Ocean-Oil can assist clients looking for a vessel either as consultants or as brokers. As consultants, they can assist a client by applying their expertise in naval architecture, making an impartial survey of the vessel or vessels under consideration, incorporating any technical recommendations, sketches, drawings or other additions of benefit to the client from an engineering point of view.

The naval architecture firm is moving to larger offices located at 3019 Mercedes Boulevard, New Orleans, La. 70114.

$1 Million To Western Gear For Motion Control Systems On North Sea Drill Rigs

Western Gear Corporation has received an order in excess of $1 million from Sphere Overseas Supply, Inc., acting as agent for Waage Drilling A/S and Oslo Drilling A/S, for two shipsets of the firm's Pipemaster line of heave compensators, riser tensioners, and guideline tensioners for use in offshore drilling under severe sea conditions.

The order is the first for the advanced proprietary systems and will be manufactured by the firm's Heavy Machinery Division in Everett, Wash.

The units will be installed on two huge self-propelled semisubmersible offshore rigs being built by Avondale Shipyards at Morgan City, La., and by the Aker Group in Norway. Both will be completed in 1973 at a cost of about $25 million each.

One rig, the Waage Drill II, will be operated by a subsidiary of Santa Fe International Corporation in a joint venture with Waage Drilling A/S & Co. of Oslo, Norway. The other, the Odin, will be owned by Oslo Drilling A/S and will be operated by Bow Valley Industries, Ltd.

The units are among the first to be designed specifically for all-weather year-round use and will operate in rigorous climatic conditions of the North Sea, where activities are now limited by severe weather.

From keel to drilling deck the rigs will measure 152 feet, with another 160 feet for the drilling mast. The vessels will be 320 feet long and 293 feet wide, will house 77 men, and are equipped for drilling to 25,000 feet.

The Western Gear Pipemaster heave compensator, recently introduced to the offshore oil drilling industry, acts somewhat like a giant shock absorber. The device cancels out the relative motion between the ship and the ocean floor caused by wave action, thus maintaining constant drill bit position and pressure.

The riser tensioner system automatically maintains a constant upward pull on the riser pipe, which is unsupported from the drilling platform to the ocean floor wellhead. The guideline tensioners are positioned on the rig floor and regulate tension on the guidelines extending to the base plate on the ocean floor. Both systems automatically compensate for the heave of the vessel and maintain tension within narrow limits, adjustable relative to the depth of the water.

Both rigs will have heave compensators with a 20-foot stroke, riser tensioners with 80,000 pounds of line pull and 50-foot stroke, and guideline tensioners with 16,000 pounds of line pull and 50-foot stroke.

As self-propelled rigs with a draft of 25 feet when under way, the Waage drilling vessels will have an unassisted speed of about seven knots with 8,000 shaft horsepower.

The Waage firm is associated with the Norwegian shipowners, Hagb. Waage, managers of Rederiaktieselskapet Ruch, Waages Tankrederi A/S, and Waages Tankrederi: II A/S. The Waage group owns a large fleet of oil tankers comprising more than 1,200,000 tons.

Oslo Drilling has the following partners: Home Oil Co., Calgary; Bow Valley Industries, Ltd, Calgary; Wilh. Wilhelmsen, Oslo, Norway, and Hagb. Waage, Oslo, Norway. Both rigs will fly the Norwegian flag.

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SNAME Hawaii Section First Meeting Of New Season Gets Report On Floating Cities

The first meeting of a new season for the Hawaii Section of The Society of Naval Architects and Marine Engineers was recently held at the Waikiki Elks Club.

Members, their ladies and guests were presented an up-to-date report on the "Floating Cities" concept by **Guy Rothwell,** chief engineer, Systems Sciences Division, Oceanic Institute. Mr. **Rothwell's** report supplemented a presentation at an earlier date before the Hawaii Section by Dr. **John P. Craven,** dean of marine programs at the University of Hawaii, and Hawaii's executive director for marine affairs. The two-part presentation by Dr. **Craven** and Mr. **Rothwell** dealt with the concept, history and the actual building and launching of a 1/20 scale model of the new design.

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Singapore Shipyard Seeks Manufacturing Partnerships

Sembawang Shipyard (Pte.) Ltd., Singapore, has issued a brochure titled "Industrial Investment Potential, Singapore". Sembawang is seeking manufacturing partnerships and is offering land, buildings, plants and engineering and administrative facilities.

