PROCEEDINGS

OF THE MERCHANT MARINE COUNCIL

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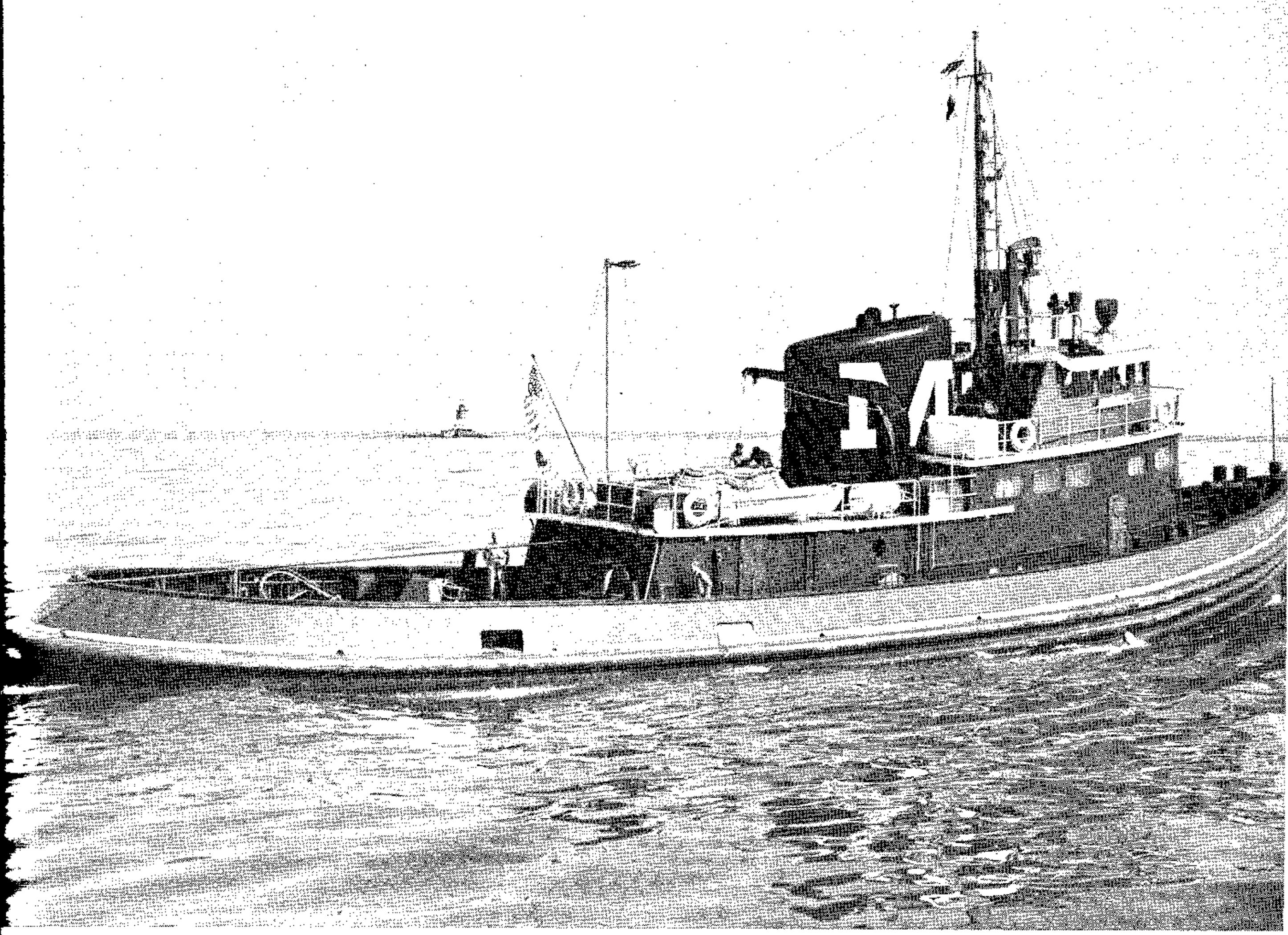

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The Merchant Marine Council of The United States Coast Guard

This Copy FOR NOT LESS THAN 20 Readers PASS IT ALONG

LCDR N. B. Binns, USCG, *Editor*
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T. A. DeNardo, *Publication Manager*

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FRONT COVER

The *M. Moran,* newest 3,500-hp ocean tug, shown off Romer Shoals in lower New York Bay. Claimed by her owners to be the most powerful American tug now in operation, she recently completed a 10,194-mile tow between Port Arthur, Tex., and Pusan, Korea. *Photo by Jeff Blinn.*

BACK COVER

The new 28-million-candlepower Charleston Light stands on Sullivans' Island, north side of Charleston Harbor entrance. The most powerful lighthouse in the Western Hemisphere, standing 163 feet high, the light is visible 19 miles and is equipped with a 70-mile sequenced radiobeacon.

SAFETY AWARD

OFFICERS AND CREW of the Lykes Lines cargoliner *Harry Culbreath* have captured No. 1 place, for the second straight year, as the safest ship in the Lykes fleet for 1961.

A total of 15 Lykes ships completed 1961 without lost-time injuries, but the record of the *Harry Culbreath* was declared best of the entire fleet by the safety committee using the lost-time injury ratings of the National Safety Council. The *Harry Culbreath*'s safety record dates back to September 23, 1957.

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MARINE CORROSION IN SHIPS

By CDR R. S. Capp, USCG (Retired)

> The following remarks are extracted from a paper delivered by CDR R. S. CAPP, USCG, and Mr. B. J. Philibert before the National Association of Corrosion Engineers in 1959. These remarks are from part I, written by CDR Capp, while part II, not printed here, was prepared by Mr. Philibert. Although several years old, these remarks are still valid, and take on a new timeliness in view of the current inquiries into new means of protecting against corrosion. This discussion is written from the viewpoint of Coast Guard and Navy vessels rather than merchant vessels; however, it is believed that several of the major problems under discussion are common to all vessels. These remarks do not touch upon tank vessels, per se, as it is intended to discuss some of those problems in a later article.—*Ed.*

MARINE CORROSION aboard ships has been a serious problem for over 100 years of iron and steel construction, and probably before that, in the fastenings on wooden vessels. While seagoing conditions are no worse today than formerly, the average vessel is subjected to highly corrosive chemical attack while in most ports, as well as salt water corrosion while underway. The almost total shift to welded construction has made corrective measures mandatory. For these reasons, there is a growing awareness of the scope of the problem.

A review of the literature indicates that external hull corrosion below the waterline has been the subject of extensive research as has the problem of hull appendages, but relatively little has been done about upper decks and deckhouses externally and almost nothing in regard to internal corrosion except in tanks. Progress toward effective control of these problems is a direct reflection of this emphasis. Today, underwater body corrosion, while still a costly problem, is well under control and no really serious conditions are known where any enlightened approach has been used. This is not to indicate the problem is solved, only that it is relatively under control. To a somewhat lesser extent this is true also of tank corrosion, although the progress is not so far advanced. But topside corrosion is with us still. Any doubting Thomases have only to walk to the waterfront where almost every vessel in port will have men applying paint to hull and superstructure—quite often over rust!

On the subject of internal corrosion in areas other than tanks, the picture is even bleaker, since in many cases the operators are not even aware that it exists.

For these reasons, this paper will cover briefly, and quite inadequately, underwater body and tank corrosion and will emphasize those items of "lesser importance" which add tremendously to the maintenance bill annually. It has been estimated that American industry generally loses $8 billion annually through oxidation and corrosion, and anyone in the marine repair industry will agree that a very large percentage of this figure is in his field.

UNDERWATER BODY

For many years continuous studies on improved hull coatings have been carried on, particularly in the Navy. Present coatings, if applied properly, and that point can't be overemphasized, provide excellent adhesion and considerable abrasion resistance. The intelligent use of zinc anodes of high purity fitted with cast-in steel straps for welded application has assisted materially. (We still haven't found the answer to the operator problem though. Who hasn't been asked what we can do to reduce the terrible "eating away" of the zincs?) The use of cathodic protection on both active and inactive vessels had progressed from a fairly exotic concept 15 years ago to a highly practical and effective system which is complementary to the coating system and promises even more in the future due to recent use of plastics.

At present, so long as the protective film remains intact and zinc anodes and water pieces are properly positioned and attached, underwater corrosion is not serious in the first 18 months after undocking. This happy condition coincides reasonably well with the overall average interval between dockings. No matter how good the coating, abrasion in the normal course of operation will break the film and make routine docking for inspection necessary. The normal wear of stern tube bearings, propeller damage, shaft inspection, and repair of electronic transducers also makes a periodic docking mandatory. In the case of merchant ships, both the Code of Federal Regulations and the Classification Society Rules require routine dockings and withdrawal and inspection of the shaft. Therefore, any system which will provide adequate protection for at least 18 months is likely to result in little or no serious underwater corrosion. Of course, the system which stays basically intact and requires little or no touchup at these dockings has a very definite economic advantage over one which requires complete renewal. However, there are so many variables in application technique, adequacy of surface preparation, and temperature and humidity conditions prevailing at the time of application, that the additional first cost of long-lived coatings is not always recovered.

