PROCEEDINGS

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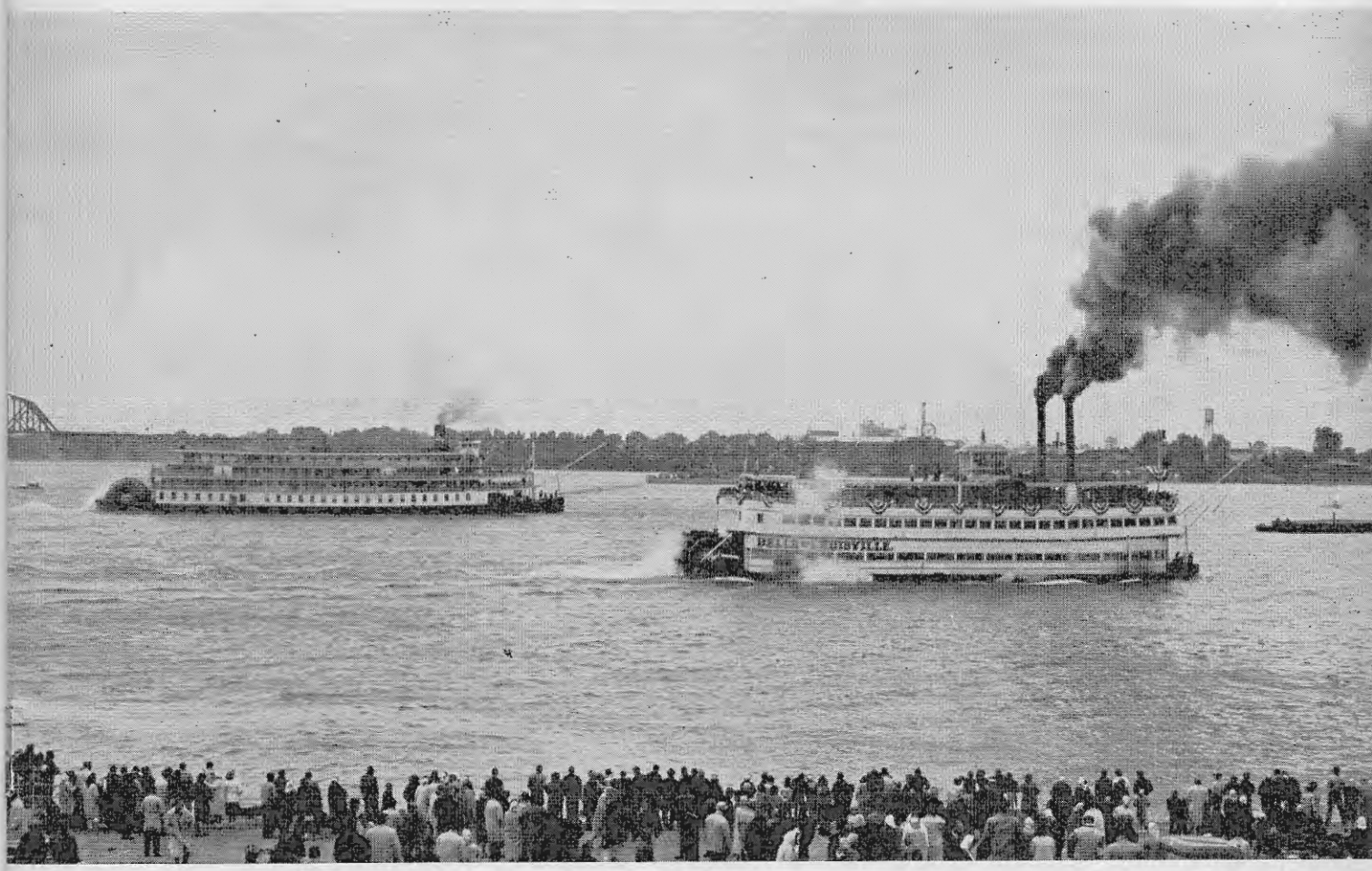

Features

NOTES ON INSPECTION AND REPAIR OF WOODEN HULLS

THE DESIGN OF INFLATABLE LIFERAFTS FOR SURVIVAL AT SEA

PROCEEDINGS

OF THE

MERCHANT MARINE COUNCIL

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

EXCURSION LINER GETS TOW

Photo courtesy Bob Howard, Record-American, Boston

THE CAPE COD excursion liner *Yankee*, with 156 persons on board is shown drifting helplessly off Rose Point, Mass. A Coast Guard patrol boat is standing by to assist. The motor vessel, which had suffered a power failure, was towed safely into Provincetown.

THIS COPY FOR NOT LESS THAN 20 READERS—PASS IT ALONG

CONTENTS

FRONT COVER

Steamboatin' returns to the Ohio River. The *Belle of Louisville* lost a race but not her pride last summer to the *Delta Queen* from Cincinnati. The fourteen mile sprint originated in Louisville as part of the Kentucky Derby festivities, and was the first major steamboat race there in 35 years. *Courtesy Louisville Courier-Journal.*

BACK COVER

M. T. Noggin, the personification of unsafe seamanship demonstrates how not to go ashore—*courtesy G. Seal, Pacific Maritime Association.*

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NOTES ON INSPECTION AND REPAIR OF WOODEN HULLS

THE FOLLOWING NOTES regarding inspection and repair of wooden hulls are excerpted from the complete material prepared by the Merchant Marine Technical Division at Coast Guard Headquarters and published in Navigation and Vessel Inspection Circular No. 1–63.

These notes are intended as an aid to responsible persons for the development of "good practice" procedures. These notes are for guidance and information only and are not intended to be mandatory nor to interfere with specific modifications dictated by local practices.

Persons interested in obtaining the complete publication should direct their inquiries to the Commandant (CHS) and ask for Navigation and Vessel Inspection Circular No. 1–63 with enclosure.

GUIDE TO INSPECTION

GENERAL

Intelligent inspection and repair of wooden construction requires knowledge and judgment. Inspection is made to determine that the vessel is safe and has a reasonable chance of remaining so until the next scheduled inspection. A good basic knowledge of wood construction and the deficiencies to which it is susceptible is essential.

HULL DEFICIENCIES

Hull deficiencies in wooden vessels group themselves into three categories:

1. Time
   a. Decay
   b. Marine borers
   c. Electrolytic and Galvanic Action
2. Stress
   a. Cracks
   b. Broken members
   c. Failure of fastenings
   d. Failure of caulking
3. Damage
   a. Hull damage due to collision, grounding or to normal wear and tear

STRUCTURAL PROBLEMS

In wooden vessels structural problems develop in nearly new vessels as well as in older ones. Deterioration, especially that caused by decay and marine borers, can occur with surprising rapidity. Boats which have been free of such infestations can become infected with slight changes in service area or operation. That the vessel was sound at its last inspection has less bearing on the present condition of a wooden vessel than on one of steel.

CONDITION OF VESSEL FOR INSPECTION

If practicable, inspect the vessel out of the water with the interior of the hull opened up as much as possible. The bilges and forepeak should be dry and reasonably clean and excess tackle, tools and gear which might interfere with proper inspection should be cleared away. This is not always possible. However hard to inspect (and thus hard to maintain) areas should not be missed.

Where the interior of the hull has closely fitted ceiling or paneling, sufficient access should be provided to allow examination of the interior at selected locations. Apparent soundness of the ceiling should not be taken as indicative of soundness beneath it.

VISUAL INSPECTION

An overall examination of the hull of a wooden vessel which has been in service can give the inspector an idea of the portions where deficiencies can be expected. Distorted planking, pulled butts, local damage and unexplained wetness or weeping are telltale indications.

Particular attention should be paid to stern, transom, region under the covering boards, the wind and water area and around hull fittings. It is

TREASURY DEPARTMENT COMMENDATION

COAST GUARD Lieutenant Commander Richard B. Brooks, assigned to the Merchant Marine Technical Division, Coast Guard Headquarters, has been given the Secretary of the Treasury Commendation for Achievement Award.

The award was in recognition of Brooks' "aggressiveness, keen power of analysis, and untiring efforts in collecting and publishing information relating to the inspection and repair of wood hull vessels." (This material has been published in Navigation and Vessel Inspection Circular No. 1–63, entitled "Notes on Inspection and Repair of Wooden Hulls.")

The Commander undertook the project on his own time in addition to his regular duties. This information has been of great assistance to Coast Guard merchant marine safety inspection procedures.

Brooks, who holds a Master of Science of Naval Architecture and Engineering Degree from Massachusetts Institute of Technology, is shown receiving the Commendation from Rear Admiral O. C. Rohnke, Chief of the Office of Merchant Marine Safety.

impossible to list each area of trouble in each type of boat. In general, areas which are hard to maintain, have poor ventilation or are subject to heavy stresses have the most deficiencies.

INSPECTION FOR DECAY AND MARINE BORERS

Serious deterioration of a wooden hull goes on within the wood itself with little or no outward sign until it is well advanced. In order to spot decayed (dry-rotted) wood, which has not progressed to the point where the wood appears eroded and spongy, sounding with a hammer can be of use. Unsound wood will give a dead or dull sound. Heavy timbers whose interiors are rotted may give a distinctive drum-like tone. Where the sound is not that of good solid wood, the member is suspect. A probe or drill can then be used to determine the extent of decay.

It should be realized that decay progresses rapidly and that it is more economical to eliminate small decayed areas early than to become involved in costly major replacements caused by neglected decay.

It is imperative that indiscriminate probing and boring be avoided. Holes made by a probe or drill in the hull exterior are potential entry ways for marine borers. In the hull interior they allow easier moisture penetration and thus aid in starting decay.

Probing and boring should be done carefully and only where there is an indication from nondestructive testing that the hull is unsound, not as a matter of routine.

Holes made by boring should be plugged with dowels or plugs which are glued in place, not merely driven into the wood. Plugs and dowels should preferably be treated with wood preservative to prevent future trouble. Areas which have been probed should be filled with a suitable compound. When covering boards or other obscuring construction is involved, it is often difficult to locate deteriorated members by probing. In such cases, when bolted or screwed fastenings are involved, check for tightness of randomly selected fastenings. If the member is solid, the fastening thus set up will take hold at the beginning of the turn. If serious decay is present the fastening will turn freely and fail to take a bite, indicating soft and spongy wood.

Decay (dry rot) is most often found in the following locations:

1. In the wind and water area.
2. Around overboard discharges and other fittings.
3. In the stem area.
4. At the transom.

INTERNALLY

1. All areas that are poorly ventilated (especially the forepeak).
2. In the bilge especially at the turn and along the keel.
3. The lower courses of bulkhead planking.
4. Areas under refrigerators or other machinery which may drip fresh water.
5. In the area of butt blocks and longitudinal members where dirt and debris may have retained fresh water.
6. At the heads of frames caused by fresh water leakage through defective covering boards.
7. Where the futtocks of sawn frames join and at the faying surface where the frame abuts the hull planking.
8. At the terminal ends of frames, floors, engine foundations, etc. where end grain is present.

Under freezing temperature conditions wood structural members with a high moisture content, particularly in the bilge areas, may appear quite sound when, in fact, they may be in advanced stages of decay. Periodic examination of these areas should be conducted before freezing sets in or after allowing sufficient time for thawing.

The other principal form of deterioration which goes on within the wood is marine borer attack. Marine borers can attack any wood which is beneath the water. No species of wood is immune to attack and no method of protection of the wood is completely effective.

Borers can enter the wood through hairline breaks in sheathing (either copper or fiberglass) or through scrapes, nicks or tool marks in protective bottom paints. If borer infestation is suspected a spot check of the wood beneath the sheathing should be made.

A probe is the most effective tool to use in the detection of borers. Avoid overzealous probing since each probe hole is a potential site of borer entry. After probing is complete the resulting holes should be filled with a patching compound.

Marine Borers die when removed from the water for any period of time. A vessel which has been out of the water for a few days and is essentially dry will probably have no live borers.

Where borer attack is just starting it is possible to burn the holes clean with a torch and then fill them with a suitable compound. If the attack is extensive, however, the only method acceptable is to replace the affected wood.

The first principle in reducing the chance of borer attack is to keep the worm away from the wood. This is accomplished by sheathing or by toxic paints. If the protective coating is broken borers can enter. To prevent this sheathing, where fitted, should be unbroken and in good condition and the bottom paint should be free from scratches, nicks and scrapes before the vessel is again in the water.

Worm shoes, rubbing strakes and similar members whose protective coatings have been broken should be inspected carefully. If they have heavy borer infestation they should be replaced. Care should be taken to see that the infestation has not progressed from them to the main part of the hull structure. Though worm shoes are usually separated from the hull by creosote-impregnated felt or by copper sheathing, this separation is usually not 100 percent effective.

INSPECTION OF FASTENINGS

A boat is no better than its fastenings. Most hull fastenings are concealed from view, being countersunk and covered; their inspection is difficult.

Planking fastenings which are loose, broken or wasted often result in sprung butts or in planks which are loose or chatter when sounded with a hammer.

When fastenings are loose it does little permanent good to harden up those which exist. Additional fastenings, properly placed, are the preferred repairs where there is sufficient room to obtain good holding power without seriously weakening the planking. If there is not room, holes in the substructure from the old fastenings should be properly plugged and new fastenings of equivalent strength should be driven. Loose planking can also result from deteriorated frames and other substructure in which case refastening is useless unless the structure is first made sound.

Particular attention should be given exposed hull fittings and through bolts. These should be sounded with a hammer and, if suspect, some should be pulled for inspection. It is advisable to pry up on exposed bolt heads with a probe or screwdriver. Often the bolt will be completely wasted away in the middle, at the faying surface of the joint, and will come out when pried up. This is caused by moisture accumulation which, besides wasting the fastenings, forms an excellent place for decay to start.

INSPECTION OF CAULKING

Caulking is subject to deterioration. It is advisable to search the

seams in any doubtful areas and recaulk. Caulking should be uniform and well "horsed" home. This can be checked with an awl or a knife. Care should be taken that the caulking has not been driven clear through the seam. Over caulking is as bad as under caulking.

Extensive trouble with caulking is indicative of structural problems.

If a hull "works" excessively, the caulking will be squeezed out. In such cases, the hull structure will have to be made sound before caulking will hold.