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Fort Schuyler President Reviews Regiment Of Kings Pointers

Reviewing officer Rear Adm. **Sheldon H. Kinney,** USN (ret.), President, State University Maritime College, Fort Schuyler, N.Y., is shown above (left) with Rear Adm. **Arthur B. Engel,** USCG (ret.), Superintendent, USMMA. In the rear (left to right), are Capt. **Victor E. Tyson,** Assistant Superintendent; Capt. **Edward W. Knutsen,** Commandant, and Capt. **Janus Poppe,** Dean.

Rear Adm. **Sheldon H. Kinney,** USN (ret.), who assumed the presidency of State University Maritime College, Bronx, N.Y., on September 1, was the reviewing officer at a November Formal Review at the U.S. Merchant Marine Academy.

Admiral **Kinney** was invited to review the Kings Pointers by Rear Adm. **Arthur B. Engel,** USCG (ret.), Kings Point Superintendent. Prior to being President of Fort Schuyler and his retirement from the Navy, Admiral **Kinney** headed the Pacfleet, Cruiser-Destroyer. He was also Deputy Chief, USN Personnel, and served as Commandant of Midshipmen at Annapolis, 1963-67.

The Fort Schuyler President inspected the Regiment of Midshipmen, accompanied by Regimental Commander **David Pasciuti,** White Plains, N.Y.

Included among the guests of Admiral **Engel** were his brother, Vice Adm. **Benjamin F. Engel,** Commander, Atlantic Area, U.S. Coast Guard, and Maj. Gen. **John M. Hightower,** Commanding General, Fort Hamilton, N.Y.

Navire Cargo Gear A/B Signs Sales Agreement With Philip C. Speer & Associates

Philip C. Speer & Associates, Inc., Stamford, Conn., has entered into a sales agreement with Navire Cargo Gear A/B of Goteborg, Sweden. Navire products, which include hatch covers of every kind, stern ramps and liquid cargo handling systems, will be offered to American-based shipowners building abroad. Navire, a total service company with a worldwide engineering and manufacturing organization, has pioneered the design and fabrication of very large capacity stern ramps for the innovative roll-on/roll-off vessels.

Jones Oregon Stevedoring Names Capt. Mansavage

Earl F. Weiss, president of Jones Oregon Stevedoring Company of Portland, Ore., has announced that Capt. **Ted Mansavage** has been named vice president of operations.

Captain **Mansavage** joined Jones in 1953, serving in the capacity of gear locker superintendent, and later as superintendent aboard vessels, and became general superintendent of the company in January 1970.

In 1946, Captain **Mansavage** joined Coastwise Line and rose to the position of master aboard their vessels until he joined Jones Oregon Stevedoring Company.

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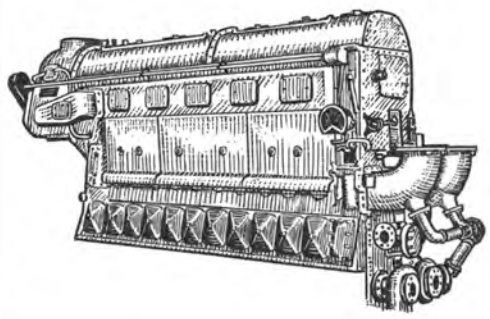

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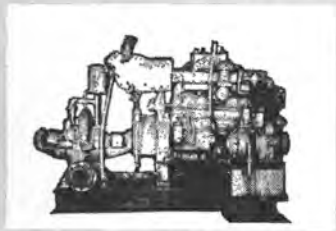
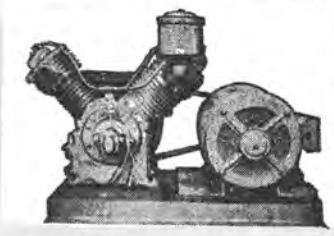


2—BUDA, Model 6-LD-468, Diesel Engines, 6 cylinders, 100 BHP, Marine, Gardner-Denver. centrifugal Pumps, Bronze, horizontally split case, 100 GPM, 280' head, 6" suction and 5" discharge.



2—GARDNER-DENVER, 150 CFM, 125 PSI, Class WB, Size 7x5¾x5, with Diehl Motors, 45 HP, 230 Volts DC, 870 RPM, 167 Amperes.

3—INGERSOLL-RAND, Size 5x5x4x 4, 50 CFM, 150 PSI, with G.E. Motor, 20 HP, 440/3/60.