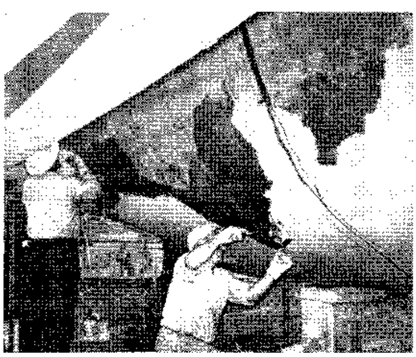

Figure 1. Failure of vinyl underwater body paint due to poor surface preparation and application.

LIGHT HULLS

All of the above discussion is directed to the subject of ships with hull plating of ½-inch thickness or greater. When we turn to the lighter hulls, however, the picture changes radically. Generally speaking, these hulls are also made for relatively high-speed operation. Since the end of World War II, numerous hulls of this type have been constructed. They include naval and Coast Guard patrol craft, offshore crew boats, pleasure craft, and special-purpose craft. Since the shell plating, the structural members and all fittings were designed to be lightweight, some consideration was usually given in the original design to resist corrosion. Many were built with galvanized steel hulls and sprayed with zinc-rich paints after fabrication. While this system did reduce shell plate corrosion when it remained intact, it introduced so many side effects that it has been all but abandoned.

COATINGS

After approximately 10 years of experimentation, it has become almost universal practice to return to mild steel construction, with dependency on the coating system and zincs or magnesium anodes for protection of the underwater body. This system, of course, requires a much more frequent docking schedule than is used on larger vessels; 6 months being the usual interval and never exceeding 1 year. Thus, the underwater protection cost on small craft is much greater comparatively than on larger vessels. To reduce this cost, reliance is placed on a higher quality coating system than on larger ships in the usually forlorn hope that protection will be adequate for longer periods.

Unfortunately, most of the high-quality coatings for these applications require reasonably good temperature control, even better humidity control and, above all, a first-class surface preparation. In the average shipyard faced with a production schedule, these goals are almost never realized. The vessel obviously is of no value to its owners while sitting on a drydock, so there is always a tendency to apply the coating whatever the temperature and humidity unless there is a veritable deluge or blizzard. The surface preparation is usually good in those areas which are easily accessible, but ranges from fair to terrible in the hard-to-reach areas which are the primary locations of corrosion.

ECONOMY

There is also a very practical economic problem involved. The shipyard will prefer to blast the entire hull at one time followed by the pretreatment and the primer coat. If the hull is of any size at all, this work will span more than a normal workday. So the shipyard and the owner are faced with the decision as to whether to work overtime, whether to do the hull in sections (both relatively costly operations), or whether to go as far as possible in one day, then sand-sweep and complete the coating the next day. Sometimes, in extreme cases, there is a decision to not even sand-sweep before picking up next day.

Of the alternatives listed above, only the first two have any hope of providing protection, but because they are costly, they are often ignored. From 20 years of practical experience with this problem, it is the writer's opinion that the "straight through with overtime and never mind the expense" method is the only satisfactory one, particularly if the coating be vinyl or epoxy. Alkyds are less likely to be adversely affected. Experience also teaches that a high-quality coat poorly applied or applied over a poorly prepared surface is an open invitation to extensive corrosion damage of the hull since it gives a false sense of security.

Figure 1 shows a vinyl film which looked good when the vessel was docked, but which had very poor adhesion with accelerated corrosion beneath. As shown, the film had just been penetrated by a knife and pulled loose by hand. Corrosive products underneath were so extensive as to require some hull inserts, although the boat was only 6 months old when this docking occurred. Other sources of corrosion on these lightweight underwater bodies are rough welds, badly fitting plates and, above all, electrolytic corrosion due to dissimilar metals.

For other reasons, propellers, shafts, bearings, rudder posts, and electronic tranducers are usually of a metal more noble in the galvanic series than the hull proper. Designers usually go to great lengths to insulate these from the hull, but in the final analysis, the only really effective protection is the coating film—and that only if intact. Since many lightweight vessels operate in shallow waters, film abrasion is a constant problem. Once penetration of the film has been accomplished, accelerated corrosion in the vicinity of these appendages can be expected.

Figure 2 shows a work deck of a buoy tender. The deck is subjected to loads of buoys, sinkers, chains, and heavy weights of all descriptions. To provide maximum safety for personnel, no weights are worked from off the deck which can be slid or dragged across it by the boom. To be effective, it must be near the water so that in rough weather it is always wet. Additionally, when buoys, sinkers, and chains are recovered from the water, they are badly fouled and this fouling is washed off with a high-pressure stream of salt water. Needless to say, any area subjected to this treatment is a problem area.

Another common problem is the practice of designer and operator alike in attaching fittings and fastenings of more noble material than the basic structure to the deck and superstructure areas. This practice leads to long-lived fittings and fastenings while the basic vessel rapidly deteriorates. Examples are bronze fire-hose valves and strainers, nonferrous armored cable in steel wireways, chrome-plated brass whistles and sirens, stainless-steel stanchions with bronze lifelines, etc. And the operator will always renew bolts, screws, and other fasteners with nonferrous or stainless replacements so he can remove them easily. All the above items have been with us for many years and an inspection of recent construction indicates the problem is growing more acute as more metals become available.

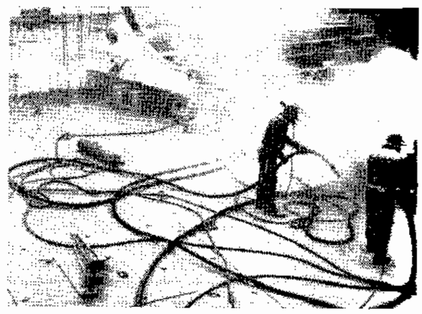

Figure 2. Typical buoy deck being sandblasted.

About 10 years ago it became common practice to use aluminum superstructures as a weight-saving feature and a whole new area of trouble developed. These troubles can be traced to three sources: the joint location, the fastener, and the protective insulator.

The joint location has, in the past, almost always been made at the deck-line; in other words, at a perpendicular base angle. Since this area is the wettest possible area to protect, rapid deterioration of the aluminum follows.

The practice of using a cathodic material on a joint of two anodic materials often results in calamity—and in fact, if we could believe in levitation, would ultimately result in a line of free floating fasteners after both the aluminum bulkhead and steel deck had completely disappeared. The classic "protection" of this joint has been to install an insulating polysulfide coating and/or a synthetic rubber gasket between the joint. Needless to say, there are at least two serious shortcomings with this type of protection: neither base metal is protected from the fastener, and the exterior sides of the joint at the deck line are not protected at all. Other difficulties experienced with aluminum superstructures are pri-

ABOUT THE AUTHOR

CDR R. S. CAPP, who has recently retired, enlisted in the Coast Guard in 1940 and was commissioned in 1943. He has served in various engineering assignments, including engineer officer of 125-ft. WSC, 180-ft. WAGL, WAVP's, icebreakers, and 327-ft. WPG's. Shore assignments include duty as Shipbuilding and Repair Superintendent at the Coast Guard YARD, and as Chief, Naval Engineering Section, 17th and 8th Coast Guard Districts. He was serving in the latter assignment when this article was prepared. He is a member of the Society of Naval Architects and Marine Engineers, the American Society of Naval Engineers, and an associate member of the American Welding Society.

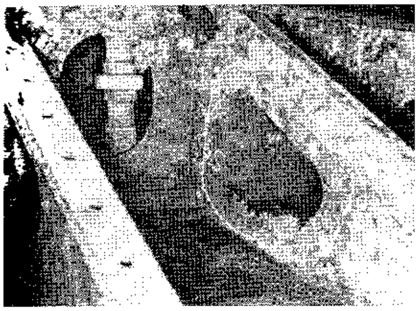

Figure 3. Deteriorated web frames in bilges.

marily the application of longstanding marine fittings of nonferrous materials and the application of armored cable with either ferrous or nonferrous sheaths, even up the mast where no abrasion of cable problem exists. It is not necessary to present a résumé of the shambles this practice makes of the aluminum structure.

Lest at this time it be thought that all naval architects are bent on destroying their own creations, there should be injected here a defense of the practices. First, his primary considerations are not corrosion protection. Secondly, the demands of the operators and owners for certain fittings and materials they have come to expect in a vessel cannot be disregarded. Third, the preoccupation of owners and operators with exterior appearance keeps him from relocating joint areas and using more effective protection. Fourth, compatible fittings in required materials are just not often available and the cost of casting or fabricating one each of anything cannot be justified. Add to all these points the natural conservatism of the shipbuilding industry and the reluctance to change classic design concepts, and you have today's marine problem child.