In old hulls, where the seams have become enlarged from repeated recaulking, copper or lead strips may have been nailed over the seams to act as caulking retainers. These are a temporary remedy and are an indication of poor general condition of the vessel. It is advisable that such strips be removed and the seams inspected for excessive width, poor caulking and decay. In some cases, wide seams or broken plank edges can be repaired by the use of thin graving pieces partially filling the wide seams. This procedure requires excellent workmanship and should be pursued with caution.

INSPECTION OF FITTINGS

The rudder and the propeller struts and fastenings should be examined carefully. The steering arrangement should be inspected from the steering wheel to the heel pintle. Wear in the carrier bearing and excessive clearances elsewhere should be corrected. The tiller lines should be in good condition with shackles moused and bolts cottered.

The shaft log glands should be in good condition and the deadwood should be sound. This is often neglected and is a potential cause of leakage.

Propeller shaft cracks are sometimes found at the keyway. A careful examination here is essential. Magnetic particle testing is usually not available in a small boatyard so the inspector must depend on visually locating surface cracks. Dye penetrant testing is relatively inexpensive and can be useful when available.

HULL DAMAGE

Most hull damage can be seen readily. Cracked and broken members are obvious faults.

Likely locations for cracks or breaks are in areas of high stress or where the structure undergoes a sudden change in shape. The turn of the bilge is the prime location for breaks of this type. The harder the bilge the more chance that damage has been done.

Wood hulls are more prone to secondary damage remote from the site of collision or grounding than are steel hulls. Damage may consist of sprung butts, pulled fastenings, sprung or cracked frames and misalignment of the structure. In inspecting any damaged wooden hull the entire vessel should be checked.

DEFICIENCIES

When deficiencies are encountered an evaluation must be made to determine their extent and their effect on seaworthiness. The following factors must be weighed in making this determination:

1. Is the defect progressive and, if so, how can its progress be arrested?
2. How long will it be before the area in question is next inspected?
3. Is the work contemplated necessary to restore seaworthiness or to prevent the vessel from becoming unseaworthy, or is it a maintenance measure to prolong the life of the vessel?

Many deficiencies, particularly surface defects or scars caused by chafing, freezing and other forms of exterior deterioration are not as serious as they may first appear. Do not be hasty in requiring the correction of minor defects of this nature in otherwise sound seasoned planking.

Specific requirements detailing the nature and extent of required repairs should be written. However, with wooden vessels the general rule "renew as original" while applicable, is not always practical nor necessarily the best way to effect repairs. Most accepted methods of marine repair may be used as long as the vessel's strength is not reduced thereby.

Wood is a natural product; its quality cannot be controlled as closely as with a manmade product such as steel. Consequently the inspector should check the material to be used in the work. Special attention must be given the type of wood proposed for each purpose and the defects in each piece.

Requirements for adequate repairs are:

1. Use of good material comparable in properties to that replaced.
2. Repairs extensive enough to assure that the hull is essentially as strong as the existing original.
3. Details and fastenings at least equivalent in strength and in quality to those replaced.
4. Good workmanship.

REPAIRS

GENERAL

Wood boat construction varies widely from locality to locality and boat to boat. All types of repairs which an inspector may encounter cannot be listed. Representative types and standards which are given here are intended as a general guide to good practice and as an aid in evaluating required repairs. They are not rules which the responsible person must follow. Repair standards for wooden hulls should be developed for the locality on the basis of local conditions and practice.

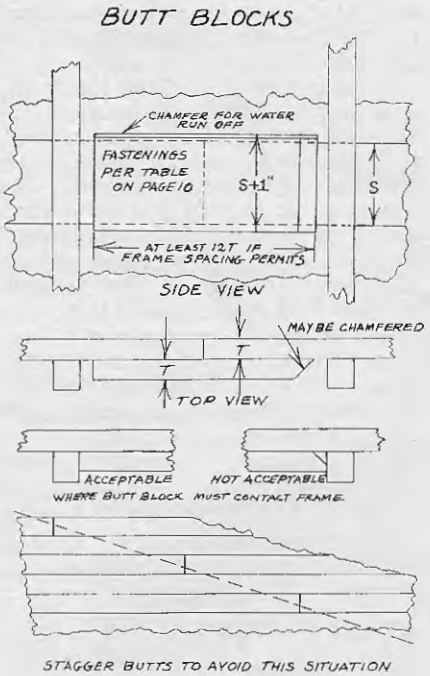
PLANKING REPAIR AND NOTES ON JOINTS

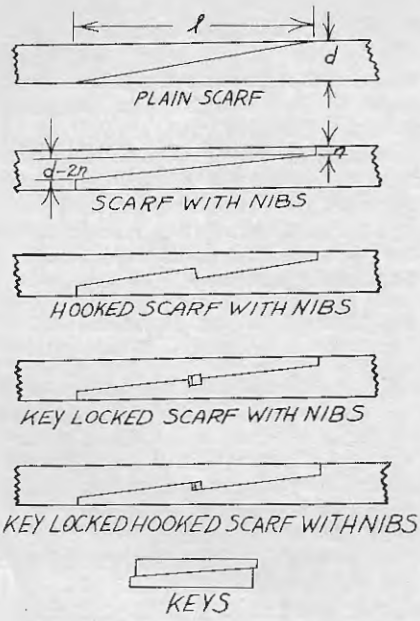
Fore and Aft Planking. When such planking is replaced, the frames and other structure should be thoroughly inspected and placed in good condition. Holes made by old fastenings should be properly plugged to insure that new fastenings will hold.

"Flats," "dutchmen" or short lengths of planking are normally not acceptable since they will not hold fastenings and are structurally unsound.

In boats with usual frame spacing the replacement plank should extend at least six frame spaces and no portion of a plank shorter than six frame spaces should be allowed to remain.

Where special conditions govern, this rule may be modified but, as a lower limit, the replacement plank should be at least 5 feet long and its butts should be spaced in accordance with the rule for butts in this chapter.





COMMON FORMS OF SCARFS

Fastenings should be at least equal in size and number to those of the rest of the planking.

When planking is placed on a boat, it should have the concave side of the annual rings facing toward the frame. This prevents "cupping" as the moisture content of the wood changes.

It is sometimes necessary to shape the inboard side of a replacement plank to fit tightly against the frames. The use of shims or packing pieces for this purpose should not ordinarily be allowed.

Diagonal Planking. The same principles apply to diagonal planking but due to the relatively short lengths of the individual planks a portion of a plank is seldom replaced.

Because the proper repair of double diagonal planking is expensive and time consuming, shortcuts involving the use of dutchmen and backing blocks are sometimes attempted. These should not be permitted. Most other planking systems follow the same basic principles of repair as outlined here. Good workmanship and care are the major requirements for proper repair.

PLYWOOD CONSTRUCTION

In general, the replacement of a portion of a panel of plywood is not acceptable. However, in the case of a small damaged area between frames, a flush patch backed by a butt block may be used.

White lead or other suitable compound on the edges of the opening is an acceptable aid in sealing the patch. Caulking should never be used and shims and fillers as a substitute for good workmanship are not acceptable. Care should be taken in allowing such a repair for small decayed areas since plywood has relatively low decay resistance. Once decay has started it travels rapidly in all directions.

Small surface defects may be repaired using commercial fillers (epoxy putty, etc.). In allowing this type of repair the wood must be decay free and all damaged wood removed. Quick repairs of this type are satisfactory where basic strength has not been affected. The danger lies in covering up progressive defects such as decay which grow worse under the repair material.

Butt Joints in Planking. Planking butts should not terminate on frames in normal construction. They should be located between frames on proper butt blocks, though in light construction with narrow strakes they may sometimes be found as glued scarf joints at the frames and in some construction with massive framing they may be found butted on the frames. As a rule of thumb, butts in adjacent planks should be at least three frame spaces apart. Those butts which fall in the same frame bay should be separated by at least three solid strakes. This is not always possible, especially at the end of the vessel, but serves to illustrate the principle of keeping butts separated as much as possible. Where frame spacing is unusual the following rule may be used as a guide.

> Butts in adjacent strakes should be no closer together than 5 feet. If there is a solid strake between they should be no closer than 4 feet. Butts should be shifted so that three or more do not fall on a diagonal line.

To be effective a butt block must have adequate size. If the frame spacing allows, its length should be at least 12 times the planking thickness. Its thickness should be equal to the planking thickness and its width at least 1" greater than the strake width. Prior to installation it is recommended that the faying surface of block and strakes be coated with a wood preservative. The top of the butt block should be chamfered to allow for water runoff. Avoid butting the block hard against the frames, if frame spacing permits, for the same reason.

The fastenings of the strake to the butt block should be of equal strength to that of original butts. The fastening size should be equal or larger and no fewer number of fastenings should be allowed.

Plywood butt blocks may be used but it should be remembered that through plywood has greater uniformity of strength in all directions, it has somewhat less strength than the "along the grain" strength of the basic wood from which it is made.

For new construction or for repairs "not in kind" the following table lists the suggested number of fastenings for planking:

Suggested *Minimum* Number of Fastenings for Planking to Butts and Frames

Width of Plank (inches)	Number of Fastenings in Butt of *Each* Plank	Number of Fastenings in Frame		
		½ to 1 Inch Plank Thickness	1 to 1½ Inch Plank Thickness	1½ to 2 Inch Plank Thickness
3 to 4	3	2	2	2
4 to 6	4	[1] 2	2	2
6 to 7	5	3	2	2
7 to 8	5	3	3	2
8 to 10	6	3	3	3

[1] Planking at the side end of this range may require 3 fastenings.

Glued Scarf Joints. For a glued scarf joint the plain scarf without nibs is the simplest and strongest. Waterproof glue should be used and the slope of the joint should be 1/12 or flatter for maximum joint efficiency.

Scarf slope (depth/length)	*Typical joint efficiency for a well-made glued joint without nibs*
1/12	90%
1/10	85%
1/8	80%
1/5	65%

These efficiencies can be attained only with optimum gluing conditions and excellent workmanship.

Mechanically Fastened Scarfs. Mechanically fastened scarf joints

are most often nibbed, hooked, or keyed to provide extra axial restraint and to aid watertightness.

The surface of the joint should be smooth and flat to insure good fit and watertightness.

The fastenings should be adequate in size and number and should be arranged so as to prevent splitting the wood.

The slope of the joint, $\frac{d-2n}{1}$, should be $\frac{1}{12}$ or flatter.

Most mechanically fastened scarf joints are nibbed at the ends for a depth of approximately 25 percent of the depth of the member, giving a joint length of at least 6 times the depth.

A scarf joint which is fastened by mechanical means alone cannot, even under the best of conditions, produce a joint approaching a solid member in strength.

Glued Butt Joints. Glued butt joints never give joint efficiencies of over 20 percent and should not be permitted.

FRAMING REPAIR

Sister Frames. Damage to one or more scattered or isolated frames can be repaired by the use of sister frames though it is preferred that the frame be replaced if practicable. Damage to more than two adjacent frames should not be repaired with sister frames.

The preferred type of sister frame is one of equal or greater size than the damaged one and as long as possible. This frame should be fastened to the planking and other structure with fastenings at least equal in size and number to those of the damaged member. In placing the frame adequate wood preservative on all faying surfaces is recommended.

Long sister frames, well tied in to the main structure of the vessel should not normally butt against damaged frames though this is acceptable where it forms the best method of tying in the new frame. If the frames abutt, a good sealer is required to exclude moisture from between the pieces.

Where structural or machinery interference or other reasons prevent the fitting of a long sister frame, well tied into the other structure, a shorter "partial sister" may be fitted as a temporary repair. This should extend as far as is practicable on both sides of the damage and should be securely fastened to the damaged frame by through bolting or equivalent means as well as to the planking and other structure. Provisions should be made to exclude moisture from between the pieces.

A good wood preservative is recommended for use on all faying surfaces. Assure that precautions are taken that standing water cannot accumulate at the top of the partial frame and cause decay. A sister frame should not be used as a repair for decayed frames. The decayed wood will eventually "seed" the sound wood with decay spores in spite of any attempts to prevent it by the use of wood preservatives or to isolate the new wood with sealing compounds. When extensive decay is present in a frame the only permanent repair is to replace it and any adjacent wood affected.

Decayed Frame Heads. Heads of frames under the covering boards often become decayed. With sawn frames, this can be corrected by replacing the upper futtock. If the futtock is long or the frame is in one piece, it can often be cropped off well below the rot (at least 2 feet is a good rule) and a piece spliced in using a glued and screwed scarf joint of proper dimensions. As an alternate measure a lap joint of sufficient length may replace the scarf. Repairs to more than two adjacent damaged frame heads should not be made by short cropping but should be made by renewing the frames or replacing the damaged sections by scarfing and then sistering the frame.

Use of Fiberglass Reinforced Plastic. Glassing an unsound structure as a way of restoring strength is a temporary repair. This is especially true of glassing planking or other areas which tend to work or "come and go". The laminate has little flexibility along its length and breadth and tends to develop "tension cracks" which destroy watertightness and strength.

Before allowing any wooden structure to be repaired using reinforced resin, an evaluation should be made considering the following items in addition to those noted before.

1. In the hull, even a hairline crack can allow undetected entry of marine borers.

2. With old structure which has been painted or preserved a good bond is very difficult to attain.

3. Any rot present may continue to grow worse under the glass if the proper conditions of moisture and heat develop.

4. It is difficult to acquire enough strength from a reinforced resin coating to make up that lost from the unsound substructure.

5. It is difficult to check the soundness of the substructure once the glass has been applied.

Full Sheathing of an existing wooden hull with fiberglass reinforced plastic as a method of restoring strength and watertightness to a deteriorated vessel is not normally acceptable.

MATERIALS

WOOD

The best single source of information available in the broad field of wood technology is "The Wood Handbook" (Handbook No. 72) developed by the Forest Products Laboratory of the Department of Agriculture. This book can be obtained from the Superintendent of Documents, Washington, D.C., 20402. It is highly recommended as a thoroughly practical work which should be part of the technical library of every inspection office and every wood boat building or repair yard.

Shipbuilding Wood. Douglas-fir, southern yellow pine (longleaf), and white oak furnish over one-half of the wood used for boat and shipbuilding. Choice of various species depends upon their properties, availability, and cost.