1—INGERSOLL-RAND, Size 4x1½x 3½, 10 CFM, 600 PSI, with Diehl Motor, 7½ HP, 120 Volts DC.

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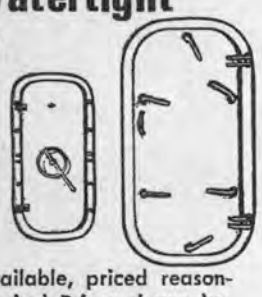

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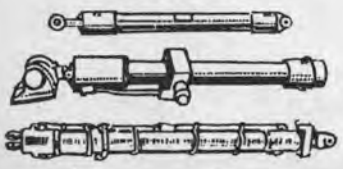

Bore	Overall Stroke	Rod Diameter	retracted length	Action
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2"	8"	1½"	20"	double
2.5"	15"	1.12"	25½"	double
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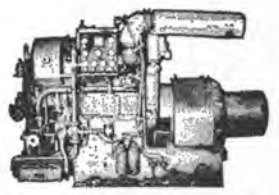
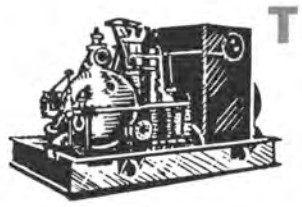


4—GENERAL MOTORS, Model 3-268A, marine, 150 BHP, 1200 RPM, 3 cylinders, with 100 KW Generators, 450/3/60.

3—GENERAL MOTORS, Model 3-268 A, Marine, 150 HP, 1200 RPM, 3 cylinders, with Allis-Chalmers Generators, 100 KW, 120/240 DC.

TURBINE GENERATORS



4—GENERAL ELECTRIC, 525 PSI, with G.E. Generator, 250 KW, 440/3/60.

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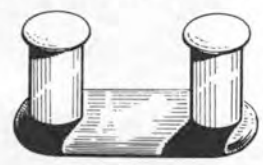
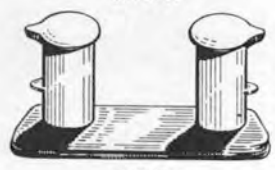


STYLE A



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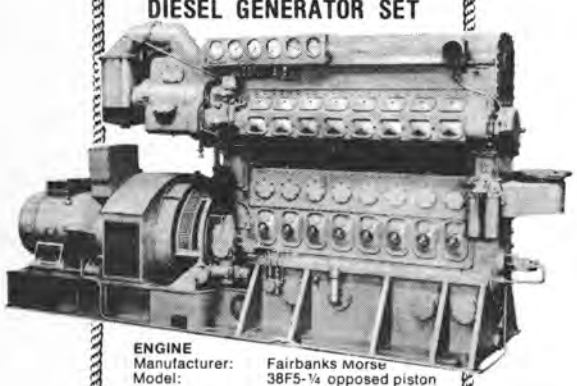

ENGINE	
Manufacturer:	Fairbanks Morse
Model:	38F5-¼ opposed piston
RPM:	1200
Cylinders:	8
Rotation:	Left hand (CCW from drive end)
GENERATOR	
Manufacturer:	Westinghouse
Capacity:	(500 KVA) 400 KW
Voltage:	450 (3-phase, 60-cycle)
Amperes:	641
RPM:	1200
Exciter:	Direct mounted
Total Weight:	21,000 lbs.
Condition:	**UNUSED**

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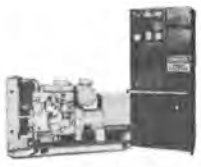

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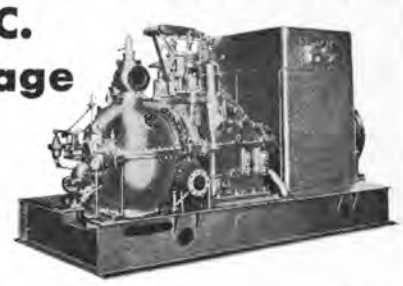

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Waukesha Bearings Corp., P.O. Box 798, Waukesha, Wis. 53186

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Combustion Engineering, Inc., Windsor, Connecticut 06095

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Murray & Tregurtha, Inc., 2 Hancock St., Quincy, Mass. 02171

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Independent Petroleum Supply Co., 1345 Ave. of Americas, New York, N.Y. 10019
The West Indies Oil Co., Ltd., St. John's Antigua, W. I.