TANKS

Tanks are the only interior areas on which any recent important work has been done if our interpretation of the literature and personal experience are correct. This preoccupation with the protection of tanks has become an economic necessity, and because the literature is so full of reports, it will be touched on only lightly. Generally speaking, fuel tanks in ships and boats are subjected to just about the most serious corrosive conditions which can be imagined. These tanks are never pressed completely full because of the need to allow for expansion. When they have been emptied of fuel, they are filled with salt water ballast to provide stability. Flat surfaces and other regions which do not drain efficiently undergo rapid deterioration. The combined influence of the oil and water promotes this extreme corrosion, the high oxygen content of the oil being held mainly responsible along with the relatively high sulfur content, particularly of Mideast crudes and high distillates and diesel fuel. Steaming out of the tanks aggravates these conditions by loosening the scale and increasing the chloride-ion concentration at the higher temperatures involved.

BILGES, VOIDS, AND INACCESSIBLE INTERIOR SPACES

In order to provide a clear picture of the magnitude of the problem in these areas, some background should be presented. The author has been directly concerned with shipboard maintenance throughout his career, and has never seen a vessel where exterior hull corrosion has progressed to the point of endangering the vessel. However, he has repeatedly seen vessels whose exterior appearance, underwater body, and visible interior regions looked good to excellent which were found to be both unsafe and unsound after a thorough inspection of voids, bilges, and inaccessible interior space. He has witnessed the renewal of over 2 million pounds of shell plating, longitudinals, frames, and other structural members of which over 95 percent was caused by serious internal corrosion. Needless to say, the lighter the scantlings, the more serious this deterioration becomes. And despite the seriousness of the problem, these areas have actually received less attention than any other corrosion problems aboard ship.

Adequate maintenance of bilges is handicapped by the shape and type structure, the fact that they are out of sight, that maintenance of the areas is considered an operator's job with an operator's priority, and the area is almost always wet. The shapes of ship's hulls ordinarily dictate that the bilge will be a polyhedral shape with design considerations overriding any maintenance thoughts. Because the hull must withstand severe dynamic loading, it must be relatively rigid which requires structural keel, web frames, longitudinals, and bulkheads. Since the loading is in multiple directions, these members are usually channels, T-bars, flanged plate, angles and bulb angles. Once these members are installed, it is extremely difficult to reach the underside of T-bars, angles, and channels with surface preparation or coating, especially considering that space is almost always at a premium. (See fig. 3.)

APPEARANCES ARE DECEPTIVE

A bilge area which looks to be in an excellent state of preservation when viewed from above is often in a very advanced state of deterioration. Moreover, this space is always damp and often very wet indeed. Drainage is ordinarily provided by means of limber holes through the structural members to an eductor foot valve or bilge pump suction strainer. Unfortunately, the trim of the ship is not constant and changes with the motion of the vessel and with its loading. Oftentimes, therefore, the drainage suction is not located advantageously for the conditions existing at the time of pumping. Secondly, some water must always remain unless wiped up by hand or scooped out, since there must be some clearance between the eductor foot valve or bilge pump suction foot valve. It should also be borne in mind that this interior area is completely below the waterline. Except in the unlikely event that the water temperature is at or very near the interior ambient temperature, condensation of the entire area will be very heavy.

Such a condition is not conducive to effective surface preparation and coatings application. Therefore, many operators repeatedly report, "We can't do anything about that until we get in drydock." Then, while the vessel is in drydock, higher priority items (at least to the operator's mind) take precedence and the deterioration accelerates. Figures 3, 4, and 5 show the results of this procrastination and ineffective protection. In justice to the operator, it should be mentioned that he is under considerable pressure to maintain a "presentable" topside appearance. Since his topside rapidly deteriorates, he puts all available manpower on that which can be seen, and treats the bilges as "out of sight and out of mind." He has some justification in this feeling, too, since new and improved maintenance materials and methods keep flowing for underwater body and topside areas, but the same old red lead system is still standard for his bilges.

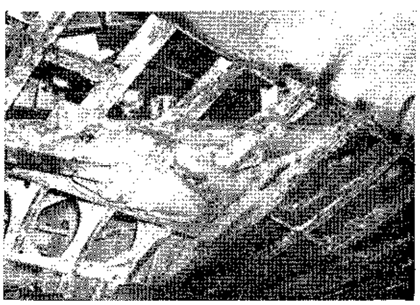

Figure 4. Deteriorated shell, bounding bars, sight edges and frames

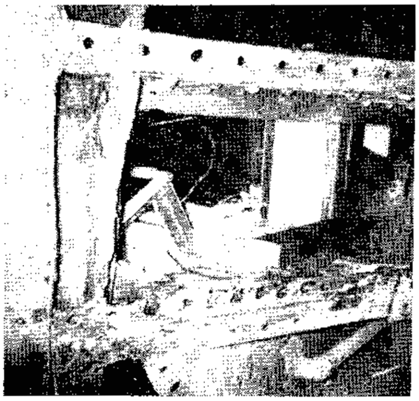

Figure 5. Deteriorated frames, sight edges and structure.

VOIDS

Voids are small, usually sealed compartments normally used to isolate fuel tanks from water tanks, water tanks from ships's shell, etc. They are usually very deep and narrow. The only normal access is a bolted manhole plate very time consuming to remove. Result: it is almost never removed unless it is suspected that an adjoining tank is leaking. These compartments are, of course, completely out of sight and any coating system which is effective would be quite useful even if its appearance were unsatisfactory. Yet, even today vessels continue to be built with voids coated with a wash primer and oil-based, air-drying, red lead. They are usually next seen when the plating is renewed.

INACCESSIBLE INTERIOR SPACES ABOVE THE HOLD

In many ways, these areas are the most insidious of all. They are so close to areas used daily and are so taken for granted that real inspection is seldom made until the structure is damaged beyond recall. And, indeed, in most ships, they cannot be inspected without costly destruction of hull insulation, built-in furniture, and removal of equipment, so that a calculated risk is often the way of sound economics. To properly appreciate this problem it must be understood that the living areas, galleys, mess decks, ship control spaces, etc., are like the bilge areas, neither square nor rectangular but must necessarily follow the shape of the ship's hulls. On the other hand, bunks, wardrobes, tables, and chairs and various electronic equipment are usually of conventional shapes.

ARRANGEMENT PROBLEMS

Since space is always at premium, these units usually have to be placed near to the shell or to bulkheads. The irregular shape of the hull leaves open areas inaccessible to cleaning which, if not covered with sheathing or fitted boundaries, would become receptacles of refuse and trash. Therefore, it is normally the practice to fair these items of furniture and fixtures into the ship's shell and to the bulkheads. And, again, due to operator's desires, these fairing pieces are often austenitic stainless-steel plates. This leaves a void space between the now built-in furniture and the shell wherein deterioration begins almost immediately. To make use of available space, officers' berths, and most crews' berths on merchant vessels, are fitted with two storage drawers underneath and the entire berth fixture presents a closed appearance all the way down to the deck. Even with the drawers removed, the vertical height is so small and the horizontal deck distance so great that no effective deck maintenance can be performed without physical removal of the bunk. Moreover, the deck may very well actually be a tank top so that rapid deterioration is taking place on both sides of the plate. These are examples of a problem which has endless ramifications and the examples are by no means all inclusive.

GREATEST SINGLE CAUSE OF CORROSION

One of the greatest single causes of corrosion of the interior vessel is the unseen damage which continues to occur under hull insulation. (See fig. 6.) Requirements for hull thermal insulation aboard ship require maximum barrier to thermal conductivity in a covering of very lightweight and of small size, fire retardancy, and reasonable immunity to mechanical damage. Every attempt would be made to have as thorough a vapor barrier material as possible after meeting the above requirements. Although cork sheets have been used in the past, and still are in icebreakers and other Arctic vessels, for their superior thermal properties, its very great fire hazard has almost completely removed it from general use. Areas where condensation protection rather than thermal insulation is the problem are often covered with expanded vermiculite if appearance is not a consideration. But well over 95 percent of all hull thermal insulation is Fiberglass board with an inner face of hardened and treated fibrous glass cloth.

Unfortunately, although this is a highly fire-retardant thermal barrier which is itself noncorrosive and verminproof, it is a very poor vapor barrier material and the fittings required to secure it are not noncorrosive. It is also expensive to install, requiring laborious cutting and fitting, spot welding of studs for retainers, and maximum surface preparation for the adhesive. The only real protection for the shell plating behind it is the use of a fairly effective corrosion-resisting adhesive. Because of the expense of renewal, sections are very rarely cropped out for inspection of the hull plating.

Normally, insulation is removed from the shell only for correction of mechanical damage to the insulation batt itself or when it becomes waterlogged and hangs free on its studs from the shell or overhead. In almost every case of the latter, which incidentally is quite common, extensive corrosion of the steel or aluminum is evident and large-scale renewals are necessary. The longitudinal stiffener, as seen in figure 6, came to light only because of the need to renew the insulation.