Where requirements call for strength, moderate to good decay resistance and ability to hold fastenings well (frames, keels, stems, etc.), the following woods are most commonly used:

Douglas-fir
Southern yellow pine (longleaf)
Teak
Western Larch
White Oak

Where light wood which is easy to work and is warp and decay resistant is required (planking, etc.) the following woods are most commonly used:

Alaska cedar
Cypress
Mahogany
Cedar (Port Orford, Northern White, and Western Red)
Redwood
Tangile (Philippine hardwood)

Where light, easily worked and strong woods of moderate to low decay resistance are required, the following woods have found favor:

Sitka spruce
Western hemlock
White pine
Yellow poplar

There are many other varieties suitable for boat use. These are listed together with their properties in the Wood Handbook and in Volume 1 of Bureau of Ships Publication "Wood—A Manual for Its Use as a Shipbuilding Material".

Bending Woods. Unseasoned white oak is the choice bending wood. It bends readily and is high in decay resistance. Red oak, hickory, rock

elm, white ash, beech, birch, and hard maple, also bend readily but do not have the decay resistance of white oak. White oak and its best substitute, rock elm, are expensive and hard to obtain, but do the best job.

Wood Defects. Wood, being a natural material, is not uniform in quality and is subject to defects. Some of these affect only the appearance of the wood. Others affect the strength of the wood and are of importance.

The chapter of "The Wood Handbook" on Stress Grades and Working Stresses discussed defects of interest to persons concerned. Among the most important of these are—Knots Shakes, Checks, Splits and Pitch Pockets.

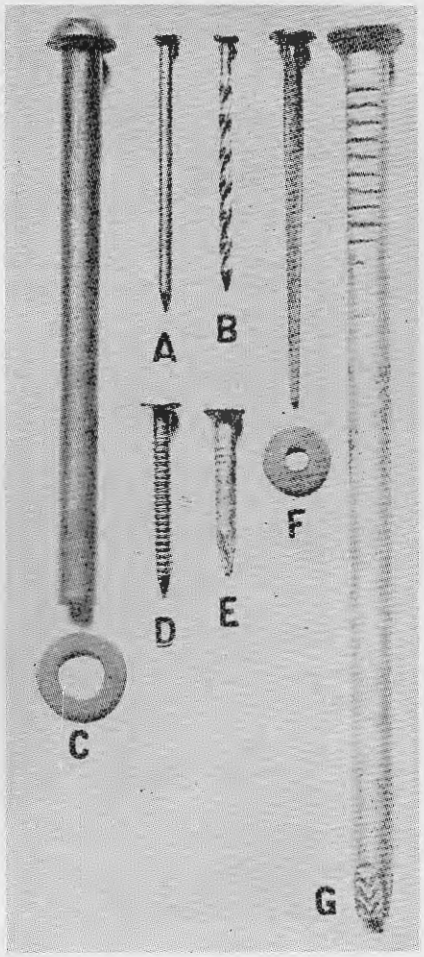
Plywood. Plywood is a built up board of laminated veneers in which the grain of each "ply" is perpendicular to the ones adjacent to it. Its chief advantages lie in more nearly equal strength properties along the length and width of the panel, resistance to change in dimensions with moisture content and resistance to splitting. Major disadvantages are low decay resistance and the difficulty of painting it properly.

Plywood is excellent where strength is needed in more than one direction and where the relatively large size of the panels available can be utilized. It is no stronger than the wood from which it is made and is not a cure-all for wood structural problems.

Plywood is made from several types of wood and in many different types and grades. In general, "Marine-Exterior" type of fir plywood or its equivalent, technical or Type 1 hardwoods are the only plywoods acceptable for use as hull planking. These plywoods are identical with ordinary "Exterior" type in that they are bonded with waterproof glue by a process using heat and pressure. Their advantage lies in the fact that the Interior plies contain few gaps and thus its strength, ability to hold fastenings and resistance to decay are much higher than "Exterior". "Marine" plywood is more expensive than "Exterior" but provides additional safety and durability.

Fir plywood is graded according to the appearance of the exterior veneers. These grades run from grade "N" intended for natural finish and grade "A", suitable for painting, down through grade "D", the poorest quality. Each side is graded. For example, a panel may be graded "Marine Exterior A–B" where "Marine Exterior" refers to the type of bonding used and the allowable defects in the inner plies, while "A–B" refers to the appearance of the two sides of the panel.

DRIVEN FASTENINGS



A—Wire nail. (not commonly used in boat construction)
B—Spiral grooved nail.
C—Drift bolt.
D—Boat nail with grooved shank.
E—Chisel point boat nail.
F—Square cut boat nail with rivet burr and cut washer.
G—Boat spike with chisel point.

Marine plywood is usually available only in appearance grades B–B and better. The strength of the wood is indirectly reflected in the grading since the poorer grades have openings, splits, pitch pockets and other defects which adversely affect strength and decay resistance.

All plywood is marked with its classification. This classification may appear on the panel back, on its edge or both.

MECHANICAL FASTENINGS

Mechanical fastenings should be of material suitable for the service intended. Ferrous fastenings should be hot-dipped galvanized. Among the usual nonferrous types brass is not acceptable where it will be exposed to salt water attack.

Caution should be used in selecting fastening material because of the problem of galvanic action which can arise if dissimilar metals are used close to one another. A bronze washer used with a steel bolt will result in the eating away of the steel.

GALVANIC SERIES IN SEA WATER

PROTECTED END (CATHODIC OR MOST NOBLE)

Monel
Copper
Red Brass
Aluminum Brass
Yellow Brass—Silicon Bronze
Nickel—Inconel
Naval Brass
Muntz Metal—Manganese Bronze
Lead—Tin
Stainless Steel (Reference should be made to the specifications for stainless steels being considered since they vary widely in their properties)
50–50 Lead-Tin Solder
13 Percent Cr Stainless Steel
Cast Iron
Mild Steel—Wrought Iron
Aluminum—Cadmium
Galvanized Steel
Zinc
Magnesium

CORRODED END (ANODIC OR LEAST NOBLE)

The number, size and spacing of fastenings should be equivalent to or better than those replaced. For new construction and for repairs "not in kind" a general guide for good practice is the "National Design Specifications for Stress Grade Lumber and its Fastenings", a publication of the National Lumber Manufacturers Association. In applying the standards found therein, consideration should be given to the severe conditions of marine service.

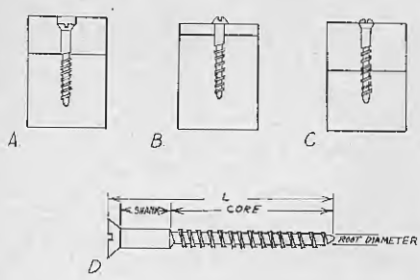
A general guide for use of the various types of fastenings follows:

Bolts. Bolt holes should be of such diameter as to provide an easy fit without excessive clearance. Tight fit requiring forcible driving of the bolt is not recommended.

Washers. A washer not less than a standard cut washer or, in lieu thereof, a metal plate or strap should be inserted between the bolt head and the wood and between the wood and the nut.

Stopwater. A suitable wicking or stopwater should be fitted in way of the faying surface of the joint at each through bolt subject to moisture.

Placement of Bolts in Joint. The center to center distance between bolts in a row should be not less than four times the bolt diameter.



TYPES OF WOOD SCREWS
A. FLATHEAD, B. ROUND-HEAD, C. OVAL-HEAD
A SHOWS A SCREW PROPERLY INSERTED AND COUNTERSUNK.
B AND C SHOW INCORRECTLY INSERTED SCREWS.
D SHOWS PRINCIPAL PARTS OF A WOOD SCREW.

The spacing between rows of bolts should be 5 times the bolt diameter for a bolt whose length from the bottom of the head to the inner side of the nut when tightened is 6 times the bolt diameter or longer. For short bolts, this distance may be decreased but in no case should be less than 3 times the bolt diameter.

The "end distance" from the end of a bolted timber to the center of the bolt hole nearest the end should be at least 7 times the bolt diameter for softwoods and at least 5 times the bolt diameter for hardwoods.

The "edge distance" from the edge of the member to the center of the nearest bolt hole should be at least 1½ times the bolt diameter. For bolts whose length is over six times their diameter use one-half the distance between bolt rows and in no case below 1½ times the bolt diameter.

For perpendicular to the grain loadings (joints at right angles), the edge distance toward which the load acts, should be at least 4 times the bolt diameter.

Bolting Groups. In general, all groups of bolts should be symmetrical in the members. The individual fastenings should be offset slightly as necessary to avoid placing more than one on the same grain.

SCREWED FASTENINGS

Lead Holes. Lead holes for wood screws should be about 90 percent of the root diameter of the screw for hardwoods and about 70 percent of the root diameter for softwoods. For large screws and for hardwoods, a shank hole of a diameter equal to the shank of the screw and of a depth equal to the shank may be used to facilitate driving. Lag screws should always have a shank hole.

The lead hole for the threaded portion of a lag screw should have a diameter of 65–85 percent of the shank diameter in oak and 60–75 percent in Douglas-fir and southern pine with a length equal to the length of the threaded portion. Denser woods require larger lead holes and the less dense require smaller holes. For long screws or for screws of large diameter, lead holes slightly larger than those recommended here should be used. The threaded portion of the screw should be inserted by turning and not by driving with a hammer.

Lubricants. Suitable lubricants should be used on screws, especially in dense wood, to make insertion easier and prevent damage to the screw.

Depth. Penetration of the threaded portion for at least a distance of 7 screw diameters for hardwoods and 10–12 times in softwoods is required for maximum holding power.

Loading. If possible, screws should be placed so that they are loaded across the screw and not in withdrawal.

The spacing, end distance and edge distances for wood screws should be such as to prevent splitting the wood. Lag screws should follow the rules for bolts.

Nails and Spikes. Cut nails have relatively poor holding power in joints which are subject to moisture changes. Their use in marine applications should be avoided. Barbed nails are better suited for marine service.

Lead Holes. Lead holes for nailed joints may be ¾ of the diameter of the nail without causing loss of strength.

Types of Load. If possible, nails should be loaded across the nail and not in the direction of withdrawal. This is especially important in end grain.

Spacing of Nails. The end and edge distances and spacings of the nails should be such as to prevent splitting of the wood.

Boat Spikes and Drift Bolts

Lead Holes. Lead holes for boat spikes should be the size of the short dimension of the spike and should extend approximately 75 percent of the spike depth. The lead holes for drift bolts should be slightly less than the bolt diameter and of a depth equal to the bolt length.

Type of Load. Where possible, spikes and drift bolts should not be loaded in withdrawal. This is especially important in end grain.

Insertion. A clinch ring or washer may be used under the head to prevent crushing of the wood. Spikes should be driven with the edge of the chisel point across the grain to avoid splitting the wood.

Spacing of Spikes and Drift Bolts. The end distance, edge distance and spacing of the spikes should be such as to avoid splitting the wood.

GLUES AND GLUING

Modern glues of the resorcinol and phenol-resorcinol resin types are the most satisfactory for severe service use such as for marine repair. Other glues have lower resistance to moisture and should be avoided where this is an important factor.

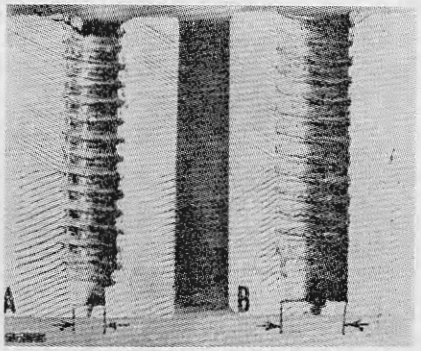
Not all woods are easily glued. Wet wood (above about 15 percent moisture content) is difficult to glue as is very dry wood. Normal seasoned wood of most species can be glued. Strong glued joints are possible only using the side grain of wood. These joints can be very nearly as strong as the wood itself. It is impossible to join end grain with glue and get joints which are even 20 percent as strong as the wood. A scarf or some other form of joint which gives a surface approaching side grain condition must be used where end connection is desired.

The glue manufacturer's instructions must be followed. Curing temperature and surface condition are important. The temperature must be about 70° F. or higher for a full cure of resorcinol resin glue and the surface should be smooth. In the past, surfaces have been intentionally roughened in the mistaken belief that slightly rough surfaces glue better. This is not true. Waterproof glues are poor fillers. Thus the surfaces should be as smooth as possible.

WOOD PRESERVATIVES

The use of wood preservatives is not required. However, their use in wood under severe service conditions will pay for itself many times in decreased decay and borer attack and thus decreased repair and replace-

SECTIONS THROUGH SCREW HOLES



A—Proper lead hole size.
B—Lead hole too large. Screw drove easily but had poor holding power.

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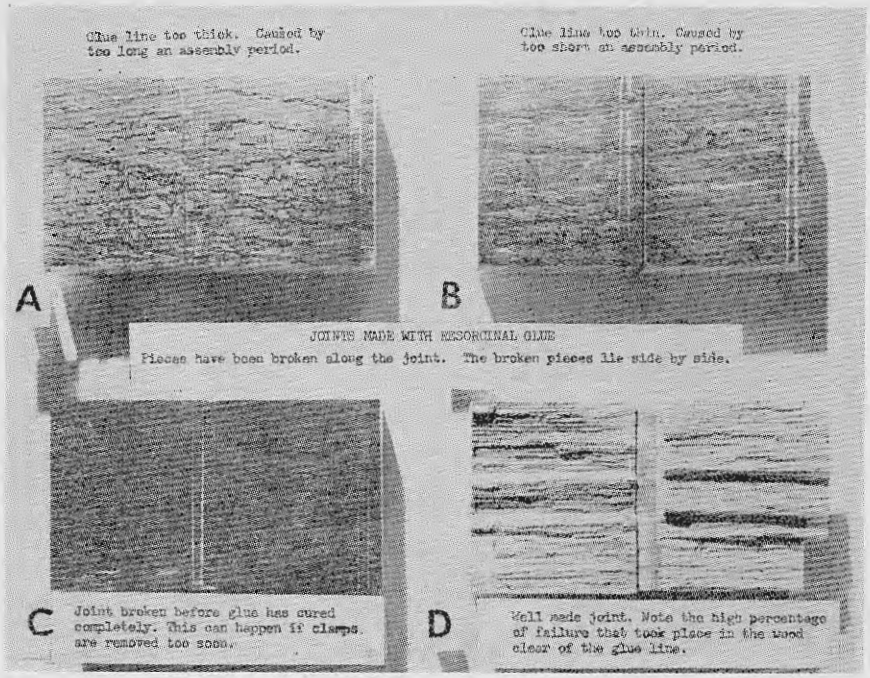


ment costs. Their proper use should be encouraged since it increases the chance of the vessel remaining sound until her next inspection and thus contributes to maintaining a reasonable standard of safety.

