PROCEEDINGS OF THE

MERCHANT MARINE COUNCIL

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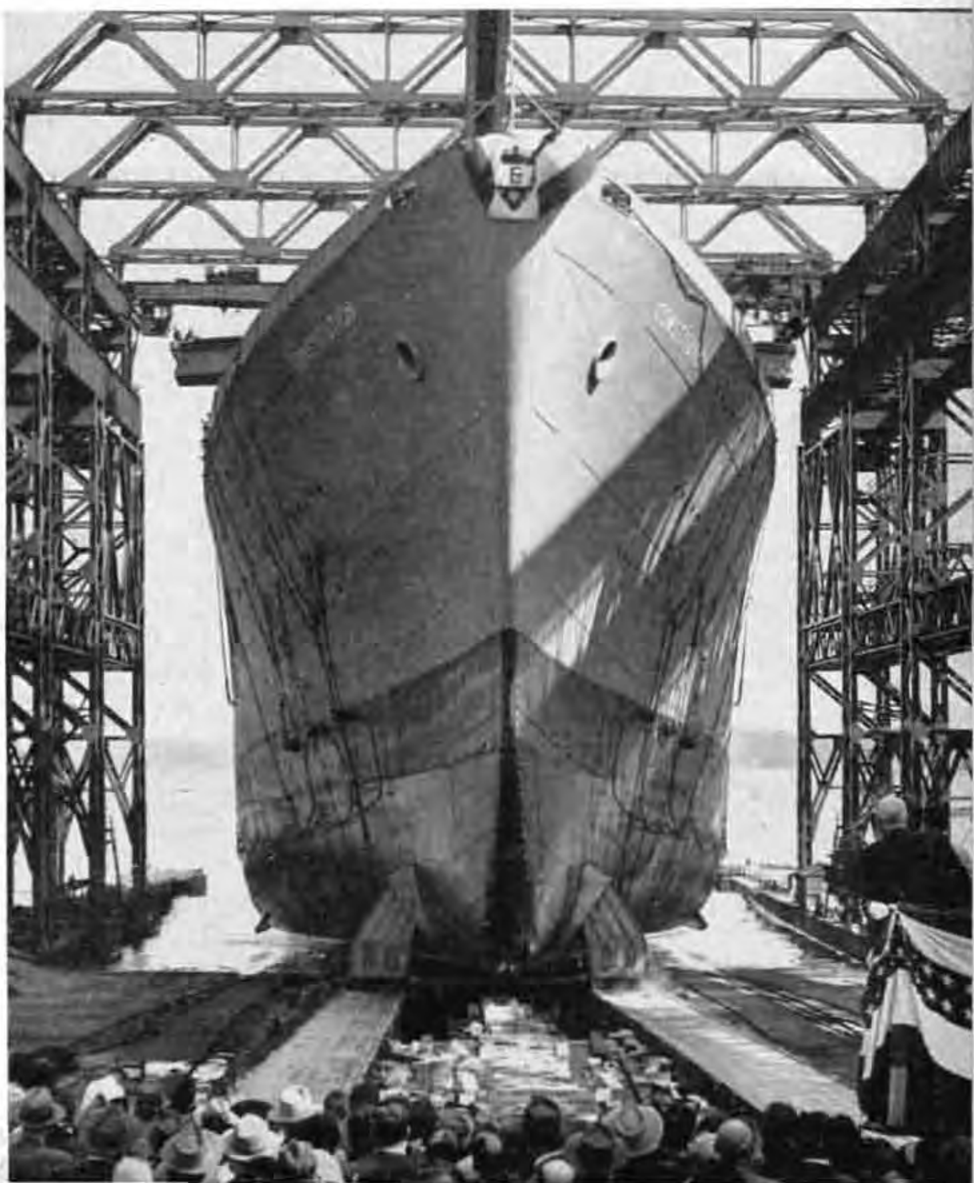

THE SEA IS A WOMAN

By Frank H. Keith

The sea is a woman, charming and deep.
Haunting a million of men though they sleep—
A sweetheart whose bosom is pulsing and warm,
A vixen who taunts them in tempest and storm!
A mother-like being, she gives from her heart
The catch for a crew, and fish for the mart;
And often she dances beneath a great moon
While a sailor is singing a voyager's tune . . .
I know she's a woman—she has to be,
For so many men are in love with the sea!