Another similar problem is that of steel deck corrosion and deterioration under deck coverings. A wide variety of deck coverings is used, none of which is probably the best for the purpose but is the best compromise obtainable for an effective covering within acceptable weight and fire-retardancy requirements. Generally speaking, these consist of nonslip trowel-on coverings in showers and wet spaces, cloth particle pressure sensitive treads, vinyl asbestos tile in living spaces, quarry tile in galleys, and rubber matting in front of switchboards. As can be seen from this list, all except the rubber matting, which is simply laid down, depend on the adhesive, the grout, or the topcoat sealer to prevent water entering between the steel deck and the deck covering. This in turn presupposes first-rate workmanship and materials on application, and extensive inspection and maintenance on the part of the ship's force. Since this happy combination seldom occurs, deterioration of steel decks

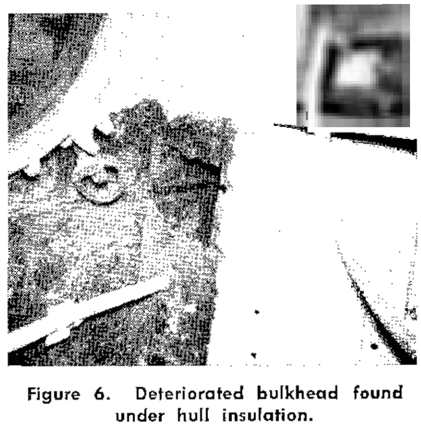

Figure 6. Deteriorated bulkhead found under hull insulation.

under the covering, particularly in washrooms, showers, and galleys, is not uncommon.

Mr. J. M. Van Orden, terminals manager of Matson Steamship Co., laid the big problem on the line to the Naval Architects when he said: "It is my considered opinion that the naval architect and designer must keep one question in mind at all times when designing a vessel and that is, 'Will this item be easy to maintain; or will it require constant replacement or continual expenditure of labor and money to keep it in efficient and safe condition?' "

Unfortunately, the naval architect is in such a rapidly changing field and his first interests are seldom concerned with corrosion problems that he most often overlooks those very areas where major reduction of hull maintenance expense could be accomplished easily. For example, the classic requirements for primers in all the interior areas listed above are still red lead for steel and zinc chromate for aluminum. Only when ship and boat designers know with certainty what coatings are actually an improvement, and only when information on these improved coatings is presented fully, including cost data, will the marine field begin to have more effective protective measures. Of course, protective coatings alone are not enough. Materials selection, design factors, and more effective day-to-day maintenance are continuing urgent needs.

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"SHOELESS" JOE JACKSON

When I was very small there were tales oft told of a baseball player with the descriptive name of "Shoeless" Joe Jackson; it appears that this gentleman performed his "on-the-job" duties without footgear, and this in an era when spike users were rampant on the base paths. Now there are numerous jobs and occupations in this world where commonsense and ordinary self-preservation require not only the wearing of shoes but the wearing of safety shoes; you and I both know most of the jobs—they range from logger to lineman and swamper to ship's superintendent. Yet, you and I also know too many men who should wear safety shoes but don't. These men, obviously, are intent on having their names go down in folklore—not as "Shoeless" Joe but as "Toeless" Tom.

A recent survey, according to the American Factor's, Ltd., "Safety Bulletin," has developed the "reasons" why men will not wear safety shoes.

The most frequently voiced "reasons" are listed below, together with the true facts which belie them:

Gripe: "Safety shoes hurt my feet."

Fact: Not if they are properly fitted.

Gripe: "They're too heavy."

Fact: Each steel toecap weighs only slightly more than the ordinary fiber cap in any shoe—about as much as a pair of glasses or a wristwatch.

Gripe: "The steel toecap makes my feet cold!"

Fact: Safety shoes have a layer of insulation between the steel cap and the toes, protecting against both cold and heat.

Gripe: "The steel cap covers only two or three toes anyway!"

Fact: 75 percent of all toe fractures happen to the first and second toes. And the steel cap takes the load and often protects the other toes, too.

Gripe: "If something heavy crushed the steel cap, the edges would cut off toes!"

Fact: Anything that heavy would crush the toes anyway. Except for steel toecaps, injury to toes would be greater.

Gripe: "I don't handle heavy stuff so why should I wear safety shoes?"

Fact: Toe injuries often are caused when something falls off a shelf or is dropped by another worker. And even a small object dropped from a height can injure your toes.

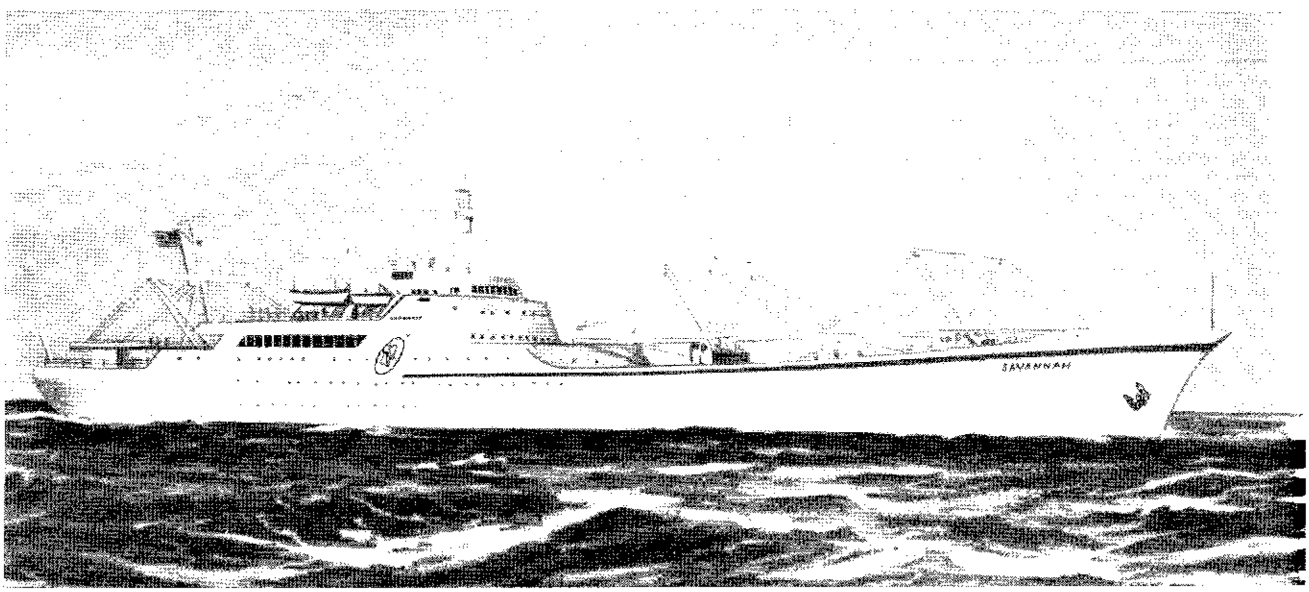
Gripe: "Safety shoes cost too much!"

Fact: The most popular styles available cost around $10 a pair—no more than any good work shoe. And the toe protection costs little or nothing.

Gripe: "They aren't good looking!"

Fact: Safety shoes are available in work and dress models and look as good as any other shoe—some even are good looking enough to wear to church on Sunday.

In view of the above facts, it is difficult to understand why any one would run the risk of a serious toe injury that could cripple him for life.



SAFETY CONTROL—NS *SAVANNAH*

By Capt Gaston R. DeGroote

Master, NS *Savannah*, States Marine Lines, Inc., Camden, N.J.

IT WOULD BE SUPERFLUOUS to discuss here the conventional safety features of the NS *Savannah*, which are similar to those found in any modern vessel built in the United States. Reference to radiation safety measures (those designed to protect the health and well-being of personnel) will also be limited.

My discussion deals with safety as demonstrated in the construction of the *Savannah's* nuclear system, and in the controls which assure safe operation of the reactor plant. My remarks will be of a semitechnical nature rather than a presentation of safety ideas or results.

It should be noted at this point that the systems I shall describe were determined to be necessary, not just for this type of reactor, but for this specific reactor, installed in the *Savannah*. Different reactor types that may be used in future ships may or may not require these particular safeguards. Similarly, advanced concepts of the pressurized water reactor itself could call for completely different methods of control.

It should also be noted that in this project the Government has an active upgrading program in continuous operation, whereby we hope to simplify equipment and controls as much as possible.

CHARACTERISTICS

The NS *Savannah* is a single screw passenger cargo vessel of advanced design. Her length overall is 595 feet 6 inches; her beam, 78 feet. She will draw 29 feet 6 inches, loaded. Her displacement is 22,000 tons, and her cruising speed is 20 knots. Maximum shaft horsepower is 22,000. There are accommodations for 60 passengers, who will also have the use of attractive dining and recreation facilities, including a swimming pool. The *Savannah* will require a crew of about 110. Some 9,400 tons of cargo can be carried in her 7 cargo holds.

Approximately amidships, abaft of No. 4 hold, is the reactor compartment. The nuclear reactor is the heart of the *Savannah's* propulsion system—it can take her 14 times around the world without refueling. The world's fossil fuels—oil, coal and gas—are ample for years to come, but are not inexhaustible. So we look to the atom for a new kind of fuel to meet future needs. In merchant shipping the prospect of nuclear power is extremely attractive because cargo capacity can be increased by eliminating the need for storing a large fuel supply.