Wood preservatives used for protection against decay fungi and marine borers either kill the organism or prevent it from growing. For marine use the preservative must offer no toxic hazard to the crew, must be free from objectionable odors and must be able to remain in the wood and do its work in the presence of moisture. No known wood preservative is ideal for marine use but certain ones have proved effective for specific applications.

There are two general classes of wood preservatives, oil soluble and water soluble. Both have been used in the marine industry.

OIL SOLUBLE PRESERVATIVES

Coal Tar Creosote. One of the most used of the oil soluble preservatives is coal tar creosote. This preservative is highly toxic to wood-attacking organisms, is relatively insoluble in water and is easy to apply. It has some disadvantages, however, which limit its use in the marine field. It has a distinctive unpleasant odor, is somewhat of a fire hazard when freshly applied and causes skin irritation in some individuals. Its main disadvantage is that it is almost impossible to make paint or other coatings adhere to it.

Copper Naphthanate Solutions. Copper naphthanate solutions form one of the most used groups of marine wood preservatives. A 3 percent solution, equivalent to one-half of 1 percent copper by weight, provides good protection against decay when properly applied. The protection afforded against marine borers is slight. Wood treated with copper naphthanate is a distinctive green color. Much of the "treated wood" which can be purchased is preserved with copper naphthanate. The paintability, glue bonding ability, and structural stability of the wood is only slightly affected by the copper salts. These properties will vary, however, depending upon the oil used as a solvent.

Pentachlorophenol Solutions. "Penta" solutions have proven satisfactory for marine use. Field tests have shown that a 5 percent solution offers adequate protection against decay when proper application techniques are used. Little if any protection against marine borers is provided.

Pentachlorophenol does not give wood any distinctive color. In itself, it affects the characteristics of wood very little. The final effect of the preservation treatment on physical characteristics depends upon the petroleum solvent used.

Water Repellent Preservatives. Copper naphthanate and "penta" are often combined with water repellents. These repellents aid in stabilizing the moisture content of the treated wood. This is a material aid in reducing the chance that decay growth conditions will occur. In order to be effective these solutions should contain no less than 5 percent pentachlorophenol or 2 percent copper in the form of copper naphthanate.

Solvents. Almost any petroleum product from mineral spirit to used engine oil can be used as a vehicle for the preservative depending upon local conditions. In general, the heavier high viscosity residium types offer the best retention. The choice of solvent is usually a compromise of effectiveness, paintability and initial cost.

Water Preservatives. Waterborne preservatives include zinc chloride, tanalith, copper arsenite, chromated zinc arsenate and many others. Their major applications are those in which the leeching out of the preservative by moisture is not a problem. In general, these preservatives have not proven satisfactory for severe marine service. Some preserved wood obtained for repair use may have been pressure treated with one of these preservatives. It can give satisfactory service if care is taken to use it in a location where it is protected from the action of rain and sea water.

METHODS OF TREATMENT

Pressure Treatment. In the commercial treating of wood a method utilizing high pressure is often used. This method requires expensive equipment and is seldom seen in a boatyard. Nonpressure treatments available to the boatyard are brushing, cold soaking and various types of "hot and cold" bath processes.

Brush Treatment. The simplest way of applying a preservative solution is to brush it on. Every crack and check must be flooded with pre servative if the treatment is to be effective. Small pieces such as butt blocks can be dipped into the preservative. Solutions of pentachlorophenol or copper naphthanate, available commercially, have proved effective when used in this way.

"Penta" stock solutions are available in what is known as 1:5 and 1:10 strengths, (i.e., the solution must be diluted 1 part of solution to 5 or 10 parts of solvent to achieve a "normal" wood preserving solution.) These stock solutions are used without dilution for preserving cracks, holes resulting from old fastenings, for coating joints and hard to get spots, etc. Care must be exercised since wood preservatives are toxic. When using the brush-on method the entire surface must be thoroughly coated.

Soaking. Cold soaking in copper naphthanate or "penta" solutions for periods of up to 48 hours provides much better retention of the preserva-

tive than does a brushing. An even better method consists of heating the wood in a hot preservative bath and then transferring it to a cold bath of preservative. The heating causes the air entrapped in the wood to expand. The sudden cooling sets up a vacuum which aids preservative penetration.

The effectiveness of a preserving treatment depends on the amount of preservative which is retained in the wood. This is often difficult to determine. Requirements in Federal Specification TT–W–571 for recommended net retentions of oilborne preservatives are shown in the following table. This amount will provide good protection and even lesser amounts will still offer a considerable measure of protection.

Recommended Net Retentions of Preservative

Service		Product Pentachlorophenol 5 percent—Petroleum Oil	Copper Naphthanate (0.75 percent cer metal) in petroleum oil
Lumber and Structural Timber	Coal Tar Creosote		
In Contact with Ground or Water	14 to 20 lb/cu ft	10 lb/cu ft	10 lb/cu ft
Not in Contact with Ground or Water	6 lb/cu ft	6 lb/cu ft	6 lb/cu ft

TREATING ISOLATED DECAY

A method which can arrest the progress of incipient decay, at least temporarily, is as follows:

> The affected area is scraped clear of all decayed material and for some distance into apparently clear sound wood. A strong preservative solution, for example 1:10 pentachlorophenol stock solution, is applied freely. This is allowed to soak in and dry. Repeated applications are made until the wood refused to take any more preservative. Often a small "cofferdam" can be made to retain a pool of preservative over the area. To be effective the preservative must sink in and sterilize the wood for a considerable distance since decay sends out spores ahead of the damaged area.

After the treatment is completed the cavity made by the scraping may be left unfilled but it should be properly painted. Filling it will simply hide any additional rot still working.

This method is a temporary repair only. It usually will slow decay attack but will seldom eliminate all traces of decay.

"SALTING" AND OTHER BILGE WATER TREATMENT

Decay will grow in a boat only where fresh water is present. This may be in the form of condensation or may come from rain, fresh water drains, or other sources. Salt water will not support fungus growth. The fungus usually does not die but its attack slows or stops.

In some areas of the country, it has been the practice to "salt" the bilges with rock salt. There are two disadvantages to this practice.

1. The salt dissolves readily and must be replaced often. A large part of it goes over the side when the bilges are pumped.

2. Strong salt solutions are hard on fastenings and metal parts. The wood stays sound but the life of the metal parts is reduced.

For these reasons, "salting" is of doubtful value.

Extensive tests have been run [1] on various chemicals to replace rock salt. The ones that offer the best promise are pentachlorophenol or orthophenylphenol. These chemicals, normally thought of as insoluble in water can be applied in the following manner:

> Nylon "bean bags" containing crystalline "penta" are made and distributed through the bilge. A number of very small ones is superior to a few larger ones. Care must be taken in handling the "penta" since, like all good fungicides, it is toxic.
>
> The "penta" goes into solution in the bilge water. This is very slight (about 20 parts per million) so that in spite of frequent pumping, very little penta is used up. The slight amount of penta dissolved makes the water fungistatic, that is to say, it will not support fungus growth. As long as the bean bags remain a considerable amount of decay protection is afforded. The solution is harmless to fastenings and metal parts and, with normal precaution, is not hazardous to handle. Since very little penta is used the cost of the treatment is surprisingly low.

In his conclusion, Dr. Scheffer states "Judging from these results, bilge water saturated with orthophenylphenol or with pentachlorophenol might be expected to preserve any wood that is wetted by it frequently and exclusively".

Caulking. The art of caulking is an ancient one which requires experience and a certain "touch." A good caulker makes his work look easy but it is a skill which takes much experience to develop.

Boats are caulked with caulking cotton, oakum is used for large vessels. Caulking cotton comes in bundles which can be shredded out to proper size for the seam. Plumber's caulking stuff which is short stranded should never be used. The caulking stuff is driven into the seam with a caulking iron forming loops with each drive of the iron. These loops should touch each other when in place. After the caulking is in place it is redriven or horsed home with the iron leaving room for filling the seam. Various irons of different shapes are used depending upon the location and condition of the seam.

Caulking should never be driven through the seam but should be in a "rope" about halfway through. Caulking may be driven dry but it will not last as long as that which has been lubricated with linseed oil or other suitable lubricant. After caulking the seam may be filled with seam compound, white lead putty or other material as the circumstances require. Old caulking should be "reefed out" prior to putting in new. If the seams are narrow they are often opened up with a "dump iron" or a reaming iron to facilitate caulking.

In older vessels the seams may have been widened by repeated caulking over the years. This condition, coupled with unsound frames and structure, may make it impossible to keep caulking in the seams. Some owners may have fastened strips of lead or copper over the seams in an effort to correct the trouble. This "stopgap" method does little to maintain watertightness and may cover up deterioration. The preferred

[1] Scheffer, T. G., *Treatment of Bilge Water To Control Decay in the Bilge Area of Wooden Boats.* Journal of the Forest Products Research Society, Madison, Wisconsin: September 1959.

method of repair is to strengthen the structure and the fastenings prior to recaulking. If this does not stop the trouble portions of the boat may require replanking.

DETERIORATION

DECAY

Wood has proved itself to be good for long service under proper conditions. One of the greatest enemies of wood is decay or "rot." Much of this rot in boats is preventable if care is used in construction, maintenance and repair.

Decay in wood is caused by various fungi which are living organisms whose growth depends upon suitable temperature (50° to 90° F.), suitable food (wood) and moisture. Wood that is dry will not rot nor will waterlogged wood. In order to provide a condition suitable for fungus growth wood must be moist (from 20 to 30 percent moisture content). This condition is promoted by poor ventilation. A well designed vessel should have adequate ventilation of its enclosed spaces. Bilges, cabins, etc., of vessels in service should be opened periodically to allow a change of air. Good ventilation of interior structure in wooden hulls is one of the most effective measures in the prevention of decay.

Not all wood offers the same natural resistance to decay. Most wood species have moderate to low natural decay resistance. In general, heartwood is much more decay resistant than sapwood of the same species.

The fresh surface of decay is usually fluffy or cottony as contrasted to the powdery growth of mold. The various rot fungi act in slightly different ways but if left unchecked all can destroy the wood in short order.

It is relatively easy to recognize advanced decay. The wood is discolored, softened and brittle and may show cracks and collapsed areas. Early decay is more difficult to recognize. It may appear as a discoloration in streaks along the grain of the wood. No known test available to the inspector can be substituted for experience in spotting early decay. The mere presence of a stain does not indicate decay. Wood is prone to pick up stain and coloration from blood, fish, bird droppings and various other sources. Probing with an ice pick is sometimes a help in finding "soft spots" in areas in which visual inspection and sounding with a hammer have aroused suspicion as to the soundness of the wood. Turning up a splinter with a knife blade may also help. Sound wood tends to produce long clean splinters while wood with early decay, having lost much of its strength, will break off abruptly.

While the final test for rot is to collect samples from the interior of the wood by probing, as noted above, or by boring with a drill these procedures should be used with caution. *Excessive drilling and probing can weaken otherwise sound structure.*

Fungi are living plants that can and do travel from an infected area to a sound one. It is useless to place sound wood against rotten and expect the sound wood to survive.

Once decay is well started in a piece it is difficult and most often impossible to stop its progress. In early decay the use of wood preservatives can be of aid in controlling the attack. Used properly in new construction or in repair they can prevent it.

MARINE BORERS

Marine borers are present to a varying degree in almost all the salt and brackish waters of the world. They attack practically every species of wood used in boat construction. There is no sure method of protection from their attack. The two principal methods are to physically keep the worm away from the wood (sheathing) and to make the wood unattractive to the worm (toxic substances and coatings). The main types of marine borers are listed in the following paragraphs.

Shipworms. These pests are actually mollusks and not worms. There are several species of Teredo and Bankia in this group. Though they vary in detail, their attack upon wood follows the same pattern.

They start their lives as tiny free swimmers. Upon finding a suitable home, even a tiny crack in a sheathed bottom, they attach themselves and quickly change form. As a pair of cutting shells develop on their heads they bury themselves in the wood and feed upon it. Their tails or "syphons" always remain at the entrance to their burrow but, as the worms grow, their heads eat channels in the wood. The entrance holes always remain small and hardly noticeable but the interior of the wood becomes honeycombed. When they are not crowded some species of shipworm can grow to lengths exceeding four feet.

Martesia. These are wood boring mollusks which resemble small clams like the shipworm, they enter the wood when they are small and do their damage within. They do not grow to the length of shipworms but, nevertheless, they can do considerable damage. Their main area is in the Gulf of Mexico.

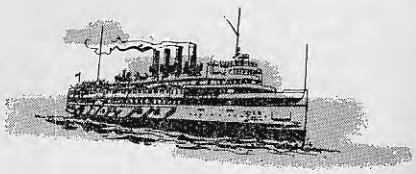
Limnoria and Sphaeroma. These are small creatures which attack the surface of the wood. When large numbers of them are present the surface can be eaten away to such an extent that the remaining sound wood between their burrows can be removed by the action of moving water. This erosion causes the pests to burrow deeper. Their attack, though serious, is much more easily detected than that of shipworms.

Protecting Wood Hulls From Marine Borers. Coal tar creosote is the most effective chemical for use against marine borers. However, it adds considerably to hull weight, has an objectionable odor and does not allow the effective application of antifouling paints. Wood which has been treated with certain other wood preservatives has some resistance to borer attack while an *unbroken* layer of copper bottom paint or of sheathing prevents the entry of the borer.

Any break in the protective coating is an open invitation to borer infestation. It is of first importance that the bottom coating of a boat be continuous. Tool marks, scrapes, nicks, etc., should be properly preserved and painted prior to refloating the vessel.

The same principle applies to bottom sheathing whether copper or fiberglass reinforced resin. A small break can admit enough shipworms to honeycomb the structure of the ship while the sheathing makes their detection difficult. In order to protect the hull coatings, some boats are fitted with worm shoes attached to the bottom of the keel and separated from it by creosote soaked felt or copper sheathing. These shoes are designed to take the scraping of any grounding, to have their protective coating broken rather than that of the hull and thus protect it from worm attack. All such shoes, rubbing strakes, etc., should be viewed with suspicion since it is impossible to assure 100 percent separation from the hull and since an infected worm shoe is a source of "free swimmers" which can move to any break in the protective coating of the hull.