Poem Courtesy, Lykes Fleet Flashes

Proceedings of the

MERCHANT MARINE COUNCIL

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The Merchant Marine Council of the United States Coast Guard

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SAILING BY SUFFERANCE

Editorial by Boris Lauer-Leonardi

Since man sails the sea on sufferance, eternal vigilance is the price of safety. If any one trait distinguishes the seaman it is his constant alertness. He notices driftwood on his course long before anyone else has seen it. He watches approaching vessels, estimating their course and speed, notes landmarks, buoys, weather, cloud formations, state of tide, direction and velocity of current and the wind. In fact everything even remotely affecting his ship and her progress is included in his observations.

This may sound like a big order, but actually a lot of it the seaman does subconsciously. At that, running a boat is a full-time, 24-hour-a-day job. Even asleep part of him guards his ship, as witness many a skipper who has come on deck, aroused from deep slumber because the motion changed due to shoaling water, on altered course or any other good reason.

Our able seaman has a darting eye. He scans the sky and the water and little escapes his notice. He is just as vigilant in good weather as in bad, and in strange waters as at home.

Even in port the smart skipper has the ship's safety foremost in his mind. Is he lying in protected waters? Has he room to swing? Should he expect squalls from the west you'll surely find him anchored under the western shore. If his vessel swung much before night, he might clear his anchor before turning in.

Besides the ship the good skipper is interested in his crew. Are they feeling well, or are they tired? Do they get along, or is there friction?

Below decks is his domain also. Engines, stoves, water and fuel supplies, victuals and menus all come in for attention. True, he may and should delegate authority, but never should he relax an unobtrusive surveillance of all facets of ship operation.

A good skipper never takes anybody's word for anything. If a hand informs him that "there is plenty of water here" the skipper checks the chart personally because, after all, if his vessel piles up it is his responsibility, and his only.

Skippers have no excuses.

NOTE: *This article was published in the September 1950 issue of "The Rudder" and is reprinted herein by special permission of the author and the magazine.*

SHIP LOSSES DURING 1949

According to a summary published by Lloyd's Register of Shipping, the world lost 414 ships totaling 858,661 tons in 1949.

Ships of more than 100 tons lost or condemned in consequence of casualty or stress of weather totaled 219, with 236,690 tons, while ships broken up were 195, with 621,971 tons.

Norway was the country that lost more ships as maritime casualties—27 with 15,757 tons. Great Britain lost 25 ships with 63,868 tons in 1949, besides ships broken up.

United States ships lost in 1949 were 14, with 3,458 tons.

SOME CASE HISTORIES OF SHIPBOARD LUBRICATING PROBLEMS DURING WORLD WAR II

BY CAPT. W. D. LEGGETT, JR., U. S. N., MEMBER,[1] GEORGE L. NEELY, VISITOR,[2] AND COMMANDER J. B. RITCH, JR., U. S. N., VISITOR[3]

Introduction

In the days of sailing vessels, seagoing lubrication was a simple business. The few mechanisms which required any attention of this nature could be lubricated by an occasional lick with a swab from a tallow bucket. However, modern engineering has relegated the tallow bucket along with the sailing vessel to a limbo beyond our reach. Whether we like it or not we are faced today with seagoing lubricating problems which require not only detail design formulae but also a continuous exercising of sound common sense and engineering judgment. It is our hope that in this paper we can relate some lubricating experience of the Navy in World War II that will add to the general fund of knowledge on this subject and at the same time bring home some basic principles of lubrication which will help us avoid similar mistakes in the future.