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EGD Spee-Flo Co., 4631 Winfield Rd., Houston, Texas 77039
Marine Engineering & Construction Co., Inc., 1664 Tchoupitoulas St., New Orleans, La. 70130
Patterson-Sargent, P.O. Box 494, New Brunswick, N. J.

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Henschel Corporation, 14 Cedar St., Amesbury, Mass. 01913
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Hoffman Rigging & Crane Service, 560 Cortland Street, Belleville, N.J. 07109
Kocks Pittsburgh Corp., Four Gateway Center, Pittsburgh, Pa. 15222
M.A.N. Maschinenfabrik Augsburg-Nurnberg AG, Werk Augsburg, West Germany
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Electro-Motive Division General Motors, La Grange, Illinois 60525
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Oceanic Electrical Mfg. Co., Inc., 159 Perry Street, N.Y. 10014

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Universal Hydraulics, Div. of Ohio Brass Co., 4500 Beidler Road, Willoughby, Ohio 44094

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Philadelphia Gear Corp., Schuylkill Expressway, King of Prussia, Pa. 19406
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Nicolai Joffe Corp., P.O. Box 2445, 445 Littlefield Ave., So. San Francisco, Calif. 94080
Merrin Electric, 162 Chambers St., New York, N.Y. 10007
Metritape, Inc., 77 Commonwealth Ave., West Concord, Mass. 01742
Peltz Brothers, Inc., 3499 Inventors Road, Norfolk, Va. 23502
Stow Mfg. Co., 225 Shear St., Binghamton, N.Y. 13902
Vokes Filter Div., (Cardwell Machine Co.), Cardwell and Castlewood Rd., Richmond, Va. 23221
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Jantzen Engineering Co., 15 Charles Plaza, Baltimore, Md. 21201
James S. Krogen, 1460 Brickwell Ave., Miami, Fla. 33131
Littleton Research and Engrg. Corp., 95 Russell St., Littleton, Mass. 01460
Robert H. Macy, P.O. Box 758, Pascagoula, Miss. 39567
Marine Consultants & Designers, Inc., 308 Investment Insurance Bldg., Corner E. 6th St. & Rockwell Ave., Cleveland, Ohio 44114
Marine Design Inc., 1180 Ave. of Americas, N.Y., N.Y. 10036
Marine Design Associates, P.O. Box 2674, Palm Beach, Florida
Maritech, Inc., 38 Union Sq., Somerville, Mass. 02143
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Metritape, Inc., 77 Commonwealth Ave., West Concord, Mass. 01742
Robert Moore Corp., 350 Main St., Port Washington, N.Y. 11050
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Ocean-Oil International Engrg. Corp., P.O. Box 6173, New Orleans, La. 70114
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ELCO Corp./Safecraft Division, Maryland Road & Computer Ave., Willow Grove, Pa. 19090
Electro-Nav, Inc., 501 Fifth Ave., New York, N.Y. 10017
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ITT Mackay Marine, 2912 Wake Forest Road, Raleigh, N.C. 27611
Lorain Electronics Corp., 2307 Leavitt Road, Lorain, Ohio 44052
Magnavox Navigation Systems, 2829 Maricopa St., Torrance, Cal. 90503
National Marine Service, 1750 So. Brentwood Blvd., St. Louis, Mo.
Radiomarine Corp., 20 Bridge Avenue, Red Bank, N.J. 07701
Raytheon Co. Marine Products, 676 Island Pond Rd., Manchester, N.H. 03103
Sperry Marine Systems Div., Charlottesville, Va. 22901, Division of Sperry Rand Corp.

Star Lifeline, Ltd., 1148 W. 15th St., No. Vancouver, B.C., Canada
Teledyne Hastings Raydist, P.O. Box 1275, Hampton, Va. 23361
Tracor, Inc., 6500 Tracor Lane, Austin, Texas 78721

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Mobil Oil Corp., 26 Broadway, New York, N.Y. 10004
Shell Oil Co., 1 Shell Plaza, Houston, Texas 77002
Texaco, Inc., 135 E. 42nd St., New York, N.Y. 10017

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Marine Engineering & Construction Co., Inc., 1664 Tchoupitoulas St., New Orleans, La. 70130
Mobil Chemical Company, Metuchen, N.J. 08840
Patterson-Sargent, P.O. Box 494, New Brunswick, N. J.
Porter Paint Company, 400 South 13th Street, Louisville, Ky. 40203

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Shell Oil Co., 1 Shell Plaza, Houston, Texas 77002
Texaco, Inc., 135 E. 42nd St., New York, N.Y. 10017
The West Indies Oil Co., Ltd., St. John's, Antigua, W. I.