Metal shoes and rubbing pieces are sometimes fitted for the same purpose. Of course these never become worm infested but they must be carefully fitted and bedded to prevent borers from working their way underneath the shoe around the edges and thus into the main structure.



SS *DOLLY TURMAN* CITED AS "GALLANT SHIP"

PRESENT AT ceremonies marking presentation of the Gallant Ship Award to the SS *Dolly Turman* of Lykes Bros. Steamship Co., Inc., for her role in the rescue of 47 crew members from the sinking Japanese freighter *Fukuzan Maru* in 1961 were, standing left to right: George Tharp, Chief Engineer of the vessel; Henry F. Oleaga, second assistant engineer at the time of the rescue and a member of the lifeboat crew participating in the rescue; Captain Thomas A. King, Gulf Coast Director of the U.S. Maritime Administration; Lykes Lines President Joseph T. Lykes, Jr.; Gustav Olson, chief mate; Ernest Lawson, cook and baker; and Juan Herrera, messman. Front row, left to right, are Ralph Galino, third cook; Max Todorovich, oiler; Paul Seabrook, seaman; and Walter Hollins, Jr., fireman/water tender. In addition to the Gallant Ship Award to the vessel, each member of her crew at the time of the rescue received a unit citation and the 10 men who risked their lives to man the *Dolly Turman*'s lifeboat to effect the rescue on the edge of a typhoon were additionally presented with the Merchant Marine Meritorious Medal.

The *Dolly Turman*, owned and operated by Lykes Brothers Steamship Line, has been cited as a "Gallant Ship," the highest award the United States Government can bestow upon a merchant ship. The award is the result of rescue operations in mountainous seas on the edge of a typhoon in which the 47-man crew of a sinking Japanese vessel was saved. The "Gallant Ship" award carries with it a unit citation for her entire crew. In addition, the Master will receive the Merchant Marine Meritorious Service Medal, as will the 10 seamen comprising her lifeboat crew who have been cited for heroism. This is one of the highest individual awards for U.S. merchant seamen.

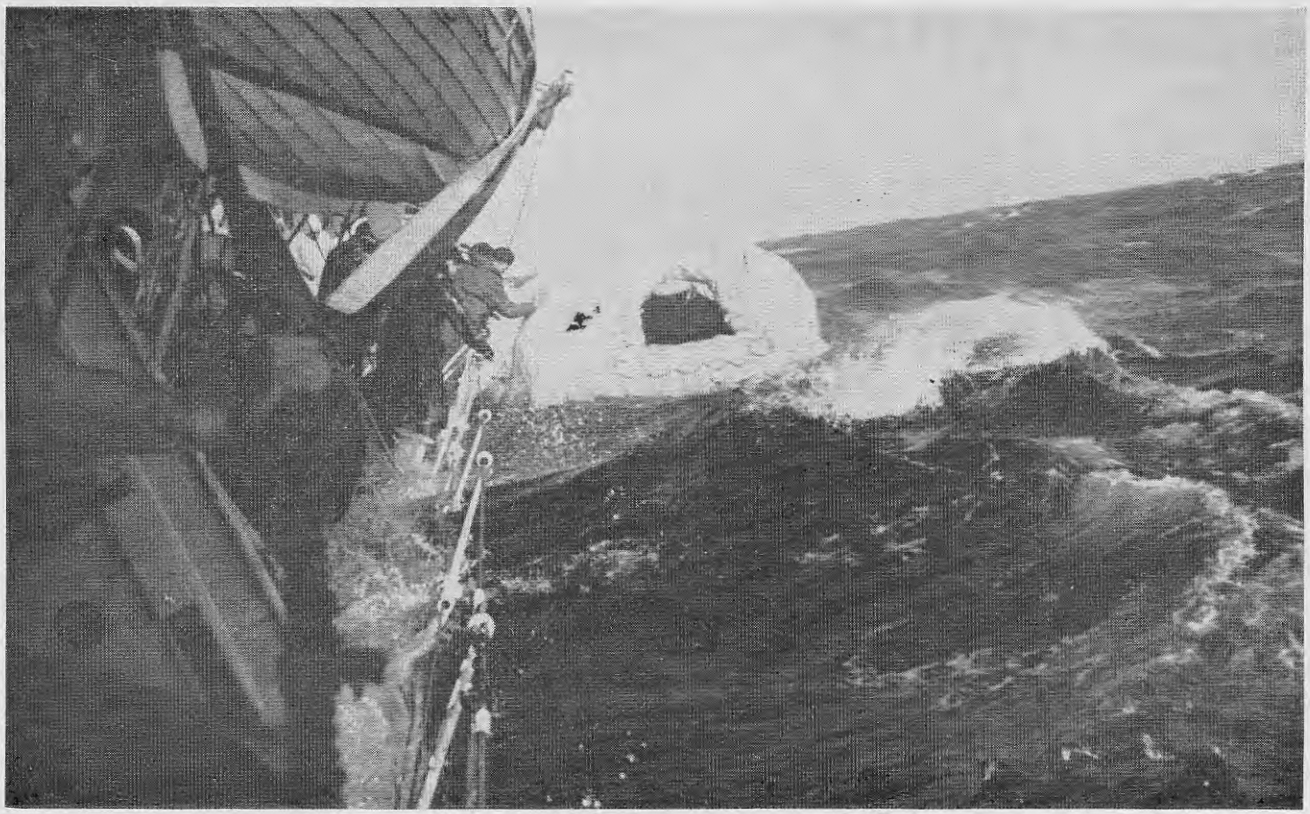
With her citation as a "Gallant Ship," the *Dolly Turman* joins the select company of 14 other merchant ships so cited, 9 of them for actions in which they participated during World War II, 3 for their part in the *Andrea Doria* rescue, 1 for a mass rescue of 14,000 civilians during the Korean operation, and 1 for a rescue operation off Alaska in 1959. "Gallant Ship" awards are authorized under Public Law 759 of the 84th Congress, introduced by Senator Warren G. Magnuson, Chairman of the Commerce Committee of the Senate. The law authorizes "Gallant Ship" awards to be made to any United States or foreign ship which participates in outstanding or gallant action in marine disasters or other emergencies for the purpose of saving life or property. The awards are authorized by the Secretary of Commerce, with concurrence by the Secretary of the Treasury.

Naming of the *Dolly Turman* as a "Gallant Ship" is the result of her response to a distress call on October 26, 1961, from the Japanese ship *Fukuzan Maru*, foundering in mountainous seas on the edge of typhoon Billie near 17° N., 147° E. The *Dolly Turman* raced to the aid of the stricken vessel, and stood by the ill-fated ship during an abortive attempt to reach port. Despite all efforts throughout the long night to save their ship, however, the crew of the *Fukuzan Maru* was forced on the morning of October 27 to abandon ship.

Standing by in gale-swept seas, the *Dolly Turman* lowered a lifeboat. The launching of the lifeboat was successful despite constant danger of its being swamped by the seas or crushed by the heavily rolling ship. Once launched, the 10-man crew of the lifeboat showed no hesitancy in their determined efforts to reach the seamen of the *Fukuzan Maru*. With complete disregard for their own safety, the crew of the *Dolly Turman* lifeboat reached the stricken vessel. In less than an hour the lifeboat completed the transfer of 47 men from the Japanese ship to the safety of the *Dolly Turman*. Moments later an explosion rocked the *Fukuzan Maru* and within 2 minutes the ship had gone down.

MEDICAL ASSISTANCE AT SEA

The value to merchant seamen of AMVER (Atlantic Merchant Vessel Report), the system of radio assistance at sea maintained by the U.S. Coast Guard, is well illustrated by the account of a rescue effected by SS *Atlantic* of American Export Lines. March 30, at 0634 G.m.t. the 13,652-ton tanker *Olympic Valley*, in position 32 37N, 69 40W, bound for New York, requested medical advice from Commander, Fifth Coast Guard District, for an oiler who had fallen in the engineroom, sustaining head injuries. Treatment instructions were prescribed by USPHS Hospital Norfolk, with recommendation for prompt medical attention; Coast Guard Rescue Coordination Center, Portsmouth, Va., called for list of vessels with doctor aboard within 100-mile radius of tanker's position. The "surface picture," derived from a plot maintained on an electronic computer in the New York AMVER center, showed SS *Atlantic* to be most favorably located. At 1527 G.m.t. Norfolk Hospital prescribed further treatment and recommended that the tanker either divert to nearest shoreside medical facility or that patient be, if feasible, evacuated to vessel with medical facilities. AMVER surface picture information was passed to *Olympic Valley* which arranged to meet *Atlantic*. Actual contact was made at 2223 G.m.t., when *Atlantic's* doctor was taken by small boat to the tanker for consultation. *Olympic Valley* then continued on to New York with the patient, arriving March 31. The injured man was then taken to hospital to complete his recovery. He most likely owes his life to the prompt assistance and cooperation of the master and crew of SS *Atlantic*.



FORCE 10 wind.

THE DESIGN OF INFLATABLE LIFERAFTS FOR SURVIVAL AT SEA

By David V. Edwards

DEVELOPMENT OF THE inflatable liferaft as a piece of marine equipment is probably the outcome of the successful use of rubber dinghies during World War II. It was estimated that over 17,000 airmen owed their lives to these dinghies, known to many people as "the yellow thing the kids played with one summer." Today dinghies have not only changed considerably in design, but their name is also changed—to inflatable liferafts.

As far as the marine industry is concerned, inflatable liferafts came of age in May 1960 when the International Convention for the Safety of Life at Sea met in London to review safety regulations for merchant ships. With the experience gained by several maritime nations who had enforced carriage of inflatable liferafts on fishing vessels, the Conference agreed to their use on ships engaged on International voyages. The new International rules are still awaiting final ratification and full scale provisioning has not yet started. Since inflatable liferafts are relatively new it is proposed here to describe some of the operational features of their design.

Mr. Edwards' article on the background and design of inflatable liferafts represents the author's personal opinion only, and does not necessarily represent the official view of the U.S. Coast Guard. There are several areas in the construction standards for this type of equipment where differences of opinion presently exist. Mr. Edwards' article is presented because of its timeliness and interest.—ED.

FLOTATION

The prime purpose of a liferaft is to provide flotation to the survivors of an abandoned ship. Satisfactory flotation is dependent on many links in a chain of events which is described here in more or less logical order.

STOWAGE

To ensure that a liferaft functions when needed it must be stowed on the vessel correctly. The raft must be located where the crew can get to it even in a late stage of a casualty. The forecastle is usually considered unsuitable and in a small vessel such as a trawler the best place for the raft is behind the wheelhouse. However, care should be taken to keep the raft away from excessive heat such as engineroom casings or funnel. It need hardly be said that rafts should be accessible; in one instance it was reported that a raft was located in the ship's store below decks! A liferaft is supplied either in a valise or a container. A valise stowed raft needs extra protection in the form of a wood or metal box fitted with collapsible sides, whereas a container stowed raft is suitable for installation without any additional protection. With new vessel construction a lot can be gained by providing lockers in the superstructure in which to stow the liferafts, the lockers having canvas shelves rather like pipecot berths.

PAINTER

As soon as a raft is installed the painter should be made fast to a strong point on the vessel. It is the painter which triggers off inflation and if this is let go when the raft is thrown overboard it will be lost.

Many raft stowages are fitted with a hydrostatic release but this will not inflate the raft and is only a refinement of the method of holding the raft on to the ship. With a hydrostatic release fitted, the restraining straps on the raft stowage will be undone automatically at a predetermined depth of water by the pressure, allowing the raft to float to the surface. In shallow water the valise will merely remain floating on the surface, tethered to the foundered ship and it will be necessary for a survivor to pull the painter to inflate the raft. Should the ship founder in more than 100 feet of water the buoyancy in the packed raft will be sufficient to put tension on the painter and trigger off inflation. Apart from the unlikely occurrence of a ship foundering in deep water before the crew can reach the rafts, there is one serious snag in making the design of a raft meet this condition, i.e.: after inflation of the raft has occurred the painter must break, or something must break, unless the raft is to be dragged under water with the ship. Now this means putting a limit on the maximum breaking strain of the painter system. Successful rescues by inflatable liferafts far outnumber the failures but it is interesting to note that among the failures painter breakages have been prominent. This fact has naturally caused concern among users and quite recently the Icelandic Government, which was the first to adopt inflatable liferafts on fishing vessels, has insisted that the strength of the painter system should be 2,200 pounds for rafts having carrying capacities of 9 men or more. The reasoning behind this approach is that the painter must be strong enough to hold the raft alongside a ship in the worst possible sea conditions—when the raft is needed the most. It is quite likely that an inflated raft, especially a large one, would break even a 2,200 pound painter before being pulled under by a sinking ship but there is no guarantee of this and so, quite rightly, automatic operation is taking second place to the more important aspect of not losing the raft from a ship still afloat in heavy seas.

INFLATION

Inflation of a raft is initiated by the pnll on the painter, which, in addition to being attached to a strong point on the raft, is also connected to the valve of a gas cylinder. It is not necessary to open the valise or container in which the raft is stowed, since the internal pressure generated after opening the gas valve is more than sufficient to burst open the fastenings which are specially designed for this purpose.

TWENTY man liferaft.

The gas cylinder is filled with carbon dioxide and a small amount of nitrogen. At low temperature the pressure of carbon dioxide is very low and causes sluggish inflation and, in order to improve the inflation time, nitrogen is added. Unlike carbon dioxide, which liquifies and falls to a low pressure when cold, nitrogen remains a gas and its pressure remains relatively high and so helps the flow of the gas mixture into the raft. At normal or high temperatures the addition of nitrogen to the gas content does little or nothing to help, in fact it is a nuisance since its presence reduces the total weight of gas a cylinder can safely contain.

The volume to which the gas expands varies with the surrounding temperature and in order to achieve satisfactory inflation at very low temperatures it is necessary, in addition to adding nitrogen, to allow an extra amount of gas. This extra amount may be as much as one-third more than that required at normal temperatures. Obviously this extra gas has to go somewhere when the raft is inflated at normal temperature and for this reason relief valves are fitted. A small amount of extra gas can be absorbed by the raft as extra pressure, but with a one-third allowance this is not feasible since it would rise to over three times the working pressure at normal temperature, and to about six times at 150° F. If, on the other hand, only sufficient gas is contained in the cylinder for normal temperature inflation, the raft will be badly underinflated at low temperature.