It is important to point out that the *Savannah* is not expected to be economical at this time as compared to conventional ships. Instead, its purpose is to demonstrate to the world that the force of the atom can be harnessed and put to peaceful use for the benefit of all mankind. Also, to allow American steamship companies to observe the possibilities of nuclear power for future vessels, and thus to foster the growth of our American Merchant Marine.

Now let us look at the *Savannah's* nuclear plant. The reactor generates heat—which raises steam to run the turbine. Fuel is placed in the core of the reactor in a unit consisting of pellets of enriched uranium oxide encased in stainless steel tubes. A controlled nuclear reaction takes place, causing tremendous heat. Water is circulated around the hot fuel, carrying heat to a secondary water system in a heat exchanger. This secondary water supply, converted into steam, drives the turbine.

The reaction is controlled by 21 boron stainless steel control rods. When the reactor is shut down, all the rods are fully in place within the core, and neutrons released by the fuel are absobed by these rods. When the plant is started up these control rods are withdrawn, singly or in groups, and the number of neutrons available to split the atoms in the uranium is increased.

CONSTRUCTION

The *Savannah's* reactor system was designed and constructed with safety as a paramount consideration. Under no circumstances will passengers or operating personnel be exposed to dangerous, uncontrolled radiation. Operation of the ship will not adversely affect any environment in which is located. The nuclear plant will be protected from almost any possible damage due to ship movements, at sea or in port. With this in mind, we first observe that the reactor core—where nuclear fission takes place—is sealed within a carbon steel pressure vessel with a wall 6½ inches thick, clad internally with stainless steel. This vessel is approximately 27 feet long and 8.2 feet in diameter.

The pressure vessel, in turn, is enclosed by primary shielding which consists of a steel and lead tank filled with water.

Next, there is a steel containment vessel which surrounds not only the core, the pressure vessel and its primary shield tank, but also most of the associated reactor systems, such as heat exchangers, pressurizer, pumps and related valves.

In addition the ship's hull is specifically designed to protect the containment vessel against damage from collision.

An egg crate structure of steel on the bottom protects the containment vessel from being pierced through grounding.

ABOUT THE AUTHOR

CAPTAIN GASTON R. DeGROOTE, who has recently been designated as Commodore of the States Marine Lines fleet, began his nautical career as a deck cadet at the age of 15. Since that time he has sailed 6 of the 7 oceans and entered some 75 world ports.

During World War II Captain DeGroote participated in numerous Atlantic convoys. In 1950, while in command of the SS *Kelso Victory*, he participated in the evacuations of Hungnam and Inchon, Korea.

The Commodore has been associated with States Marine Lines since 1947. He has received extensive training in the field of nuclear propulsion and presently is Master of the world's first nuclear powered merchant ship, the NS *Savannah*.

A concrete wall 4 feet thick surrounds the containment vessel and serves as part of the secondary shield. As a cushion against damage there is a special resilient collision mat which lines the sides of the compartment in which the containment vessel is located. It consists of alternate layers of redwood and steel, and is 2 feet thick.

There are sway brackets, designed to support the containment vessel in the event that the ship is rolling or pitching. This possibility has been further dealt with by installing the latest type stabilizers which function to reduce the "roll" of the ship.

The upper portion of the containment vessel is provided with a lead and polyethelene shield. Finally, the base of the compartment has an insulating water shield.

This adds up to approximately 2,400 tons of steel, lead, concrete and polyethelene which comprise the secondary radiation shield for protection of the ship's personnel from harmful radiation.

A complex system of instruments constantly monitor reactor performance, as well as operation of the pressurizer, pumps, and other parts of the plant. These instruments transmit signals to a main control panel, and also to the automatic safety and control systems.

SAFETY SYSTEMS

The safety system is designed so that if conditions develop which could be hazardous to the reactor or to personnel the reactor will immediately and automatically shut down. To do this, all control rods which have been withdrawn are returned to their original position in the core, instantly stopping the fission process. At the same time there also are visible and audible alarms.

This automatic shutdown is accomplished by either of two methods, depending upon the type of emergency—one called scramming and the other called fast insertion.

In a scram action, it takes only 8/10 of a second for hydraulic activators to insert all withdrawn rods into the core.

In the case of fast insertion, electric drives are used, taking a maximum of about 4 minutes.

Either a fast insertion or a scram signal overrides all control signals, manual or automatic. Once a scram is initiated it cannot be stopped by the operator. Fast insertion can be stopped by the operator by means of an override switch on the control console. A manually operated switch also permits the operator to cause a scram at any time.

There are two alarm panels and two amplifiers. All scram signals enter these panels. From there they are applied to safety amplifiers which will trip and release the scram action in the control rod system.

Now what are the conditions in the reactor plant which will activate the safety system for automatic shutdown? One condition would be an abnormal nuclear level—another condition could be nonnuclear, such as abnormal temperatures, pressures, and flow rates—items familiar to us in conventional marine power plants.

Nuclear conditions in the reactor are measured continuously by 10 measuring channels which cover the entire neutron flux range of the reactor. These channels receive their signals from 10 neutron detectors located in vertical wells around the shield tank of the reactor. There are at least 3 detectors for each of 3 power ranges—startup, intermediate, and operating power. Therefore, situations which would lead to an unsafe condition in the reactor at any power range are always monitored by at least 3 detectors and at times by 7 detectors.

During plant startup, an unsafe condition measured by any one of four detectors will scram the reactor. In the intermediate and power ranges, at least two detectors must signal an unsafe condition before a scram is initiated. This guards against shutdown caused by instrument failures, but still provides for maximum reliability and safety.

In addition to nuclear protection, the power plant is also instrumented to prevent unsafe conditions of a nonnuclear nature. This nonnuclear instrumentation is a network of standard reliable indicators, controllers, and equipment to provide information and to control the primary, secondary, auxiliary, propulsion, and ship services systems. The basis for design of the nonnuclear instrumentation is twofold: a) simplicty, and b) failsafe—that is, to fail to the more favorable nonoperating condition upon failure. Also, alarms are provided to indicate equipment or instrument conditions which would place the plant in an undesired operating condition.

Of course, the containment which encloses the nuclear portion of the plant must contain penetrations of piping and instrumentation cables. To keep these penetrations at a minimum we have converted many of our pneumatic controls to be electrical, using multiconductor cables for penetration, then reconverting to pneumatic control at the main control console. Thus, it is possible to have the more rapid response of a pneumatic system, and still maintain integrity of the containment design.

Both the nuclear and nonnuclear characteristics of the NS *Savannah* incorporate the latest and most reliable safety features known to the nuclear and conventional power industries today.

ENGINEERING TRAINING

A nuclear reactor, like a conventional plant, requires skillful operation by well trained personnel, therefore I would like to mention the training participated in by her deck and engineering officers. The 21 engineering officers, all handpicked by States Marine Lines, began their training in September 1958. This group successfully completed a 15-month course at Lynchburg College and in the field at such sites as Hanford, Washington; San Jose, California; and Idaho Falls, Idaho. Simulator training at Lynchburg in the summer of 1960 completed the field training. Following this training these officers joined the vessel at Camden where they are participating in equipment testing as the machinery is installed. In addition to being licensed by the United States Coast Guard as marine engineers, these men also successfully passed the reactor operators' 2-day written test required by the Atomic Energy Commission.

Six deck officers, all holding masters licenses, were selected to participate in training for the *Savannah*. Although this course was in less detail than that undertaken by the engineers, it was designed to provide a good appreciation and understanding of the limitations of the reactor.

It included schooling at Lynchburg and training at Argonne National Laboratory, Chicago; Taft Engineering Center, Cincinnati, Ohio; and the Damage Control School at Philadelphia, conducted by the United States Navy. After completing this 12-month course, the master, chief officer, and second officer were selected.

The *Savannah*, in addition to being equipped with the latest safety control devices, will be manned by the best trained personnel to be found on any merchant vessel in the world.

SAVANNAH DELIVERED
BUILDER TO BUYER

A BRIEF CEREMONY effecting delivery of the first nuclear powered merchant vessel from the New York Shipbuilding Corporation of Camden, N.J., to the Maritime Administration of the Commerce Department took place on May 7, 1962. Present at the ceremony which was held in the office of Captain J. P. German, USCG, Commanding Officer of the U.S. Coast Guard Reserve Training Center at Yorktown, Va., were (seated left to right) Commodore Gaston DeGroote, Ship's master, Dr. Marvin Mann, Manager, Nuclear Division, New York Shipbuilding Corp., Mr. R. A. Hinckley, Secretary, New York Shipbuilding Corp., Mr. J. C. Czudak, receiving delivery papers for the Maritime Administration, as Construction Representative, and Mr. H. Hanson, Superintendent of the States Marine Lines. Standing, (left to right) are Mr. George Keilman, Executive Assistant, New York Shipbuilding Corp., Mr. C. A. West, Maritime Administration, Commerce Department, Mr. T. M. Christian, Operations Representative, Maritime Administration, Mr. W. F. Long, Site Representative, Babcock and Wilcox Company and Mr. W. F.. Beckwith of the American Bureau of Shipping. The *Savannah* has been berthed at the Coast Guard Training Center for sea trials since February 1962.