PLASTICS—Marine Applications
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Hubeva Marine Plastics, Inc., 390 Hamilton Ave., Bklyn, N.Y. 11231
Philadelphia Resins Co., 20 Commerce Dr., Montgomeryville, Pa. 18936

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Escher Wyss Gmbh, P.O. Box 798, Ravensburg, Germany
Federal Propellers, 1501 Buchanan Ave. S.W., Grand Rapids, Mich. 49502
Ferguson Propeller, 1132 Clinton St., Hoboken, N.J. 07030

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Goulds Pumps, Seneca Falls, N.Y. 13148
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Worthington Corporation, Harrison, New Jersey 07029

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Cating Rope Co., 309 Genesee St., Auburn, N.Y. 13022
Columbian Rope Co., 309 Genesee St., Auburn, N.Y. 13022
Du Pont Co., Room 31H1, Wilmington, Delaware 19898
Jackson Rope Corp., 9th & Oley, Reading, Pa. 19604
Wall Rope Works, Inc., Beverly, N. J. 08010

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Henschel Corp., 14 Cedar St., Amesbury, Mass. 01913
Hose McCann Telephone Co., Inc., 524 W. 23rd St., N.Y. 10011
Sperry Marine Systems Div., Charlottesville, Va., 22901, Division of Sperry Rand Corp.

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Howmet Corporaton, Southern Extrusions Division, P.O. Box 40, Magnolia, Arkansas 71753

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SHAFT REVOLUTION INDICATOR EQUIP.
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Henschel Corp., 14 Cedar St., Amesbury, Mass. 01913

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Levin Metals Corp., P.O. Box 398, Point Station, Richmond, Cal. 94807
National Metal & Steel Corp., 1251 New Dock St., Terminal Island, Cal. 90731
Zidell Explorations, Inc., 3121 S. W. Moody St., Portland, Ore. 97201

SHIP BROKERS
Hughes Bros., Inc., 17 Battery Pl., New York, N.Y. 10004
Mowbray's Tug and Barge Sales Corp., 21 West St., N.Y., N.Y. 10006
Oaksmith Boat Sales, Inc., Fisherman's Terminal, Seattle, Wash. 98119

SHIPBUILDING STEEL
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Bethlehem Steel Corp., 25 Broadway, New York, N.Y. 10004
Huntington Alloy Products, Div. International Nickel Co., Inc., Huntington, W. Va. 25720
International Nickel Co., 1 New York Plaza, New York, N.Y. 10004