It is obvious that the lubricating system and the oil films on various bearing surfaces are essential parts of modern machinery design. Still, problems involving lubrication came to light during World War II which indicated that the importance of the relationship of the lubricating oil film to the operation of some of our naval machinery had been underestimated. In many cases major fleet units were immobilized for months, too many vessels of a badly needed class were spending too much time in port, and specialists in lubrication were carrying out tests on ships during wartime operations in enemy waters.

The authors have assembled, from their own experiences and from records of the Navy Department, instances of machinery troubles on naval vessels which were, or appeared to be, lubrication failures. Some of the difficulties arose from the use of the wrong lubricant or its improper application; some were from improper bearing design, problems of metallurgy, or a combination of these and other factors. A few cases show that some limiting quality of the lubricant was not fully evaluated in the design of the unit.

Strangely enough, the majority of the difficulties were due to the disregard of some simple principle of lubrication. Since lubrication depends on design as well as on materials, a change of lubricant alone was seldom sufficient to insure trouble-free operation. The importance of the selection of a properly designed lubricant for a properly designed machine cannot be overemphasized.

Case Histories

Since this is a paper on lubrication, the cases will be divided to the best of our ability into thick and thin film lubrication problems. Let us start with thick film lubrication, which fortunately covers most applications.

In thick film lubrication we have the ideal condition of an oil film completely separating the surfaces of machine elements. An excellent example is the Kingsbury-type thrust bearing where the entire thrust of the propeller is transmitted through the oil film. The oil film literally pushes the ship through the water. The geometry of the film and the stress distribution in the film are necessarily a designed part of the equipment. In this type of bearing it is possible to apply the principle of the oil wedge or converging film formulated by Osborne Reynolds. This principle of lubrication, using air as the lubricant, was demonstrated by Prof. Albert Kingsbury [1][4] at a conference in the Navy Department in 1896. It is possible that the relatively trouble-free operation experienced with this bearing is attributable to the thorough understanding by the manufacturers of the principles of lubrication involved.

Turbines and Reduction Gears

Turbine lubrication is one of the best known and most important examples of thick film lubrication using a lubricating oil. Here we have a

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[1] Director, U. S. Naval Engineering Experiment Station, Annapolis, Md.

Captain Leggett graduated from the U. S. Naval Academy in the class of 1921. As a junior officer he had duty in the engineering departments of destroyers and battleships. During four tours of duty in submarines he served as Chief Engineer, Commanding Officer and as Division and Squadron Engineer. In 6 years of duty in the Navy Department he was instrumental in initiating and carrying out the program which resulted in American-built Diesel engines for the Navy and the electric-drive submarine. During World War II he was Machinery and Repair Superintendent at the Mare Island Navy Yard and later Fleet Maintenance Officer of the Seventh Fleet.

[2] Assistant Manager, Product Acceptance Department, Standard Oil Co. of California.

Mr. Neely graduated from the U. S. Naval Academy in the class of 1922. He resigned from the Navy in 1925 to take a position as research engineer with Standard of California. During the next 17 years he was instrumental in the development of a number of important patents in the field of lubrication. During World War II he served with the Navy as an officer specialist in fuels and lubricants and, as a Commander, was Head of the Petroleum Section of the Naval Technical Mission to Japan in 1945. Postwar he was manager, Lubricant Division, Standard of California, and later Vice-President of The California Oil Co.

[3] Fuels and Lubricants Project Officer, U. S. Naval Engineering Experiment Station, Annapolis, Md.

Commander Ritch graduated from the U. S. Naval Academy in the class of 1939. After a 3-year tour of duty in the engineering department of the U. S. S. *New Mexico* he served as flag lieutenant to Commander Battleships, Pacific Fleet, until the fall of 1943. He then attended the Naval Postgraduate School and the University of California at Berkeley in the course in Petroleum Engineering. In 1946, he was assigned temporarily to the Bureau of Ships and participated in Operation Crossroads as a member of the BuShips group. He went to the Experiment Station in 1947.