TAKE TIME TO BE SAFE

"Through the last minute of his life he spent 10 seconds thinking about how long it was to lunch, 30 seconds about an imagined grievance, and 20 seconds about getting the job over with as soon as possible. Not one second of thought was given to safety. Then the accident occurred which cost him his life and robbed him of the ability to think of anything. When it is too late, we can always see many reasons why we should have been more alert, more observant and more careful. Ten seconds devoted to visual safety check may have resulted in 40 years more life.

"How much time have you got, friend? Have you got 10 seconds or 3 to 6 months? Ten seconds now to check for safety hazards, or 3 to 6 months lying in a bed or cast? The decision is really yours, you know.

"A safety program is no more effective than the people who are in it. Since every working individual participates in the Safety Program, this simply means that it is no better than the most negligent person working. We pay a price for everything; money for food, clothing, shelter, and entertainment; diligence and care for job safety and anything from a bruise or cut to loss of a limb or eye for lack of safe practices."

—*"Safety Review"*

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A centralized engineering control for steam-powered vessels was recently unveiled by the Westinghouse Electric Corporation. The system operator would occupy a suspended-in-air heat and humidity controlled cubicle located in the engineroom. Advantages of the system are claimed to include improved control and inspection, increased safety, and a reduction in required personnel.

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A contract for a study to determine whether or not nautical charts are meeting the needs of the mariner was recently awarded by the Coast and Geodetic Survey. The study will include a survey of chart users to determine their needs and an evaluation of the current state of the nautical charting art.

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The Marine Exchange of Los Angeles-Long Beach Harbor, Inc., recently reported the arrival of the 200,000th vessel since that agency opened in 1923. The tally includes only oceangoing, self-propelled vessels, and excludes arrivals during World War II when the exchange was closed.

MARITIME SIDELIGHTS

The demilitarized aircraft carrier *Chenango* recently departed New York Harbor on a voyage to a shipbreaker's yard and the end of a distinguished career. The 553-foot vessel started her career in 1939 as the tanker *Esso New Orleans* and was converted to an aircraft carrier a year and a half later.

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The conversion of two C–4 freighters into trailerships is nearing completion at Todd Shipyard's Seattle facility. The vessels, the *New Orleans* and the *Mobile,* will be operated by the Waterman Steamship Corp, between U.S. Gulf ports and San Juan. Each ship can carry 166 35-foot trailer bodies and will additionally have 435,000 cubic feet for conventionally stored general cargo.

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The Coast Guard icebreaker, *Eastwind* has been designated to participate in Navy Antarctic Operation Deep Freeze 63 and is scheduled to sail from Boston so as to arrive at Port Lyttleton, New Zealand in the middle of October 1962. It is expected that the *Eastwind* will return to Boston about 1 May 1963.

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The *Esso Jacksonville* left Humble Oil & Refining Company's Baytown refinery May 28 with the largest load of specialty products ever shipped to a foreign port in a Humble tanker. She carried 22,000 tons of lube oils and 1,000 tons of solvent on a voyage to Karachi, Pakistan, and Bombay, India.

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The 13,100 ton *American Charger* was recently launched at Newport News, Va. The 560-foot, 20-knot vessel is owned by United States Lines and is reputed to be the fastest freighter ever designed for the North Atlantic trade.

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Construction of a 4,000-ton multiple-cargo tanker was recently ordered by Sinclair Refining Co., Inc. The vessel will have a retractable wheelhouse permitting passage under the Chicago River Bridges on her intended Great Lakes-Chicago route.

LIFESAVING MEDAL AWARDED

MR. HAROLD PERNULA has received the Gold Life Saving Medal at special ceremonies held at Cordova, Alaska.

The award was presented by Rear Adm. C. C. Knapp, Commander of the 17th Coast Guard District, on behalf of the Secretary of the Treasury and the Commandant of the Coast Guard.

In awarding the Medal, Admiral Knapp said, "The fishing vessel *Barbara Lee*, on which you were serving as a crew member, was capsized by a freak breaker near Gray's Harbor, Westport, Washington, on the afternoon of January 28, 1960. After you extricated yourself from the vessel and surfaced, you observed your captain, without a life jacket, clinging to the mast, in an apparently dazed condition. Locating a plank you swam to your captain, and with great exertion, attempted to hold him on the plank, but a large breaker tore him from your grasp. Exhausted from your strenuous efforts, you were pulled aboard a lifeboat in a semi-conscious state. Your gallant efforts to save the captain of the *Barbara Lee* were in accordance with the highest tradition of the sea."

On June 1, 1962, the U.S. privately owned merchant fleet of 1,000 gross tons or over totaled 985 vessels with a deadweight of 14,383,000 tons, composed of 34 passenger combination vessels of 303,000 deadweight tons (481,000 gross), 625 dry cargo vessels of 7,083,000 deadweight tons, and 326 tankers of 6,997,000 deadweight tons.

Launching of the largest hydrofoil vessel ever built in this country was recently announced. The 90-ton *Denison,* developed by the Grumman Aircraft Engineering Corporation and built at Takobson's Shipyard in Oyster Bay, will be used to investigate the capabilities of hydrofoil vessels on the open sea.

nautical queries

DECK

Q. (a) When the seamen of a merchant vessel sign articles, how do they agree to conduct themselves?

(b) What does the articles stipulate must be done in the event of embezzlement or willful or negligent destruction of any part of the vessel's cargo or stores?

A. (a) When the seamen of a merchant vessel sign articles they agree to conduct themselves in an orderly, faithful, honest, and sober manner, and to be at all times diligent in their respective duties, and to be obedient to the lawful commands of the said Master, or of any person who shall lawfully succeed him, and of their superior officers, in everything relating to the vessel, and the stores and cargo thereof, whether on board, in boats, or on shore.

(b) The articles stipulate as follows, "And it is hereby agreed, that any embezzlement or willful or negligent destruction of any part of the vessel's cargo or stores shall be made good to the owner out of the wages of the person guilty of the same."

Q. A crack appears on an internal bulkhead of a vessel at sea. What measure could you take to stop the crack from continuing to lengthen?

A. To stop a crack in plate from lengthening, the crack should be carefully examined and the terminations or ends determined. These ends should then be drilled. The round hole tends to distribute the stress around its periphery and thus prevent the crack propagating further.

Q. A cargo of gasoline has a coefficient of expansion of .0006 per degree Fahrenheit. If this cargo is loaded at a temperature of 60° F., and cargo temperatures up to 74° F. are anticipated on the voyage, how many barrels would you leave out in a tank whose capacity is 10,000 bbls., in order to allow for expansion?

A. $.0006 \times (74° - 60°) = .0084$

$.0084 \times 10{,}000 = 84$ bbls. to be allowed for expansion

The above solution is the one in general use. A somewhat more refined solution would be:

$$\frac{10{,}000}{1.0084} = 9916.7$$

83.3 bbls to be allowed for expansion

ENGINE

Q. If the thermostatic expansion valve in a refrigeration system did not appear to function properly, you would suspect the cause to be:

(a) Foreign matter in the valve
(b) Ruptured control bulb tubing
(c) Moisture in the system
(d) All of the above
(e) None of the above

A. (d) All of the above

Q. Density of a brine solution in a refrigeration plant is measured by:

(a) Litmus paper
(b) Chemical test
(c) Hydrometer
(d) Either (a) or (b)
(e) Either (b) or (c)

A. (c) Hydrometer

Q. What materials are usually used to insulate low temperature spaces; high temperature spaces?

A. For low temperatures cork or rock wool is usually used.

For high temperatures basic minerals are used, such as asbestos, carbonate of magnesia, diatomaceous earth, mica, aluminum foil, and fibrous glass.

Q. Describe the original tests made upon new arc- or gas-welded pressure vessels.

A. Arc- or gas-welded vessels which have been both stress-relieved and radiographed shall be hydrostatically tested to not less than 1½ times the maximum allowable pressure for a sufficient time to permit an inspection of all joints and connections. Welded vessels which have not been stress relieved and radiographed shall be given a thorough hammer or impact test and following the hammer test, the vessels shall be hydrostatically tested to 1½ times the maximum allowable pressure.