SHIPBUILDING—Repairs, Maintenance, Drydocking
Astilleros Espanoles, S.A. Zurbano, 70, Madrid 10, Spain
Avondale Shipyards, Inc., P.O. Box 52080, New Orleans La. 70150
Barbour Boat Works, Inc., P.O. Box 1069, New Bern, N.C.
Beliard Murdoch S. A., Kattendijkdok Westkaai 21, Antwerp, Belgium
Bertram Marine, Division of Whittaker, 3663 N.W. 21 Street, Miami, Fla. 33142.
Bethlehem Steel Corp., Shipbuilding, 25 Broadway, N.Y., N.Y. 10004
Blount Marine Corp., P.O. Box 360, Warren, Rhode Island 02885
Bludworth Shipyard, Inc., Box 5426, Cypress St., Brady Island, Houston, Texas 77012
Brodogradiliste "SPLIT", P.O. Box 107, Split, Yugoslavia
Conrad Industries, P.O. Box 790, Morgan City, La. 70380
Curacao Drydock, Inc., P.O. Box 153, Willemstad, Curacao, N.A.
Dillingham Corp., P.O. Box 3288, Honolulu, Hawaii 96801
Dravo Corporation, Neville Island, Pittsburgh 25, Pa.
Empressa Nacional Bazan, 65 Castellana, Madrid 1, Spain
Equipment Systems, Inc., A Microdot Co., P.O. Box 95, Port Deposit, Md. 21904
Equitable Equipment Co., Inc., P.O. Box 8001, New Orleans, La. 70122
General Dynamics, Electric Boat Division, 99M Eastern Point Road, Groton, Conn. 06340
General Dynamics, Quincy Division, Quincy, Mass. 02169
Gotaverken American Corp., 39 Broadway, New York, N.Y. 10006
Halter Marine Services, Inc., Route 6, Box 287H, New Orleans, La. 70126
Havre de Grace, Havre de Grace, Md.
Hillman Barge & Construction Co., Grant Bldg., Pittsburgh 19, Pa.
Hongkong & Whampoa Dock Co. Ltd., Kowloon Docks, Hong Kong
Ishikawajima-Harima Heavy Industries Co., Ltd., 15 William St., New York, N.Y. 10005
Jacksonville Shipyards, 644 E. Bay St., Jacksonville, Fla. 32203
Jeffboat, Inc., Jeffersonville, Ind. 47130
Kawasaki Dockyard Co., 8 Kaigon-dori, Ikuta-ku, Kobe, Japan
Kelso Marine, Inc., P.O. Box 268, Galveston, Texas 77550
Kockums Malmo, Fack, Malmo, Sweden
Litton Industries, 9920 W. Jefferson Blvd., Culver City, Calif. 90230
Lockheed Shipbuilding and Construction Co., 2929 16th Avenue, S.W., Seattle, Wash. 98134
Marathon Manufacturing Company
Marathon LeTourneau Offshore Company, 1700 Marathon Building, 600 Jefferson, Houston, Texas 77002
Marathon LeTourneau Gulf Marine Division, P.O. Box 3189, Brownsville, Texas 78520
Marathon LeTourneau Marine Division, LeTourneau Rural Station, Vicksburg, Mississippi 39180
Marathon LeTourneau Offshore Pte., Ltd., P.O. Box 83, Taman Jurong Post Office, Singapore 22, Singapore
Marathon Shipbuilding Company, P.O. Box 870, Vicksburg, Miss. 39180
Marathon Shipbuilding Company (U.K.) Ltd., Clydebank Bunbartonshire, G81-1YB, Scotland
Marine Engineering & Construction Co., Inc., 1664 Tchoupitoulas St., New Orleans, La. 70130
Maryland Shipbuilding & Drydock, P.O. Box 537, Baltimore, Md. 21203
Matton Shipyard Co., Inc., P.O. Box 428, Cohoes, New York 12047
Mitsui Shipbuilding & Engrg. Co. Ltd., 6-4, Tsukiji 5-chome, Chuo-ku, Tokyo, Japan
Mitsubishi Heavy Industries, Ltd., 5-1 Marunouchi 2-chome, Chiyoda-ku, Tokyo, Japan
Monark Boat Co., P.O. Box 210, Monticello, Ark. 71655
National Steel & Shipbuilding Corp., San Diego, Calif. 92112
Newport News Shipbuilding and Dry Dock Co., Newport News, Va.
Newport Ship Yard, Inc., 379 Thames St., Newport, R.I. 02840.
Northwest Marine Iron Works., P.O. Box 3109, Swan Island, Portland, Oregon 97208
Nuclear Service & Construction Co., Inc., 9296 Warwick Blvd., Newport News, Va. 23607
O.A.R.N. (officine Allestimento e Riparazioni Navi) Genoa, Italy
Odense Steel Shipyard Ltd., P.O. Box 176, DK-5100 Odense, Denmark
Paceco, Div. Fruehauf Corp., 2350 Blanding Ave., Alameda, Calif. 94501
Pearlson Engineering Co., P.O. Box 8, Kendall Branch, Miami, Fla. 33156
Perth Amboy Dry Dock Co., Perth Amboy, N.J. 08862
St. Louis Shipbuilding—Federal Barge, Inc., 611 East Marceau, St. Louis, Mo. 63111
Sasebo Heavy Industries Co., Ltd., New Ohtemachi Bldg., Chiyoda-ku, Tokyo, Japan
Savannah Machine & Shipyard Co., P.O. Box 787, Savannah, Ga. 31402
Sembawang Shipyard (Pte) Ltd., P.O. Box 3, Sembawang, P.O. Singapore, 27
Star Shipyards, Ltd., 61 Duncan St., New Westminster, Vancouver, B.C., Canada
Sumitomo Shipbuilding & Machy. Co., Ltd. 2-1 Ohtemachi 2-chome, Chiyoda-ku, Tokyo, Japan
Swedish Shipbuilding Association, Fack S-402 70, Gothenburg 8, Sweden
Teledyne Sewart Seacraft, P.O. Box 108, Berwick, La. 70342
Todd Shipyards Corp., 1 State St. Plaza, New York, N.Y. 10004
Tracor/Mas, Inc., P.O. Box 13107, Port Everglades, Fla. 33316