Relief valves can be described as a necessary evil since they are a potential source of leakage and it is usual to provide stoppers which can be used after any excess gas has been relieved. Pressure will vary in the raft between day and night temperatures but the difference is not enough to warrant the fitting of relief valves for this purpose alone.

BOARDING

This has been the subject of continuous research and development for several years. Many experienced seafaring men could see no real future for inflatable liferafts on passenger ships until some means of embarking passengers was found, other than making them jump into the sea or climb down a rope ladder. Inflatable rafts had proved themselves on trawlers and small vessels, but the methods of rescue which had proved so effective with physically fit and tough merchant seamen and fishermen could not be applied without modification to elderly passengers.

The challenge was met by R.F.D. and Schat Davits, two companies who put on a program of research and development which, after 3 years, produced a practical solution. Trials were carried out in shipyards, at dockside, in a wind tunnel, and on several occasions at sea. The trials culminated in a mock abandon ship drill for 42 volunteer passengers on board a 17,000-ton passenger liner in the Bay of Biscay. Three specially designed liferafts were inflated at deck level whilst suspended from a davit, boarded and then lowered to the water, one after the other.

This system of getting passengers into liferafts in the same way as lifeboats has been criticized on the grounds that it complicates the issue and makes liferafts subject to some of the disadvantages of lifeboats. However, on closer examination it can be appreciated that the rafts are still portable and can be carried from a disabled davit, or from an area of fire or dense smoke, or from one side of the ship to the other and launched from another davit, or in the extreme case the same rafts can still be thrown into the water and passengers made to board by ladder, by jumping, or by climbing in from the water.

This latter problem of boarding from the water has come in for more than its fair share of attention. As far as can be ascertained from survivors' reports the majority of rescues have been accomplished by survivors jumping into the raft direct from the ship, probably the low side where

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ABOUT THE AUTHOR

Mr. Edwards joined R.F.D., Inc., in June 1962 having served with R.F.D. Co., Ltd., of Godalming, England, for the past 10 years. He has been closely connected with liferaft design and operation over this period and has taken part in the development of inflatable liferafts to the stage where they were approved by the International Convention for the Safety of Life at Sea in 1960.

there was a list. On one occasion the crew of a British Trawler had time to load blankets and other conveniences including a pack of playing cards, only to be rescued within 2 hours! Where reports indicated that survivors did board from the water only a few had any difficulty. Bearing in mind, however, that most of these rescues involved fit seamen and that rafts will be used increasingly for passengers, it is now common practice for rafts to be fitted with an inflatable step or ramp as a boarding aid. During tests on these devices it was found that a person with one arm completely disabled and wearing heavy clothes and a lifejacket could climb in unaided.

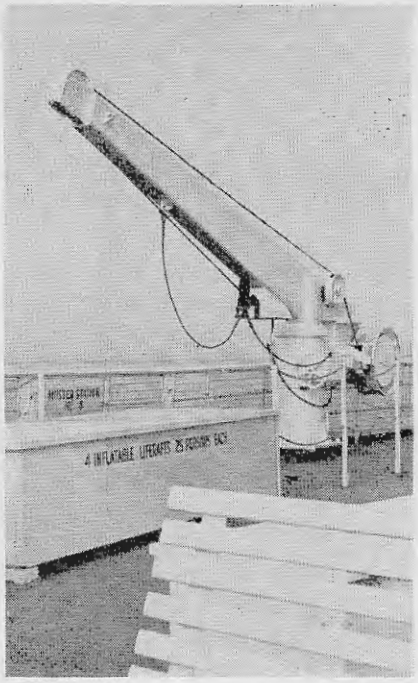
SHAPE

The basic liferaft design as far as shape and distribution of buoyancy is concerned must be touched upon although this is a subject on which not a little controversy has developed. The International Convention agreed on standard requirements which are 220 pounds buoyancy and 4 square feet for each person the liferaft is designed to carry. Some raft designs have this buoyancy distributed equally into two compartments one above the other, whilst other designs favour a bow and stern section of one tube. The basic difference in these two methods is that with the superimposed tube design, failure of one compartment still provides a full-sized raft, but in the case of the single tube raft only half of the floor area is usable. There are many other factors involved which make it difficult to decide whether one method is best, and for the time being it must be assumed that both types of buoyancy division are basically satisfactory.

Differences in plan form also exist, some rafts being circular, as were the wartime dinghies, while others are boat shaped. A circular raft has the greatest beam for a given capacity of raft, a feature which cannot be disputed, and this makes the streaming of a sea anchor in heavy seas less important than is the case with the boat shaped raft.

MATERIALS

Many liferafts are still manufactured in rubber proofed cotton fabrics, although the use of synthetic textile and rubber is increasing. One of the synthetic textiles in common use is Nylon and this can now be woven in high tenacity yarns and has a superior strength weight ratio to cotton. It is also highly resistant to most forms of rotting. One of the well-known synthetic 'rubber' products is Chloraprene, or Neoprene, and



LIFERAFT station on the "City of Vancouver."

this is now used extensively for proofing fabrics used in liferaft construction. The advantage of Neoprene is resistance to ageing, weathering, and oil, although it does not have the same low temperature flexibility as natural rubber.

The fabric, even in two- or three-ply construction, is relatively thin but it has remarkable strength—equivalent in tensile strength to mild steel. But the strength of a raft does not necessarily lie in the tensile of the fabric, but more in the low working pressure, about 2 pounds per square inch, which allows the tubes to "give" when subjected to impact. Only knife edged or pointed projections are liable to cause damage and neither the barnacle covered side of a listing ship nor a rocky shore should be cause for anxiety.

With the exception of the inflation cylinder and valves, metal and other hard materials are almost entirely eliminated from liferaft construction as damage can be caused to the fabric through corrosion or chafe.

PROTECTION

Protection is next, after Flotation, in the logical order of survival. Carley floats and other forms of buoyant apparatus provide flotation in that they keep a survivor from sinking, but flotation alone is not enough except for short periods in warm seas, and even then sharks are a problem. Exposure in very cold climates is fatal after quite a short time and in hot areas some protection from the sun is also necessary. Even the early World War II dinghies had an apron under which the survivors could obtain shelter and there is still in existence a dinghy made in the late 1930's for Imperial Airways having a canopy held up by inflatable arch tubes in the same way as modern liferafts.

INSULATION

Liferafts today usually have a double-walled canopy separated by an air layer. The floor is also double and capable of being pumped up by hand. With these refinements a full complement of survivors can raise the temperature within a raft by body heat to as high as 70° F. even with an ambient temperature below the freezing point. This is good but it has brought along an attendant problem; that of carbon dioxide concentration, the product of exhalation. When the carbon dioxide content in the air becomes higher than 3 percent there is a danger of suffocation, and the only remedy is a supply of oxygen or fresh air. Unfortunately a high concentration of CO_2 causes drowsiness and survivors in this state can easily succumb without realizing what is happening. It will be appreciated that ventilation is of the utmost importance in the design of a liferaft canopy, but in achieving good ventilation it must be borne in mind that the area of the ventilator must be sufficient to meet the needs of a full complement of survivors, it should not be possible to seal it off completely, but it must not allow water to enter the raft. The last requirement of watertightness is not as easy as it sounds when it is remembered that water can come in the form of driving rain or spray or even breaking waves. One method commonly employed is to make the entrances provided for boarding of such design that they are impossible to seal off completely. It is also highly desirable that a lookout can keep watch at all times without disturbing the features of the entrance or ventilation systems.

SURVIVAL RATIONS

Under the general heading of Protection, mention could also be made of survival rations. Water is essential to survival and much more important than food. Two pints each day per person is reckoned to be the minimum requirement although on the first day water can be completely omitted. Doctors tell us that the digestion of food uses up water, and as every available drop of water is needed by the human body to prevent dehydration, the amount of food in-

cluded in the survival pack is very limited and is in the form of hard bread or a biscuitlike substance. Condensed milk and rum fudge have also been included occasionally. Owing to the importance of water to survival, it is customary to embody in the canopy design a rain catchment area and collecting tube. Plastic bags stowed in the survival pack can be used to store water.

Provided there is a regular supply of water there is every chance that survival could continue for 2 months. During World War II three American airmen survived 70 days in an open rubber dinghy in the Pacific Ocean. In more recent times Dr. Bombard, a French doctor interested in the plight of shipwrecked mariners, crossed the Atlantic in a boat under sail, carrying a sealed ration pack which he did not open. The voyage lasted 65 days and he lived entirely from the sea.

Among the other survival items usually included are a first-aid kit, anti-seasickness tablets, torch, knife, repair kit, and pyrotechnics.

LOCATION

Probably the first thing survivors think about is being rescued. It is extremely difficult to pick out a small raft on the sea even if it is being looked for. If it is not known that a raft is in the area the chance of being spotted is greatly diminished. Many a survivor has recounted the agonizing moments when a would-be rescuer has passed almost within shouting distance without noticing anything.

INFORMING RESCUE ORGANIZATIONS

It is most important to ensure that a distress message is sent before finally abandoning a ship. This may be stating the obvious but it may not be realized that once in the raft any communication with the outside world is very limited. Radio transmitters can be supplied for inflatable liferafts, but in these days of congested radio traffic a good, high, and well insulated aerial is needed in order to get a message through on the International Distress frequencies of 2182 and 500 k/cs, and this is not easy to achieve in a liferaft except in relatively calm seas. This situation will be a lot brighter when a wider use of Very High Frequencies is made but at the moment only the Services and aircraft are so equipped.

The most certain way of ensuring the commencement of a Search and Rescue operation is for every ship to make regular reports to her owners, AMVER or someone who will take action in the event of any failure to report. A great many searches have been initiated only by a ship being "reported missing" and obviously the greater the frequency of regular reports the shorter will be the time before search is started in case of trouble, and this will reduce the area of search.

EDITOR'S NOTE: The author recommends that the most certain way of ensuring the commencement of a Search and Rescue Operation is for every ship to make regular reports to her owners, the Coast Guard, or someone who will take action in the event of any failure to report. The Coast Guard does not have the facilities to provide a vessel-following service as envisioned by this statement. Even the AMVER System, which provides a dead-reckoning plot of reporting vessels, is not capable of keeping track of whether or not vessels are overdue. Vessel operators are encouraged to require their vessels to report to them periodically with an "All's Well"-type message in order to keep track of the safe progress of their own vessels. Such a system would give the operator an early indication of trouble and the Coast Guard could be so informed.

FINAL LOCATION

Once a search has begun the problem is narrowed down to the systematic coverage of an area which can be predicted fairly accurately from the vessel's last reported position, next port of call, speed, tidal information and wind force and direction. The role of V.H.F. radio equipment at this stage is to provide a signal on to which a search aircraft or ship can "home." An alternative, though not so effective, is the fitting in the raft of a radar reflector. A good reflector will give a response on a search vessel's equipment over many miles providing the sea is not too rough. A raft without any equipment will give a radar response, but only up to 2 miles. Final location must of course be visual but this can be extended to many miles with careful use of the flare and smoke pyrotechnics and other equipment stowed in the raft. Pyrotechnics can be used in daylight although they are far more effective at night. A pyrotechnic radar reflective signal now available can eject 280,000 dipoles at 1,200 feet, giving a range of up to 12 miles for about 15 minutes.

The sun can be a help or a hindrance to location depending on its relative position to the raft and search vessel. The power of the sun can be used to good effect by reflecting its rays onto a search vessel by means of a heliograph. The colour of the raft, Indian orange and black, has been chosen after many trials to be the most conspicuous with the sun in front, behind or in twilight.

THREE CONDITIONS FOR SURVIVAL

The three conditions to survival: Flotation, Protection, and Location are all involved in the design of an inflatable liferaft and its equipment. Many years of research have brought designs to their present advanced stage and it is gratifying to know that a good number of lives saved from marine casualties in recent years are due to inflatable liferafts.

KEEPING THE WEATHER EYE PEELED

Recently a vessel was loading pallets of flour, employing a long wire sling at No. 4. A supervisor was observing the loading operation; he saw nothing amiss—but like a batter in the box who scans the entire infield for a possible weakness—he was watching. He was also engaged in conversation with a man nearby, but his eyes seemed to follow the movement of the hook, going in the hold and coming out.

The winchdriver suddenly developed the lax and hazardous habit of dragging the empty slings on the return, across the deck, and over the side. The hatch tender (sad to relate) had his back to the entire operation.

Suddenly the dragging wire sling looped across the bulwark with the bights whipping underneath—with one catching on an oil vent.

Our man went into immediate action, and before he actually realized what he was doing, had shouted to the winchdriver to "hold it!" He pointed to the snagged wire. Fortunately there was enough slack to enable everything to come to a halt before the wire set tight. Just a few feet away, with a surprised look on his face, stood the hatch tender.

What did our man prevent?

We can think of several things.

He prevented the possible maiming or death of the hatch tender, for vents do pull loose, and wires whip.

He prevented the possible pulling down of a boom.

He prevented, at the least, loss of time and money.

But best of all, he prevented an accident BEFORE it happened.

This quick action of his is known as automatic reflex action.

Many people have it, some never get it. Fortunate is the man who does.

—*"Stevedores' Guide"*

MARITIME SIDELIGHTS

There were 904 vessels of 1,000 gross tons and over in the active oceangoing U.S. merchant fleet on September 1, 1963, 11 less than the number active on August 1, 1963, according to the Maritime Administration. There were 15 Government-owned and 889 privately owned ships in active service. These figures did not include privately owned vessels temporarily inactive, or government-owned vessels employed in loading storage grain. They also exclude 26 vessels in the custody of the Departments of Defense, State, and Interior, and the Panama Canal Company.

There were two less active vessels and nine fewer inactive vessels in the privately owned fleet. One freighter, the *American Contender*, was delivered from construction. Three freighters, the *Alcoa Pennant, Alcoa Pioneer,* and *Alcoa Pilgrim,* and a tanker, *Mermaid,* were turned in to the Government on an exchange, and the three freighters, *American Marketer, American Supplier,* and *Beloit Victory,* were taken in exchange from the Government. Of the 89 privately owned inactive vessels, 12 freighters and 7 tankers were being repaired or reactivated. The others were laid up or temporarily idle.