Paper presented at the Fifty-seventh Annual Meeting of The Society of Naval Architects and Marine Engineers on November 10, 1949, by Capt. W. D. Leggett, Jr., U. S. N. and Commander J. B. Ritch, Jr., U. S. N., both of the Engineering Experiment Station, Annapolis, and George L. Neely of the Standard Oil Co. of California.

[4] Numbers in brackets indicate references listed at the end of the paper.

much more difficult and complicated problem than the thrust bearing. The lubricant used must be a compromise between an oil light enough to cool and lubricate the main journal bearings and control mechanisms properly, yet heavy enough to prevent wear of gear teeth, to cushion the loads, and to help silence the operation of the gears [2].

There are other requirements for marine turbine oils not so immediately apparent. Prior to World War II scattered reports had been received from the Fleet and from commercial turbine installations of abnormal rusting and sludging. An increasing number of reports from industry, aired in the meeting of the D-2 Committee of the American Society for Testing Materials in the summer of 1940, prompted the Bureau of Ships to direct the Engineering Experiment Station to evaluate a turbine oil, for which the manufacturer claimed special rust preventive properties. This program was supported by the builders of naval turbines because of their general feeling that the oils then specified actually were causing corrosion of metal parts in the turbine systems. A 500-hour Navy rusting test was developed by the Experiment Station which became a part of specification NS 14-0-15 for turbine oils. Later, a 48-hour rusting test was evolved which gave comparable results.

The marked superiority of the present-day product over the straight mineral oil used prior to World War II is illustrated clearly in Figure 1, which shows the relative rusting on two strips immersed in the old and new-type oils with moisture present.

Turbine oils containing oxidation and corrosion inhibitors were in use on the Atlantic at the outbreak of World War II. The evidence as to their need was shown conclusively by the North Atlantic Patrols prior to the war. However, the decision was made to continue the use of straight mineral turbine oils on the Pacific because of the supply problem. Wartime operations soon proved that an improved lubricant was required in this area also.

Long periods without oil change, at powers much higher than the normal peacetime operations, were necessary. Peacetime standards of purification and settling could not be maintained. Too many destroyers, badly needed on escort or patrol duty, were in port worrying over sludge and corrosion. In the chill of the North Atlantic, the water vapor in the warm gear cases was condensed by the passage of the cold air over their exterior surfaces, making a regular "rainfall" inside the gear case which resulted in heavy rusting. On the Pacific the problem generally took the form of sludging in the oil reservoirs and control mechanisms because of the higher atmospheric temperatures. Of course, both difficulties occurred on both oceans and frequently in the same ship.

FIGURE 1.—Comparison of the rusting on steel strips which have been immersed in inhibited and noninhibited turbine-oils for the 48-hour test.

The decision was made to change over to the 2190-T turbine oils containing corrosion and oxidation inhibitors. This change-over focused the attention of the operating personnel of the Fleet on the turbine systems, and the situation rapidly became confused. Engineering crews became supersensitive about the condition of their gear sets. Many vessels reported serious rusting after changing over to 2190-T oil. Some blamed the conditions on the new product and asked permission to return to the old straight mineral oil. One Navy Yard advised that rusting had been confined to certain classes of ships and these were all using 2190-T.

Educating the Fleet to the change-over presented a problem of some magnitude. After 18 months' operation in the forward areas on straight mineral oil, the U. S. S. *Enterprise* changed over to 2190-T oil; even after flushing the system with fresh batches of oil for 72 hours, the new oil picked up and carried in suspension sufficient rust and carbonaceous material to cause considerable alarm. This was really disconcerting—new oil in a carefully flushed-out system becoming black almost immediately. Some reassurance is definitely in order before starting after an enemy! Conventional methods, such as centrifuging, did not remove the contaminants. Another oil change was not made because of the necessity for continuous high-speed operation. The final cleaning was effected at sea by filtration through muslin bags, laundered and replaced at frequent intervals.