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Weather Routing, Inc., 90 Broad Street, New York, N.Y. 10004

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James Hughes, Inc., 17 Battery Pl., New York, N.Y. 10004
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McAllister Bros., Inc., 17 Battery Pl., New York, N.Y. 10004
McDonough Marine Service, P.O. Box 26206, New Orleans, La.
Moran Towing & Transportation Co., Inc., One World Trade Center, Suite 5335, New York, N.Y. 10048
L. Smit & Co., 11 Broadway, New York, N.Y. 10004
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Hubeva Marine Plastics-Lining, 435 Hamilton Ave., Brooklyn, N.Y. 11231
Marine Moisture Control Co., 449 Sheridan Blvd., Inwood, N.Y. 11696
Mesco Tectonics, Inc., 5 Central Ave., Clifton, N.J. 07011

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Tweco Products, Inc., P.O. Box 666, Wichita, Kan. 67201

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Bethlehem Steel Corp., Bethlehem, Pa. 18016
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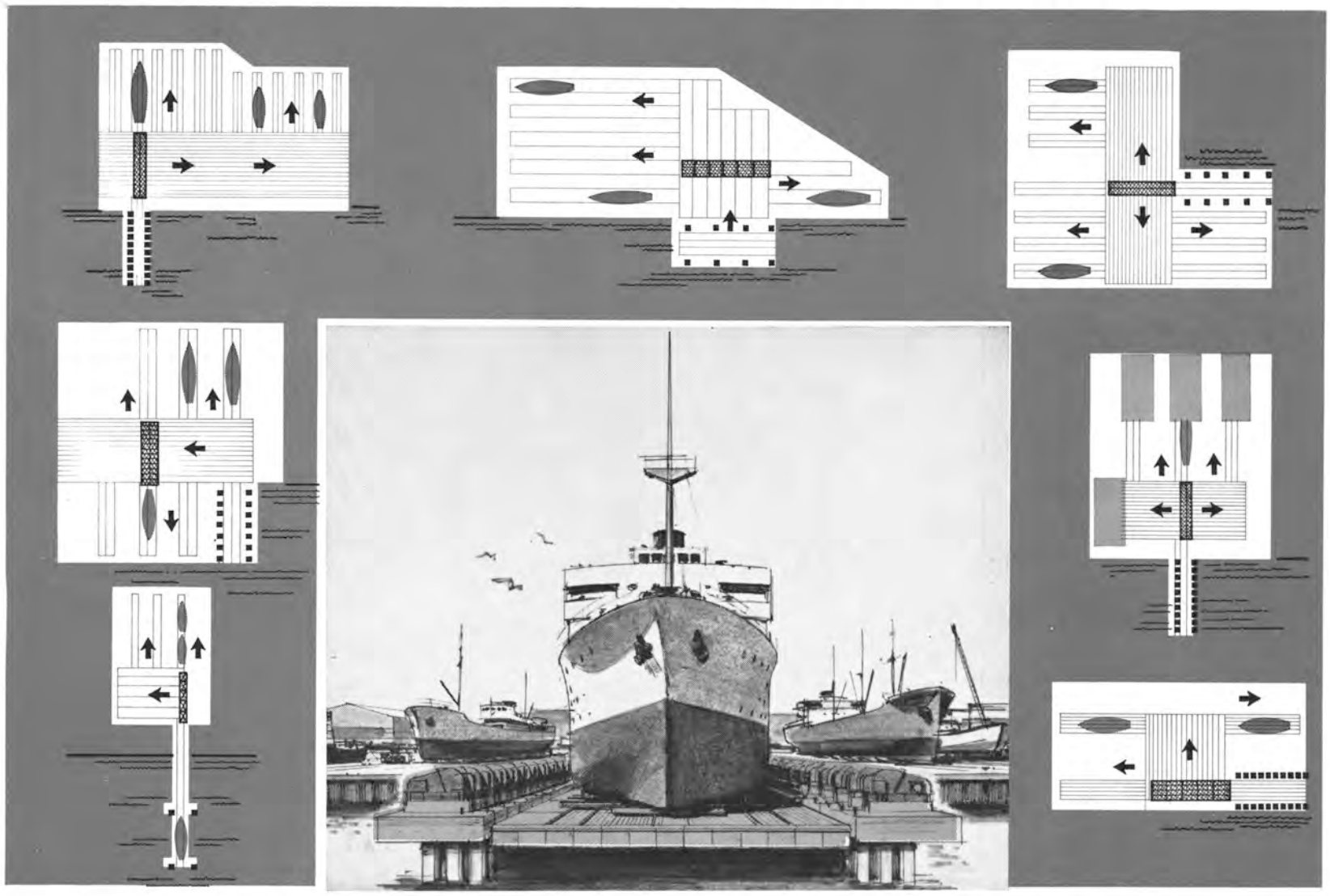