The Maritime Administration's active fleet decreased by two while the inactive fleet decreased by two. Three freighters were sold for scrap, and three freighters were transferred to the private fleet. The total Government fleet was 1,833. The total U.S. merchant fleet was 2,811. Contracts were awarded for three new freighters and one tanker and for one tanker conversion. One new freighter was delivered. The number of large oceangoing ships under construction in U.S. shipyards increased by 4 to 56.

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The St. Lawrence Seaway handled a record cargo of 4,196,000 tons during the month of June 1963. The previous high was 3,889,000 tons in October 1962. Figures released by authorities show a 14.7 percent increase during the April–June period over the same period last year. The increase reflected larger upbound shipments of iron ore.

The S.S. *Pioneer Moon*, one of nine fast cargoliners operated by the United States Lines in its express service to the Far East has established a new speed record recently on a run from Yokohama, Japan, to New York.

Captain James Knowlton, Master, reported that the 13,600-ton vessel had steamed the 9,726 nautical miles from Yokohama in 17 days, 14 hours and 48 minutes. Normally, the Company's cargoships operate on a 20-day schedule from Japan to New York.

The *Moon* averaged 23.09 knots while steaming. The ship left Yokohama at 11 a.m. April 28th and arrived off Ambrose Lightship at 2:24 p.m. May 16th. She spent approximately 12 hours in the Canal Zone.

The Distinguished Sea Rescue Award has been presented by the Marine Section, National Safety Council and the American Merchant Marine Institute to USNS *Col. William J. O'Brien,* for assisting the Israeli SS *Nakshon* to extinguish a serious fire aboard in the harbor of Iraklion, December 18, 1962. This award is presented annually to a MSTS ship which performs the year's outstanding feat of safety at sea.

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The Federal Government recently appointed American Export Lines as its general agent to operate the nuclear ship *Savannah.*

TUG *MARGARET* CITED

CAPTAIN EDWARD F. QUINN, Master of the Tug *Margaret,* recently received a letter of Commendation in recognition of the splendid seamanship shown in the rescue of 14 men from an oil rig, *Mr. Louie,* on October 3, 1961.

The presentation was made to Captain Quinn by the Maritime Administration at the Mobile Area Office.

The letter of Commendation reads as follows:

U.S. DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION
WASHINGTON, D.C. 20230

July 25, 1963.

Captain Edward F. Quinn
Tug *Margaret Walsh*

It is my privilege to commend you for the perseverance, devotion to duty and splendid seamanship which you and the crew of the Tug *Margaret Walsh* displayed in the rescue of 14 men off the Oil Rig, *Mr. Louie,* on October 3, 1961.

As the *Mr. Louie* was being towed from the Bay of Campeche for drilling operation in the Louisiana coastal waters, high winds caught the vessel and damaged the structure's derrick, causing it to collapse and hang over the side. The tow was then broken, creating an imminent danger that the oil rig might become unbalanced and turn over. In response to a call for assistance, the *Margaret Walsh* was first to arrive on the scene. A tow line was secured to the oil rig but, due to extremely high winds and heavy seas, it broke. Fearing for the safety of the men aboard, and believing that they might be coming off in life rafts, you continued to stand by but 25 foot swells and 70 mile an hour winds prevented this type of evacuation. A careful survey of the situation revealed that the best possibility for removal of the men would be to back your vessel into a very small area on the leeward corner from which the men could be lowered aboard by the use of crane and nets. After completing this daring maneuver four times, all the men were safely removed from the rig.

I congratulate you and your crew upon the performance of a service which was in keeping with the highest traditions of the United States Merchant Marine and I have directed that a copy of this letter be made a part of your service record.

DONALD W. ALEXANDER,
Maritime Administrator.

nautical queries

DECK

Q. Which of the following is a/are true statement(s) with regard to the elasticity of nylon mooring lines?

(a) Nylon will not return to its normal size after repeated stretchings

(b) Under load nylon will thin out, but when released will return to its normal size

(c) Nylon will stretch 100 percent of its original length before it will part

(d) The elastic limit of nylon is less than that of manila of equal size

(e) Both (a) and (c) above are correct

A. (b) Under load nylon will thin out, but when released will return to its normal size

Q. a. Describe the precautions which you would regard as necessary for personnel engaged in painting with the use of spray guns.

b. Describe the precautions necessary in painting with red lead or lead based paints.

A. When painting with the use of spray gun equipment personnel should wear goggles, respirators, and suitable clothing. The working spaces should be well ventilated as the respirators provide protection only against the particles of the pigment and not against volatile vapors of solvents that may be used. Flames or open lights should not be allowed near spray painting operations due to the hazard of vapor ignition and possible fire or explosion.

b. In using lead based paints the working space should be well ventilated, and if spray guns are used the precautions noted above should be heeded. Upon completion of work personnel should be cautioned to clean off carefully any paint that may have gotten on their hands or skins, due to the possible danger of lead poisoning.

Q. Viewing the gyro course recorder from the front, the pen restricted in its movement to the left side of the chart is used to record:

(a) Greenwich mean time

(b) The ship's course in degrees

(c) The hours of operation

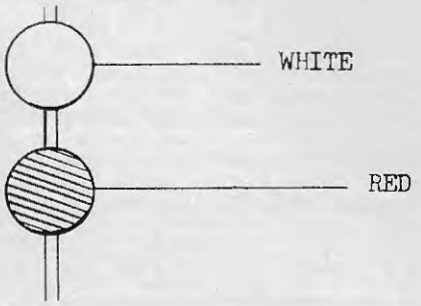
(d) The quadrant of the master compass

(e) Course changes

A. (d) The quadrant of the master compass

STORM

Q. What is indicated by a white light over a red light, such as that illustrated, shown at night at a Storm Warning Display Station of the United States?



A. A white light over a red light shown at night at a Storm Warning Display Station of the United States indicates winds ranging from 39 to 54 miles an hour (34 to 48 knots) are forecast for the area.

This is the gale warning signal.

Q. Right laid nylon mooring line should be made fast to bitts by laying it on in a clockwise direction.

(a) True

(b) False

A. (a) True

ENGINE

Q. (a) What are the duties of all licensed engineers in regard to the remote controls on inspected vessels?

(b) What is the purpose of remote controls and how should they be marked?

A. (a) All engineers should know the location of and how to operate remote controls in case of emergency. They should be examined to see that they are free and in good working condition at frequent intervals.

(b) They are a means of shutting down machinery in case of emergency. Should it be necessary to abandon ship, protection is given against being caught in the propeller, its wake and the swamping of lifeboats. They should be marked so as to show what machinery they control, and the proper direction in which handwheel should be turned in order to shut down machinery.

Q. Explain in detail just what action takes place in the joining of two metals by electric arc welding.

A. In arc welding, the pieces of metal to be welded are brought to the proper welding temperature at a point of contact by the heat liberated at the arc terminals and in the arc stream, so that the metals are completely fused into each other, forming a single solid homogenous mass, after it solidifies.

An electric arc is nothing more than a sustained spark between two terminals or electrodes. In arc welding, the arc is formed between the work to be welded and an electrode held in a suitable holder. The instant the arc is formed, the temperature of the work at point of welding and the welding electrode jumps from normal to the vicinity of 6,500° F. This tremendous heat is concentrated at point of welding where it melts a small pool of metal in the work. Any additional metal required for welding is obtained from a wire or rod, which is melted by the heat of the arc and deposited into this pool in molten state. The arc causes the molten metal in the pool to be agitated, and thus the parent or base metal and the added metal are thoroughly mixed and refined so that a firm, sound union is formed when the weld has cooled.

Q. As officer in charge of a lifeboat, explain the proper method of embarking passengers, getting this lifeboat into the water safely, and away from the ship's side in an emergency.

A. Muster boat's crew at station, remove cover and strong back, screw on drain plug cap, and release gripes taking care to release outboard gripe first if so fitted. See that the sea painter is passed and secured clear of outboard obstructions. Swing out boat and lower to rail of embarkation deck. Hold boat steady with frapping lines while passengers are embarked. After passengers are embarked and seated, lower the boat into the water and trip handle of releasing gear. If the vessel has way, steer well off using the sea painter and let go by pulling the wooden toggle. Stand by vessel to assist other boats or individuals as necessary. Boats should remain in vicinity of vessels to assist other survivors and should remain together for mutual assistance and to facilitate location by rescue craft summoned by radio equipment provided in one or more boats.

NAVIGATION AND VESSEL INSPECTION CIRCULAR NO. 14–63

AUGUST 6, 1963

Subj: Inflammable or Combustible Liquids Having Lethal Characteristics; Clarified Design Criteria for Integral Tanks

PURPOSE

To clarify the requirements which are presently outlined by 46 CFR 39.05–1(c) for construction of integral tanks intended for the carriage of inflammable or combustible liquids having lethal characteristics.

DISCUSSION

46 CFR 39.05–1(c) requires that integral tanks shall "conform with the scantling requirements of the American Bureau of Shipping". These scantling requirements of the American Bureau of Shipping require a design test head "measured to a point 4 feet above the under surface of the deck plating at the side or to the top of the hatch if that be greater". However, because of the character of the subject liquids, other portions of 46 CFR 39 require a closed gaging system (46 CFR 39.10–15) and a vent height equal to one-third the beam of the vessel (46 CFR 39.20–1(b)). The intent of 46 CFR 39, through these requirements, is to prevent human contact with the cargo. The very nature of the cargo makes it necessary that hatches and ullage openings be closed during loading operations. The hatch is therefore no longer a means whereby overpressure of the tank may be relieved. The design and test head should necessarily be compatible with the intent of Part 39.

ACTION

Technical offices and Officers in Charge, Marine Inspection shall insure that integral tanks intended for the carriage of inflammable liquids having lethal characteristics as per 46 CFR 39 are capable of withstanding a test head equal to the total pressure head imposed by the pressure-vacuum relief valve and the cargo when the tank is filled to the highest level the product may rise in the vent or associated piping.

AMENDMENTS TO REGULATIONS

[EDITOR'S NOTE.—The following regulations have been promulgated or amended since the last issue of the PROCEEDINGS. A complete text of the regulations may be found in the Federal Register indicated at the end of each article. Copies of the Federal Register containing the material referred to may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C., 20402]

TITLE 46—SHIPPING

Chapter I—Coast Guard, Department of the Treasury

[CGFR 63–40]

SMALL PASSENGER VESSELS

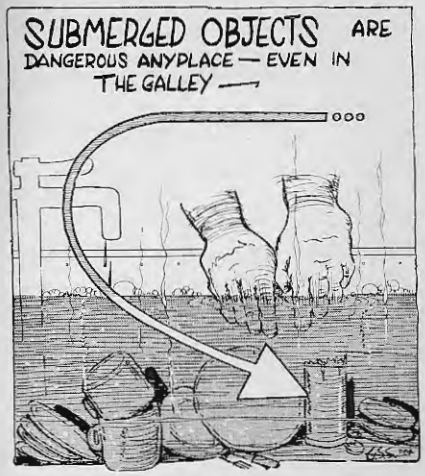
Miscellaneous Amendments

Pursuant to the notices of proposed rule making published in the Federal Register on February 2, 1963 (28 F.R. 1052–1058) and February 16, 1963 (28 F.R. 1510, 1511) and the Merchant Marine Council Public Hearing Agenda dated March 25, 1963 (CG–249), the Merchant Marine Council held a public hearing on March 25, 1963, for the purpose of receiving comments, views and data.

The proposals considered were identified as Items I to XI, inclusive. Item I contained proposals regarding small passenger vessels. The proposals in this Item regarding "portable lights for emergency purposes," "patrolmen on vessels with below deck passenger lounge areas," and "lounge arrangements for passenger spaces located below deck" are adopted without change. The proposals regarding scope of regulations for small passenger vessels are adopted with minor changes. These proposals provide that the regulations in 46 CFR, Parts 175 to 186 would apply to all small passenger vessels under 100 gross tons regardless of length. The regulations which apply only to small passenger vessels not more than 65 feet in length have been designated with an "S" for "small vessels" while those vessels which are over 65 feet in length have been designated as "L" vessels. Those regulations which do not have a specific designation are applicable to both categories of vessels, i.e., "S" and "L" vessels. In a number of cases, the text within a particular section may apply to small vessels only when the paragraph is designated as "S," or to large vessels only when it is designated "L," or to both small and large vessels when it is designated "S and L." Changes were made in 46 CFR 175.01–1, 176.01–3(c), 180.30–10(c) and 181.10–1(c). This document is the eighth of a series covering the regulations and actions considered at the March 25, 1963, public hearing.

A regulation designated 46 CFR 180.10–35 was inserted to continue existing requirements for rescue boats on "L" vessels unless the Officer in Charge, Marine Inspection, is of the opinion that the vessel itself provides a fully satisfactory rescue platform. In order that the regulations in 46 CFR Chapter I will properly reflect a change in scope of the small passenger vessel regulations in Subchapter T, amendments are made to 46 CFR 2.01–7, 24.05–1, 30.01–5, 70.05–1, 70.05–3, 90.05–1 and 110.05–1. These changes which were not described in the notices of proposed rule making published in the Federal Register are considered to be editorial changes and it is hereby found that compliance with the Administrative Procedure Act (respecting notice of proposed rule making, public rule-making procedure thereon and effective date requirements thereof) is unnecessary.

By authority vested in me as Commandant, United States Coast Guard, by Treasury Department Orders 120 dated July 31, 1950 (15 F.R. 6521), 167–9 dated August 3, 1954 (19 F.R. 5195), 167–14 dated November 26, 1954 (19 F.R. 8026), 167–20 dated June 18, 1956 (21 F.R. 4894), CGFR 56–28 dated July 24, 1956 (21 F.R. 5659, 167–38 dated October 26,



Courtesy Pacific Maritime Association

1959 (24 F.R. 8857), and 167–46 dated November 6, 1961 (26 F.R. 10609), the following actions are ordered:

1. The vessel inspection regulations shall be amended in accordance with the changes in this document.

2. Unless specifically specified otherwise, the regulations in this document shall become effective on and after the 30th day following the date of publication of this document in the FEDERAL REGISTER.

3. Regulations containing specific effective dates shall become effective on and after such dates.

4. The amendments designated 46 CFR 177.30–7, 184.30–5, and 185.22–1 shall be effective as follows:

(a) For all new vessels or vessels converted to passenger service, all requirements on or after the effective date of the regulations in this document.