In another instance, the U. S. S. *Alabama*, while operating off the Japanese home islands with Task Force 58, developed a cloudy condition of the oil in one of her four main turbine units. This indicated a water-type emulsion in the oil which the operating personnel properly thought endangered the full-power operation of the turbine. The Task Force was undergoing daily Kamikazi attacks and the possibility of dropping behind the force formation and becoming an isolated target was not enticing. The cloudiness was eliminated finally by the selective absorption of the last traces of water from the oil by muslin bags at low filtration rates, as in the case of the U. S. S. *Enterprise*.

The inhibited oils did stop the corrosion and sludging. Without them the conditions requisite for thick film lubrication could have been maintained only by much more extensive maintenance and at the expense of availability of the vessels. However, they do have their peculiarities. It was not until the Bureau of Ships issued Circular Letter No. 340, advising the forces afloat of the advantages and peculiarities of 2190–T oil, that complaints became negligible.

Corrosion within the closed turbine and gear system lends considerable emphasis to the necessity for making corrosion protection a requirement for all lubricants used aboard ship. The need for such protection in more exposed locations is apparent. The recognition of the effects of high humidity and salt air in enclosed locations such as a main gear set and the necessity of using a rust-inhibited lubricant for protection is not so obvious. It is possible that the advantages of using these lubricants have not been appreciated fully by designers and operators of this type of equipment.

Submarine Propeller Shaft Bearing Lubrication

Our World War II submarines were designed with the idea that they might have to fight a trans-Pacific war. Their record of achievement speaks for the success of this design as well as for the caliber of the operating personnel. Even so, we did not foresee everything and one thing we learned the hard way was that the Japs had a better sonic listening gear than we had given them credit for. One of the things this gear could pick up was shaft squeal. Since the shaft squeal was worst at the very low speeds used for evasive tactics, it was quite a serious problem.

Submarine shaft bearing problems are similar in most respects to those of other vessels. The shafts have bronze sleeves which rotate in wood, rubber, or plastic strip bearings. The lubricant used is sea water. It may be difficult to visualize water in this instance as forming a thick lubricating film but, theoretically, the rotating sleeve and the rounded edge of the bearing strips should, and under most circumstances do, accomplish just this for most sterntube shaft bearings. In the submarine the length of the shaft outside the hull, and the deformation of the hull due to pressure changes lead to alinement difficulties which always provide us with spots where the pressure is just about great enough to break through the film even under normal conditions.

At the very low shaft revolutions employed by submarines at creeping speeds the wedge action is not sufficient to maintain the film of water lubricant. The bearing material then grips the bronze sleeve and holds it until the shaft winds up enough to overcome the higher friction incident to the loss of the lubricating film. The shaft then unwinds until the torque drops below this frictional force and the shaft seizes again.

The result of this intermittent and repetitive wind-up of the shaft was an audible frequency vibration or squeal which was anything but soothing to the submarine personnel. At first it was believed to be due to the use of rubber bearing strips, but the same condition was found to exist with lignum vitae. Then the blame was placed entirely on alinement, which really was a major factor. One submarine was docked six times at Midway to correct for shaft alinement and repeated dockings after overhauls or refits were the rule rather than the exception. It has been estimated that this item alone accounted for half of the submarine dry dockings during the war. The bores of the shafts were even packed with sand to dampen out the vibration. All this helped but we still had shaft squeal.

A lubrication officer attached to the Fleet evolved the theory of vibration due to shaft wind-up based on:

1. The design of the bearing using longitudinal bearing strips is not well suited for the formation of a thick lubricating film of sea water. This type of grooving is used primarily to permit a free flow of water through the bearing for flushing and cooling. Under the conditions of high unit loadings, due to imperfect alinement and low rubbing speed, the lubricating film ruptured causing the shaft to bind.