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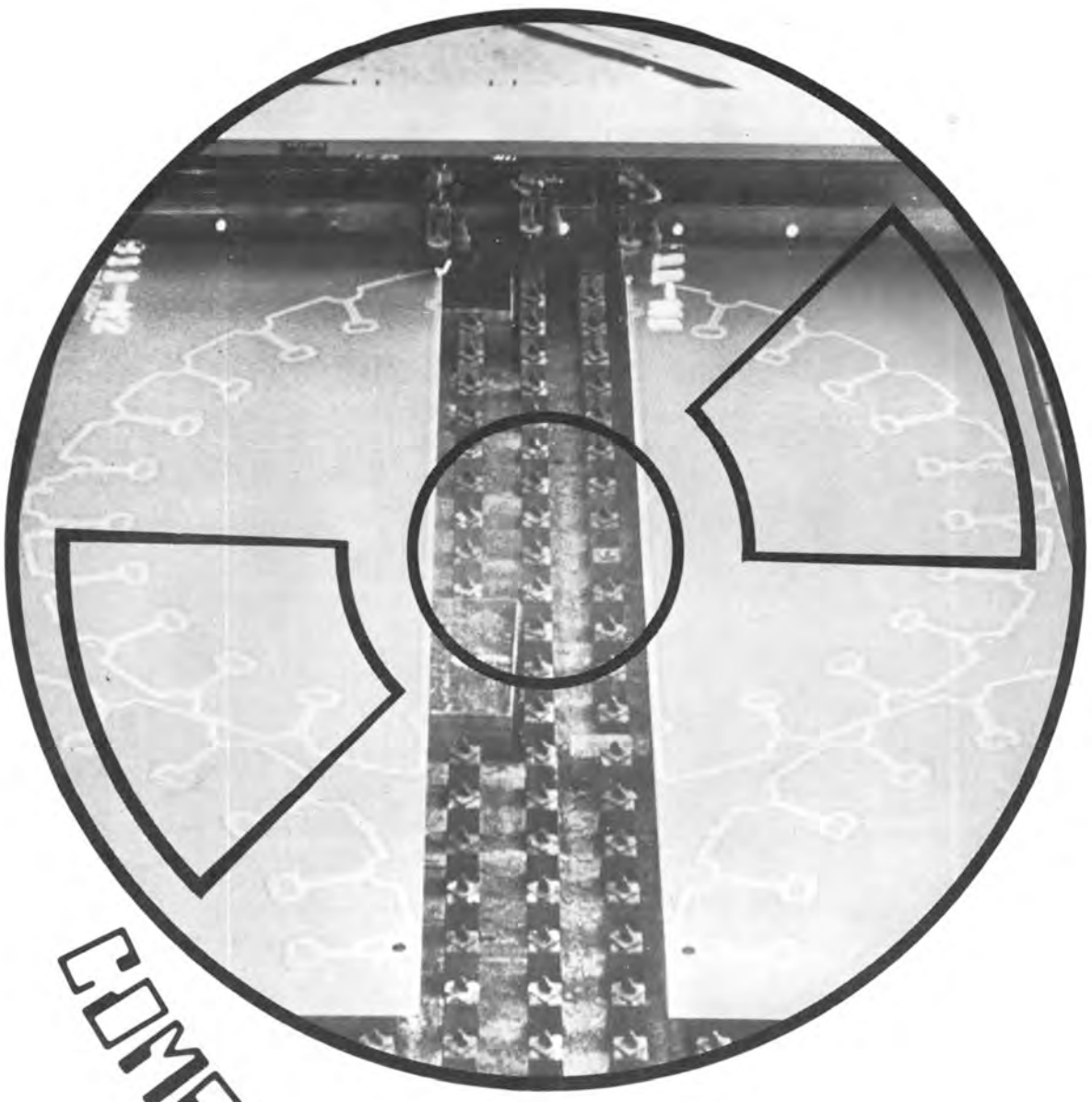

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