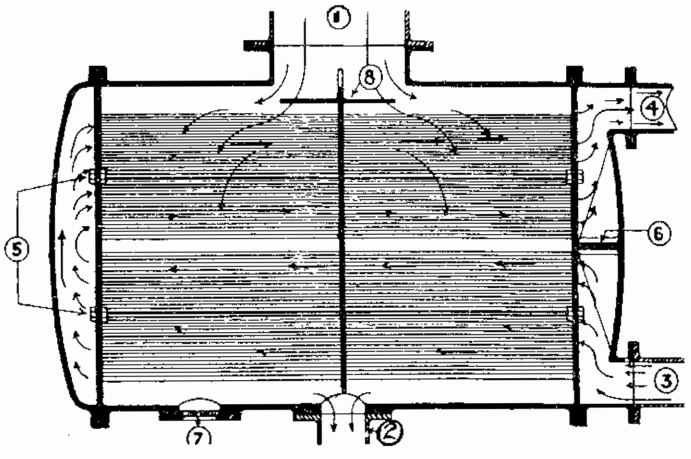
Q. What welders are allowed to make repairs to a boiler?

A. Only welders who have been examined and certified as to their qualifications by an Inspector of the U.S. Coast Guard, American Bureau of Shipping, or the Bureau of Ships of the Navy Department, and hold a certificate which is still in force.

SURFACE CONDENSER

Q. Sketch a longitudinal cross-section view of a surface condenser. Indicate the water flow by arrows and identify each part.

1. Exhaust pipe to condenser.
2. Air pump suction.
3. Inlet from circulating pump.
4. Condensing water discharge.
5. Stays.
6. Division plate.
7. Hand hole.
8. Steam baffle.



MERCHANT MARINE PERSONNEL STATISTICS

MERCHANT MARINE OFFICER LICENSES ISSUED

QUARTER ENDING 30 JUNE 1962

DECK

Grade	Original	Renewal
Master:		
Ocean	41	429
Coastwise	10	43
Great Lakes	2	20
B.S. & L.	24	100
Rivers	7	67
Radio officer licenses issued	13	96
Chief mate:		
Ocean	33	93
Coastwise		3
Mate:		
Great Lakes	2	
B.S. & L.	4	7
Rivers	4	57
Second mate:		
Ocean	42	104
Coastwise		

Grade	Original	Renewal
Third mate:		
Ocean	103	92
Coastwise		
Pilots:		
Great Lakes	2	21
B.S. & L.	68	18
Rivers	114	57
Master: Uninspected vessels	13	20
Mate: Uninspected vessels	3	5
Motorboat operators	436	1,047
Total	921	2,279
Grand total	3,200	

ENGINEER

Grade	Original	Renewal
STEAM		
Chief engineer:		
Unlimited	29	485
Limited	5	110
First assistant engineer:		
Unlimited	42	142
Limited	2	15
Second assistant engineer:		
Unlimited	53	175
Limited		2
Third assistant engineer:		
Unlimited	120	228
Limited		1
MOTOR		
Chief engineer:		
Unlimited	12	94
Limited	45	138

Grade	Original	Renewal
MOTOR—continued		
First assistant engineer:		
Unlimited	1	8
Limited	18	16
Second assistant engineer:		
Unlimited	2	15
Limited	1	1
Third assistant engineer:		
Unlimited	92	97
Limited	2	1
Chief engineer: Uninspected Vessels	11	7
Assistant engineer: Uninspected Vessels	6	7
Total	441	1,542
Grand Total	1,983	

WAIVER OF MANNING REQUIREMENTS

Waivers	Atlantic coast	Gulf coast	Pacific coast	Great Lakes	Total
Deck officers substituted for higher ratings					
Engineer officers substituted for higher ratings					
Ordinary seaman for able seamen					
Wiper or coalpassers for qualified member engine department					
Total waivers					
Number of vessels					

INVESTIGATING UNITS

Coast Guard Merchant Marine Investigating Units and Merchant Marine Details investigated a total of 4,259 cases during the second quarter of 1962. From this number, hearings before examiners resulted involving 53 officers and 227 unlicensed men. In the case of officers, 0 license was revoked, 5 were suspended without probation granted, 21 were suspended with probation granted, 9 cases were dismissed after hearing, and 10 were closed with admonition. Of the unlicensed personnel, 17 documents were revoked, 13 were suspended without probation granted, 97 were suspended with probation granted, 19 cases were dismissed after hearing, and 17 hearings were closed with admonition. Nineteen licenses and 131 documents were voluntarily surrendered.

ORIGINAL SEAMEN'S DOCUMENTS ISSUED

Type of document	Atlantic coast	Gulf coast	Pacific coast	Great Lakes and rivers	Total
Staff Officer	48	8	24	6	86
Continuous Discharge Book	3	7			10
Merchant Mariner's Documents	1,364	611	895	1,234	4,104
AB any Waters unlimited	120	34	48	39	241
AB any waters, 12 months	35	32	21	34	122
AB Great Lakes, 18 months	4		8	17	29
AB Tugs and Towboats, any waters		1	4		5
AB Bays and Sounds	1				1
AB Seagoing Barges					0
Lifeboatman	104	5	38	11	158
QMED	124	51	55	46	276
Radio Officer	2	2	4		8
Certificate of service	1,282	578	843	1,185	3,888
Tankerman	25	50	16	48	139
Total	3,112	1,379	1,956	2,620	9,067

AMENDMENTS TO REGULATIONS

Title 46—SHIPPING

Chapter I—Coast Guard, Department of the Treasury

SUBCHAPTER E—LOAD LINES

[CGFR 62–22]

PART 43—FOREIGN OR COASTWISE VOYAGE

Subpart 43.30—Load Lines for Tankers

FREEBOARD TABLE FOR TANKERS

Pursuant to the notice of proposed rule making published in the Federal Register on January 23, 1962 (27 F.R. 657–665), and the Merchant Marine Council Public Hearing Agenda, dated March 12, 1962 (CG–249), the Merchant Marine Council held a Public Hearing on March 12, 1962, for the purpose of receiving comments, views, and data. The proposals considered were identified as Items I to IX, inclusive. The proposal "freeboard for tankers above 600 feet in length" was in Item V, entitled "Tank Vessels" (CG 249, pages 196 and 197).

A number of comments were received requesting the proposals be revised to incorporate the 1959 recommendations of the United States Committee on Load Lines. These comments were rejected because their acceptance would, in principle, violate the 1930 Load Line Convention. Rule CVI of Annex I to the 1930 International Load Line Convention sets forth the basic freeboard for tankers up to and including 600 feet in length and provides that "Ships above 600 feet in length are to be dealt with by the Administration." These revised freeboards are considered to represent the maximum reductions in freeboard which are possible prior to modification of the present Load Line Convention. Accordingly, the proposal is adopted without change.

This document is the fifth of a series covering the regulations and actions considered at March 12, 1962, Public Hearing and annual session of the Merchant Marine Council. The amendment to Table 43.30–70(a) in 46 CFR 43.30–70(a) permits the maximum drafts for tankers consistent with obligations for compliance with the 1930 Load Line Convention and with safety.

By virtue of the authority vested in me as Commandant, United States Coast Guard, by Treasury Department Order 120 dated July 31, 1950

(15 F.R. 6521), and the authority in Title 46, U.S. Code, sections 85a and 88a, the following amendment revising Table 43.30–70(a) in § 43.30–70 (a) is prescribed and shall become effective on and after the date of publication of this document in the Federal Register:

§ 43.30–70 Freeboard table for tankers.

(a) * * *

TABLE 43.30–70(a)—BASIC MINIMUM FREEBOARD FOR TANKERS

L (feet)	Freeboard (inches)	L (feet)	Freeboard (inches)
190	21.5	600	108.4
200	23.1	610	110.1
210	24.7	620	111.7
220	26.3	630	113.1
230	28.0	640	114.5
240	29.7	650	115.9
250	31.5	660	117.3
260	33.3	670	118.6
270	35.2	680	119.9
280	37.1	690	121.2
290	39.1	700	122.5
300	41.1	710	123.7
310	43.1	720	124.9
320	45.1	730	126.1
330	47.1	740	127.3
340	49.2	750	128.5
350	51.3	760	129.6
360	53.5	770	130.7
370	55.7	780	131.8
380	57.9	790	132.9
390	60.2	800	134.0
400	62.5	810	135.1
410	64.9	820	136.2
420	67.4	830	137.2
430	69.9	840	138.2
440	72.5	850	139.2
450	75.1	860	140.1
460	77.7	870	141.0
470	80.2	880	141.9
480	82.7	890	142.8
490	85.1	900	143.7
500	87.5	910	144.5
510	89.8	920	145.3
520	92.1	930	146.1
530	94.3	940	146.9
540	96.5	950	147.7
550	98.6	960	148.5
560	100.7	970	149.2
570	102.7	980	149.8
580	104.6	990	150.4
590	106.5	1,000	151.0
		(1)	(1)

1 Vessels above 1,000 feet are to be dealt with by the Administration.

(Sec. 2, 45 Stat. 1943, as amended, sec. 2, 49 Stat. 88, as amended; 46 U.S.C. 85a, 88a. Treasury Department Order 120, July 31, 1950, 15 F.R. 6521)

Dated: July 23, 1962.

[SEAL] E. J. ROLAND,
Admiral, U.S. Coast Guard, Commandant.