2. Under the thin film conditions prevailing, when the film breaks down, sea water does not provide sufficiently low kinetic or static coefficients of friction for bronze rubbing on any of the bearing materials used.

The theoretical basis for the foregoing conclusions is illusrated in figure 2, which shows a typical coefficient of friction versus *ZN/P* curve, wherein *Z* is the viscosity of the lubricant (sea water), *N* is the rubbing speed of the shaft against the bearing, and *P* the unit load on the bearing. In the fluid film zone, as, for example, at position 1, a decrease in rubbing speed or an increase in unit load transfers the bearing operation to the thin film zone, position 2, where the shaft establishes solid contact with the bearing surface. The rubbing motion of the shaft, relative to the bearing, approaches zero as the high frictional forces twist the propeller shaft until the shaft torque exceeds the frictional force. Slippage then occurs and the cycle is repeated at high frequency, producing a squealing sound effect. (A homely example of the mechanism bringing this about is the creaking of an unlubricated door hinge.) The intermittent and repetitive wind-up and slippage of the shaft is illustrated between positions 2 and 3 on the *ZN/P* curve. Realinement of the bearings overcomes the high unit loading, thus increasing the value of *ZN/P* and placing the operation of the bearings back in the fluid film zone.

After other conventional attempts at eliminating the noise were unsuccessful, the lubrication officer carried out tests on a submarine at Perth, Australia. The submarine was dry docked, the bearings removed, and hand applications of grease made. Sound tests then were conducted at sea. A marked reduction in the shaft noise was obtained even though the lubricant used had not been prepared specifically for the frictional surfaces involved and only a single application was possible without redocking the submarine.

This case is a graphic illustration of the manner in which the principles of lubrication may be put to work in solving practical problems. Basic research under conditions of low kinetic speeds has shown that the application of even a small amount of properly selected lubricant will reduce greatly the frictional forces under these conditions [3]. Based on this fundamental knowledge, the lubrication specialist assumed that the application of a small amount of a selected lubricant would reduce the frictional effects for bronze rubbing on lignum vitae surfaces in the presence of sea water, and, if this were true, could reduce the force sufficiently to prevent the shaft wind-up and eliminate the cause of squeal. The effect of applying such a lubricant is illustrated at position 4. In the end, we have the rather unusual situation of one bearing using two lubricants in what is really the same lubricating system. Sea water acts in the normal speed range and the grease takes over under conditions of high load and low speed. Perhaps this isn't an ideal so-

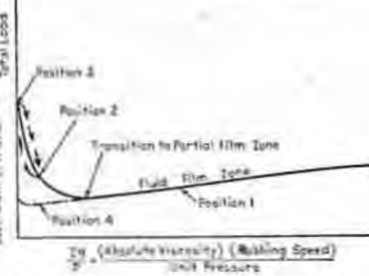


Figure 2.—Illustration of frictional characteristics of propeller shaft bearings.

lution but it does indicate the flexibility attainable and may be the only satisfactory solution.

As a consequence of the results obtained in these wartime tests, further investigation is now in progress in which scientifically prepared lubricants are applied through piping to the bearing surfaces. Although the problem has not yet been solved completely, lubrication experience points to a satisfactory conclusion. Other features of the investigation include tests of composition materials which will operate satisfactorily under these operating conditions with sea water. Figure 3 shows actual full-size bearings and bearing materials being tested in the Laboratory at the U. S. Naval Engineering Experiment Station.

Figure 4 shows the lengthy shaft and the actual location of the strut bearing on a submarine.

Periscopes

While discussing lubrication on submarines, another annoying problem that should be mentioned is that of the lubrication of the periscope. This appears to be a very simple problem embodying a journal moving slowly in both axial and rotational motion within a fixed sleeve. But that isn't all. The periscope is the commanding officer's personal instrument—look out for that!