(b) For existing vessels the requirements concerning lounge arrangements and portable lights for emergency purposes in 46 CFR 177.30–7 and 184.30–5 must be complied with prior to the next date of inspection for certification or 12 months from the effective date of the regulations in this document, whichever is later.

(c) For all vessels the requirements concerning patrolmen in 46 CFR 185.22–1 shall apply as of the effective date of the regulations in this document.

5. The regulations in this document may be complied with in lieu of existing requirements; however, the new or revised requirements in this document shall be met by no later than the effective dates specified herein.

(Federal Register of September 6, 1963.)

LICENSE RENEWAL

As a matter of general information, regulations governing the licensing and certificating of merchant marine personnel *PERMIT* the renewal of a license for a period of up to and including 90 days *BEFORE* the license expires. This fact might not be well known. 46 CFR 10.02–9(d)(2) provides that "no license shall be renewed more than 90 days in advance of the date of expiration thereof, unless there are extraordinary circumstances * * *." Therefore, in many instances, it might be more convenient for a man to renew his license early. If he does so within the 90 day period, no "extraordinary circumstances" need exist.—Editor.

TITLE 46—SHIPPING

Chapter I—Coast Guard, Department of the Treasury

SUBCHAPTER K—MARINE INVESTIGATIONS AND SUSPENSION AND REVOCATION PROCEEDINGS

[CGFR 63–50]

PART 136—MARINE INVESTIGATION REGULATIONS

PART 137—SUSPENSION AND REVOCATION PROCEEDINGS

Payment of Witness Fees, Subsistence and Mileage

The purpose for the amendments to 46 CFR 136.11–10(b) and 137.17–1(b) is to revise the procedures followed in the payment of the witness fees, subsistence and mileage to agree with current practices. Because the amendments in this document describe procedures and practices, it is hereby found that compliance with the Administrative Procedure Act (respecting notice of proposed rulemaking, public rulemaking procedure thereon and effective date requirements) is exempted by specific provisions in section 4 of this Act (5 U.S.C. 1003).

In Part 136—Marine Investigation Regulations, subpart 136.11—Witnesses and Witness Fees, the introductory sentence only of § 136.11–10(b) is amended to read as follows:

§ 136.11–10 Witness fees, subsistence and mileage.

* * * * *

(b) Upon receipt of such claim (Standard Form 1157) with supporting statement, the Coast Guard authorized certifying officer may certify to the propriety of the claim according to the following scale and submit it to the appropriate disbursing officer for payment:

In Part 137—Suspension and Revocation Proceedings, Subpart 137.17—Witness Fees, § 137.17–1(b) is amended to read as follows:

§ 137.17–1 Witness's request for payment of fees.

* * * * *

(b) Upon receipt of the witness's claim (Standard Form 1157) with supporting statement, the Coast Guard authorized certifying officer may certify to the propriety of the claim according to the scale of fees, subsistence, and mileage in § 137.17–5, and submit it to the appropriate disbursing officer for payment.

(Federal Register of September 13, 1963.)

TITLE 46—SHIPPING

Chapter I—Coast Guard, Department of the Treasury

SUBCHAPTER B—MERCHANT MARINE OFFICERS AND SEAMEN

[CGFR 63–46]

PART 10—LICENSING OF OFFICERS AND MOTORBOAT OPERATORS AND REGISTRATION OF STAFF OFFICERS

Subpart 10.05—Professional Requirements for Deck Officer's Licenses (Inspected Vessels)

MAINE MARITIME ACADEMY, CASTINE, MAINE; COURSE AS "RADAR OBSERVER"; NOTICE OF APPROVAL

The course of instruction in the proper operation and utilization of marine radar equipment given by the Maine Maritime Academy, Castine, Maine, was reviewed after receipt of a letter dated June 19, 1963, from the Superintendent of the Maine Maritime Academy. It was also requested that the Coast Guard accept the certificates issued to those deck cadets who on or after July 2, 1963, successfully completed such a course of instruction.

The regulation designated 46 CFR 10.05–46(d)(5) is added by this document in order to inform all persons concerned that the course of instruction in the proper operation and utilization of marine radar equipment is approved as given at the Maine Maritime Academy, Castine, Maine. The holders of Maine Maritime Academy's certificates, which attest to the successful completion on or after July 2, 1963, of the course of instruction in the proper operation and utilization of marine radar equipment, may present such certificates as evidence of qualifications as "radar observer" and be exempt from taking the examination specified in 46 CFR 10.05–46(b).

§ 10–05–46 Radar observer.

* * * * *

(d) * * *

(5) The course of instruction in the proper operation and utilization of marine radar equipment is approved as given at the Maine Maritime Academy, Castine, Maine. This approval shall be effective for all certificates issued to the deck cadets of the Maine Maritime Academy which attest to the successful completion of the course of instruction in the proper operation and utilization of marine radar equipment on or after July 2, 1963, and will continue in effect until this approval is suspended, canceled, or modified by the proper authority.

(Federal Register of September 18, 1963.)

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

Chapter I—Coast Guard, Department of the Treasury

[CGFR 63–48]

SUBCHAPTER C—AIDS TO NAVIGATION

PART 72—MARINE INFORMATION

Subpart 72.05—Light Lists

SUBCHAPTER F—NAVIGATION REQUIREMENTS FOR WESTERN RIVERS

PART 95—PILOT RULES FOR WESTERN RIVERS

Lights for Ferryboats and Barges

Pursuant to the notices of proposed rulemaking published in the Federal Register on February 2, 1963 (28 F.R. 1052–1058), and February 16, 1963 (28 F.R. 1510, 1511), and the Merchant Marine Council Public Hearing Agenda dated March 25, 1963 (CG–249), the Merchant Marine Council held a public hearing on March 25, 1963 for the purpose of receiving comments, views and data.

The proposals considered were identified as Items I through XI in the Public Hearing Agenda and Item X contained proposals regarding Rules of the Road. This item included proposals regarding "lights for moored barges," which are adopted in part. At the public hearing objections were made to the relaxation of the requirements governing lights on moored barges on waters navigated by seagoing vessels. Therefore, the adoption of this proposal is limited to barges operating on the Mississippi River and its tributaries north of Cairo, Illinois. The use of this revised barge lighting requirement in other areas will be studied to determine feasibility before further action is taken. This is the 10th document of a series containing regulations and actions based on this public hearing.

In this document the amendment to 33 CFR 95.35 describes the lights required for barges on the Western Rivers other than the waters of the Mississippi and its tributaries above Cairo Point, Illinois, while 33 CFR 95.36 will govern the lights for barges in the Mississippi River and its tributaries above Cairo Point, Illinois. No further action will be taken on the proposal designated 33 CFR 80.16a regarding lights for barges, canal boats, scows and other nondescript vessels on certain inland waters on the Gulf Coast and the Gulf Intercoastal Water Way until after a determination is made based on the aforementioned feasibility study.

The amendments to 33 CFR Subpart 72.05 are editorial and change the title of information pamphlets from "Lists of Lights and Other Marine Aids" to their new title "Light Lists."

(Federal Register of September 25, 1963.)

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

Chapter I—Coast Guard, Department of the Treasury

SUBCHAPTER A—GENERAL

[CGFR 63–61]

PART 3—COAST GUARD DISTRICTS, MARINE INSPECTION ZONES, AND CAPTAIN OF THE PORT AREAS

Subpart 3.55—Eleventh Coast Guard District

LOS ANGELES—LONG BEACH MARINE INSPECTION OFFICE RELOCATED

The Marine Inspection Offices formerly located in the Post Office Building, San Pedro, and the Times Building, Long Beach, California, have been consolidated and relocated, effective August 1, 1963. The Los Angeles-Long Beach Marine Inspection Office is now located in the Centre Building, 750 Broad (at the corner of Anaheim and Broad) in Wilmington, which is in the City of Los Angeles, California. The new mailing address is Officer in Charge, United States Coast Guard, Marine Inspection (Los Angeles-Long Beach), P.O. Box 217, Wilmington, California, 90746.

The purpose of this document is to amend 33 CFR 3.55–10 to show the new name given to the former Long Beach Marine Inspection Zone and the consolidation of former Marine Inspection Offices in San Pedro and Long Beach, which have been relocated in Wilmington, California. Because this rule describes Coast Guard organization, it is hereby found that the Coast Guard is exempt from compliance with the Administrative Procedure Act (respecting notice of proposed rulemaking, public rulemaking procedures thereon, and effective date requirements).

The following amendment to § 3.55–10 is prescribed and shall be in effect on and after August 1, 1963:

§ 3.55–10 Los Angeles-Long Beach marine inspection zone.

(a) The Los Angeles-Long Beach Marine Inspection Office is in Wilmington, California.

(b) The Los Angeles-Long Beach marine inspection zone comprises the land masses and waters of the State of Arizona and Clark County in Nevada and also the land masses, inland and territorial waters of that part of California which includes the counties of Santa Barbara, Kern, San Bernardino, and all counties south thereof with the exception of San Diego County, as well as all artificial islands subject to inspection on the Pacific Ocean due west thereof.

(Federal Register of September 26, 1963.)

ARTICLES OF SHIPS' STORES AND SUPPLIES

Articles of ships' stores and supplies certificated from September 1 to September 30, 1963, 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

A. L. Robertson, Inc., 325 South Kresson St., Baltimore 24, Md., Certificate No. 573, dated September 18, 1963, "300" VINYL CLEANER.

Pennsalt Chemicals Corp., 2700 South Eastern Ave., Los Angeles 22, Calif., Certificate No. 574, dated September 26, 1963, PENNSALT 3018 ELECTRICAL CLEANER. Certificate No. 575, dated September 26, 1963, PENNSALT 3028 SOLVENT DEGREASER.

AFFIDAVITS

The following affidavits were accepted during the period from August 15, 1963 to September 15, 1963:

Seal Fast, Inc., P.O. Box 18572, Houston 23, Texas, FITTINGS.

Fisher Governor Co.,[1] Marshalltown, Iowa, VALVES AND FITTINGS.

[1] Delete in the Formerly Approved Section of CG–190 dtd April 2, 1962.

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 (8–1–62).
115	Marine Engineering Regulations and Material Specifications (3–1–63), F.R. 8–20–63.
123	Rules and Regulations for Tank Vessels (1–2–62). F.R. 5–2–62, 9–11–62, 2–6–63, 4–4–63, 5–30–63, 8–20–63, 9–6–63.
129	Proceedings of the Merchant Marine Council (Monthly).
169	Rules of the Road—International—Inland (6–1–62), F.R. 1–18–63, 5–23–63, 5–29–63, 7–6–63.
172	Rules of the Road—Great Lakes (6–1–62). F.R. 8–31–62, 5–11–63, 5–23–63, 5–29–63.
174	A Manual for the Safe Handling of Inflammable and Combustible Liquids (7–2–51).
175	Manual for Lifeboatmen, Able Seamen, and Qualified Members of Engine Department (9–1–60).
176	Load Line Regulation (9–1–61). F.R. 7–27–62, 11–14–62, 2–2–63, 6–11–63.
182	Specimen Examinations for Merchant Marine Engineer Licenses (12–1–59).
184	Rules of the Road—Western Rivers (6–1–62). F.R. 1–18–63, 5–23–63, 5–29–63, 9–25–63.
190	Equipment Lists (4–2–62). F.R. 5–17–62, 5–25–62, 7–24–62, 8–4–62, 8–11–62, 9–11–62, 10–4–62, 10–30–62, 11–22–62, 11–24–62, 12–29–62, 1–4–63, 1–8–63, 2–7–63, 2–27–63, 3–20–63, 4–24–63, 6–11–63, 6–15–63, 6–22–63, 6–28–63, 8–10–63.
191	Rules and Regulations for Licensing and Certificating of Merchant Marine Personnel (7–1–63). F.R. 9–18–63.
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, 10–5–62, 9–13–63.
220	Specimen Examination Questions for Licenses as Master, Mate, and Pilot of Central Western Rivers Vessels (4–1–57).
227	Laws Governing Marine Inspection (6–1–62).
239	Security of Vessels and Waterfront Facilities (8–1–61). F.R. 11–3–61, 12–12–61, 8–8–62, 8–31–62, 11–15–62, 1–30–63, 3–27–63, 5–29–63, 6–4–63.
249	Merchant Marine Council Public Hearing Agenda (Annually).
256	Rules and Regulations for Passenger Vessels (1–2–62). F.R. 5–2–62, 9–11–62, 12–28–62, 4–4–63, 5–30–63, 8–20–63, 9–6–63.
257	Rules and Regulations for Cargo and Miscellaneous Vessels (11–1–62). F.R. 2–1–63, 2–6–63, 3–13–63, 4–4–63, 5–30–63, 8–20–63, 9–6–63.
258	Rules and Regulations for Uninspected Vessels (9–1–61). F.R. 1–20–62, 4–24–62, 5–2–62, 9–11–62, 5–14–63, 9–6–63.
259	Electrical Engineering Regulations (12–1–60). F.R. 9–23–61, 9–30–61, 5–2–62, 9–11–62, 8–20–63, 9–6–63.
266	Rules and Regulations for Bulk Grain Cargoes (5–1–62). F.R. 9–11–62.
268	Rules and Regulations for Manning of Vessels (2–1–63).
269	Rules and Regulations for Nautical Schools (5–1–63).
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, 4–24–63.
323	Rules and Regulations for Small Passenger Vessels (Not More Than 65 Feet in Length) (6–1–61). F.R. 9–11–62, 10–5–62, 12–28–62, 1–22–63, 9–6–63.
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 D.C., 20402. It is furnished by mail to subscribers for $1.50 per month of $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 SEPTEMBER 1963

The following have been modified by Federal Registers:
CG–200 Federal Register, September 13, 1963.
CG–191 Federal Register, September 18, 1963.
CG–184 Federal Register, September 25, 1963.
CG–123, CG–256, CG–257, CG–258, CG–259 and CG–323 Federal Register, September 6, 1963.

M.T. NOGGIN-

AS USUAL-TAKES THE SHORT CUT TO THE HOSPITAL.

HE HAD CHECKED WITH CUSTOMS—
HE HAD CHECKED WITH IMMIGRATION—
BUT HE FAILED TO CHECK WITH SAFETY!

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