[F.R. Doc. 62–7372; Filed, July 26, 1962; 8:47 a.m.]

EQUIPMENT APPROVED BY THE COMMANDANT

[EDITOR'S NOTE.—Due to space limitations, it is not possible to publish the documents regarding approvals and terminations of approvals of equipment published in the Federal Register dated July 24, 1962 (CGFR 62–18). Copies of these documents may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.]

ARTICLES OF SHIPS' STORES AND SUPPLIES

Articles of ships' stores and supplies certificated from 1 July to 31 July 1962, inclusive, for use on board vessels in accordance with the provisions of Part 147 of the regulations governing "Explosives or Other Dangerous Articles on Board Vessels" are as follows:

CERTIFIED

Magnus Chemical Co., Inc., Garwood, N.J.:

Certificate No. 324, dated 2 July 1962, MAGNUS AUTOMATIC TANK WASH.

Certificate No. 326, dated 2 July 1962, MAGKLEEN #1.

Certificate No. 329, dated 2 July 1962, MAGNUS DEGREASER 7–11.

Certificate No. 330, dated 2 July 1962, MAGNUS FUEL OIL TREATMENT.

Certificate No. 331, dated 2 July 1962, MAGNUS LUBRIFIN.

Certificate No. 333, dated 2 July 1962, MAGNUS SUPER SCALE SOLVE.

Certificate No. 352, dated 2 July 1962, MAGNUS FUEL OIL TREATMENT SPECIAL.

Maritec Corp., 42 Broadway, New York 4, N.Y.:

Certificate No. 530, dated 2 July 1962, TEX-MAR (ELECTRICAL PARTS CLEANER).

Certificate No. 531, dated 9 July 1962, MAR-KLEEN (ELECTRICAL PARTS CLEANER).

Polymer Coatings, Inc., 1417 Sheridan St., Camden 4, N.J., Certificate No. 532, dated 12 July 1962, DIRT-RID.

AFFIDAVIT

The following affidavit was accepted during the period from 15 June 1962 to 15 July 1962:

Boston Electro Steel Casting, Inc., 53 Gerald St., Boston 19, Mass., FITTINGS AND CASTINGS

FUSIBLE PLUGS

The regulations prescribed in Subpart 162.014, Subchapter Q Specifications, require that manufacturers submit samples from each heat of fusible plugs for test prior to plugs manufactured from the heat used on vessels subject to inspection by the Coast Guard. A list of approved heats which have been tested and found acceptable during the period from 15 June 1962 to 15 July 1962 are as follows:

H. B. Sherman Manufacturing Co., Battle Creek, Mich., HEAT NOS. 826, 827, 829 & 830.

The Lunkenheimer Co., Cincinnati 14, Ohio, HEAT NOS. 661, 662, 663 & 664.

TOO SHORT FOR SAFETY

Recently, at an east coast port, a longshoreman fell from the lower 'tween deck to the lower hold when a too-short hatch cover board gave way beneath his weight. Another "short" cover board was also dislodged and a serious injury resulted. This casualty is noteworthy because the use of a simple safety device might have avoided it.

The vessel concerned was equipped in the 'tween-deck space with a hatch cover divided into four sections, but the sections were not of the same length. When conditions are such that hatch cover boards of varying lengths are being used at one hatch, it is considered good safety practice to paint an unbroken line across the hatch cover boards when all are in the proper place. By this means only a glance is necessary to indicate to the observer when any boards are out of position or have been replaced by others that have not been inspected. Regulations require that each hatch cover board must rest on at least 2½ inches of bearing surface on the hatch beam flanges.

In this case, the hatch was adequately illuminated, but a number of defective hatch covers had been replaced in a foreign port by a local supplier, and the replacement boards varied as much as 2 inches from the required length. Also, when the replacement boards were first put on the hatch, they had not been marked.

Good seamanship and good safety practices are generally to be found together. In the present case, both were conspicuous by their absence.

MERCHANT MARINE SAFETY PUBLICATIONS

The following publications that are directly applicable to the Merchant Marine are available and may be obtained upon request from the nearest Marine Inspection Office of the United States Coast Guard. The date of each publication is indicated in parentheses following its title. The dates of the Federal Registers affecting each publication are noted after the date of each edition.

CG No.	TITLE OF PUBLICATION
101	Specimen Examination for Merchant Marine Deck Officers (7–1–58).
108	Rules and Regulations for Military Explosives and Hazardous Munitions (8–1–58).
115	Marine Engineering Regulations and Material Specifications (2–1–61). F.R. 9–30–61.
123	Rules and Regulations for Tank Vessels (1–2–62). F.R. 5–2–62.
129	Proceedings of the Merchant Marine Council (Monthly).
169	Rules of the Road—International—Inland (5–1–59). F.R. 5–21–59, 6–6–59, 5–20–60, 9–21–60, 4–14–61, 4–25–61.
172	Rules of the Road—Great Lakes (5–1–59). F.R. 1–7–60, 3–17–60, 5–20–60, 9–21–60, 4–4–62.
174	A Manual for the Safe Handling of Inflammable and Combustible Liquids (7–2–51).
175	Manual for Lifeboatman, Able Seamen, and Qualified Members of Engine Department (9–1–60).
176	Load Line Regulation (9–1–61). F.R. 7–27–62.
182	Specimen Examinations for Merchant Marine Engineer Licenses (12–1–59).
184	Rules of the Road—Western Rivers (5–1–59). F.R. 6–6–59, 5–20–60, 9–21–60, 10–8–60, 12–23–60, 4–14–61, 4–25–61.
190	Equipment Lists (4–1–60). F.R. 6–21–60, 8–16–60, 8–25–60, 8–31–60, 9–21–60, 9–28–60, 10–25–60, 11–17–60, 12–23–60, 12–24–60, 5–2–61, 6–2–61, 6–8–61, 7–21–61, 7–27–61, 8–16–61, 8–29–61, 8–31–61, 9–8–61, 9–9–61, 10–18–61, 11–3–61, 11–18–61, 12–12–61, 2–9–62, 2–17–62, 3–15–62, 4–17–62, 4–25–62, 5–17–62, 5–25–62, 7–24–62.
191	Rules and Regulations for Licensing and Certificating of Merchant Marine Personnel (6–1–62).
200	Marine Investigation Regulations and Suspension and Revocation Proceedings (7–1–58). F.R. 3–30–60, 5–6–60, 12–8–60, 7–4–61, 5–2–62.
220	Specimen Examination Questions for Licenses as Master, Mate, and Pilot of Central Western Rivers Vessels (4–1–57).
227	Laws Governing Marine Inspection (7–3–50).
239	Security of Vessels and Waterfront Facilities (8–1–61). F.R. 12–12–61.
249	Merchant Marine Council Public Hearing Agenda (Annually).
256	Rules and Regulations for Passenger Vessels (1–2–62). F.R. 5–2–62.
257	Rules and Regulations for Cargo and Miscellaneous Vessels (3–2–59). F.R. 4–25–59, 6–18–59, 6–20–59, 7–9–59, 7–21–59, 9–5–59, 5–6–60, 5–12–60, 10–25–60, 11–5–60, 11–17–60, 12–8–60, 12–24–60, 7–4–61, 9–30–61, 10–25–61, 12–13–61, 5–2–62.
259	Electrical Engineering Regulations (12–1–60). F.R. 9–30–61, 9–23–61, 5–2–62.
266	Rules and Regulations for Bulk Grain Cargoes (5–1–62).
268	Rules and Regulations for Manning of Vessels (9–1–60). F.R. 5–5–61, 6–28–61, 12–16–61.
269	Rules and Regulations for Nautical Schools (3–1–60). F.R. 3–30–60, 8–18–60, 11–5–60, 7–4–61, 9–30–61, 12–13–61, 5–2–62.
270	Rules and Regulations for Marine Engineering Installations Contracted for Prior to July 1, 1935 (11–19–52). F.R. 12–5–53, 12–28–55, 6–20–59, 3–17–60.
293	Miscellaneous Electrical Equipment List (6–1–62).
320	Rules and Regulations for Artificial Islands and Fixed Structures on the Outer Continental Shelf (10–1–59). F.R. 10–25–60, 11–3–61, 4–10–62.
323	Rules and Regulations for Small Passenger Vessels (Not More Than 65 Feet in Length) (6–1–61).
329	Fire Fighting Manual for Tank Vessels (4–1–58).

Official changes in rules and regulations are published in the Federal Register, which is printed daily except Sunday, Monday, and days following holidays. The Federal Register is a sales publication and may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C. It is furnished by mail to subscribers for $1.50 per month or $15 per year, payable in advance. Individual copies desired may be purchased as long as they are available. The charge for individual copies of the Federal Register varies in proportion to the size of the issue and will be 15 cents unless otherwise noted in the table of changes below.

CHANGES PUBLISHED DURING JULY 1962

The following has been modified by Federal Register:
CG–190, Federal Register, July 24, 1962.
CG–176, Federal Register, July 27, 1962.

U.S. GOVERNMENT PRINTING OFFICE: 1962