In an attack the periscope must be raised quickly and lowered without delay. While it is up for a very short period, the commanding officer must be able to rotate it easily so that he may fix on his target, get his attack information, and take an occasional look around to insure that the general situation is in hand.

Lubricating for these motions alone is quite simple but there are other requirements. The periscope must be sealed against leakage, so you have a packing as well as a lubricating job.

If it leaks, the water runs down on the skipper and interferes with fighting the ship; if it turns hard, longer exposures are required; if excessive clearances allow vibration, target bearings will not be accurate. We want a lubricant that will reduce friction and act as a sealant. It must not wash off when the scope is being pushed through the water. We must be able to pump it through long tubes to insure that it reaches the bearings and seals to be lubricated as shown in figure 5. It must be heavier than water so it will not leave a slick when trying to evade. It would be nice if it would reduce the reflection from the bright bearing surface of the exposed periscope, so we would not feel quite so conspicuous. As a matter of fact it would help if the same

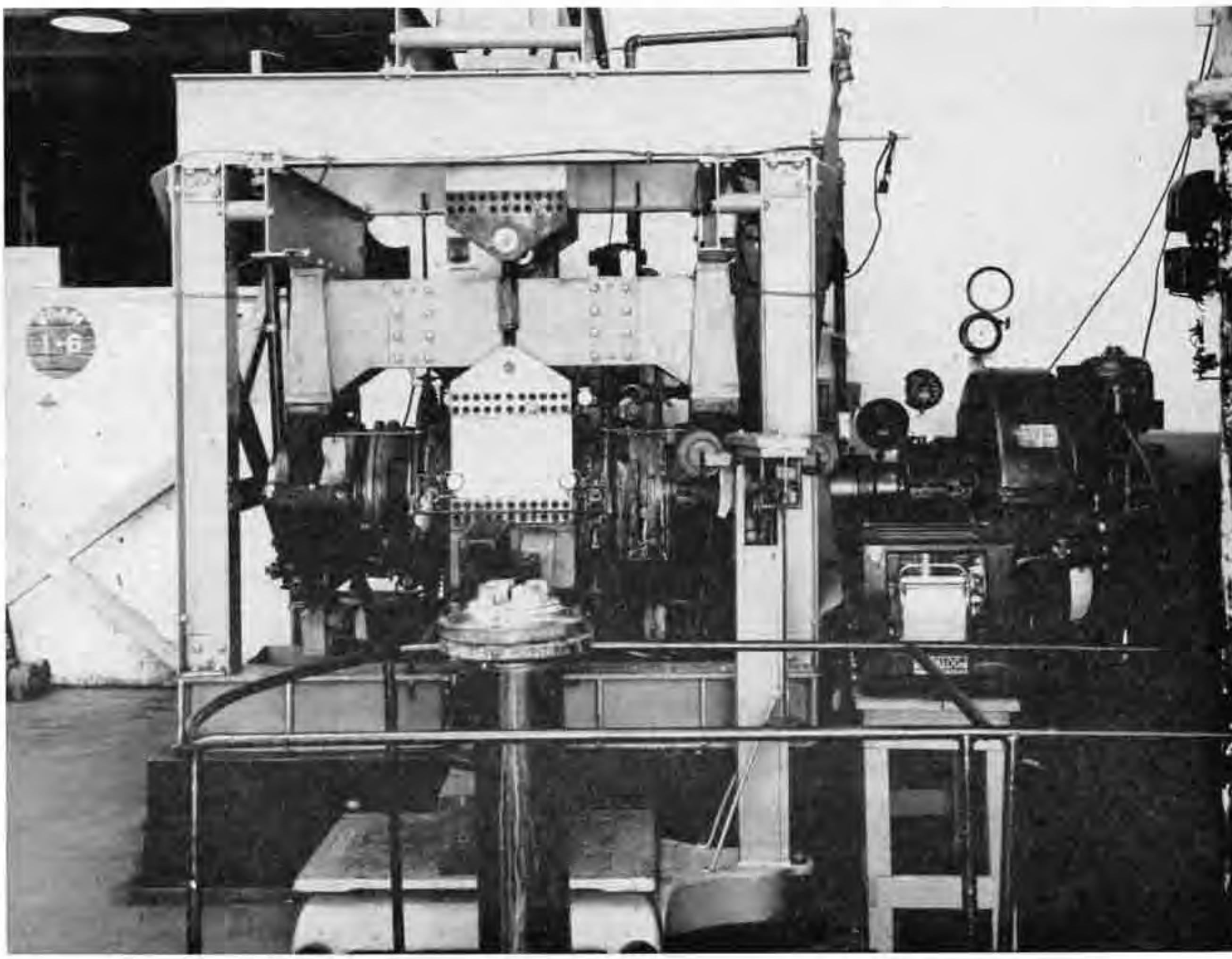


FIGURE 3.—The stern tube and strut bearing testing machine used at U. S. N. Engineering Experiment Station to test materials for these bearings.

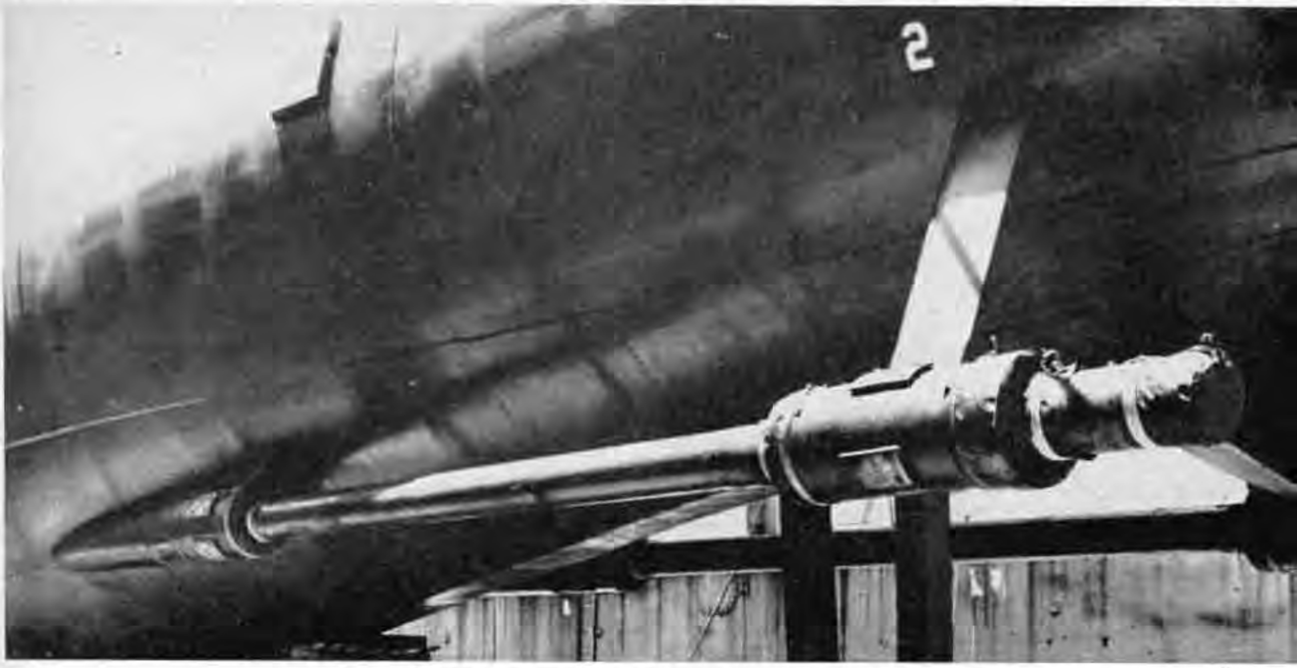


FIGURE 4.—The stern tube and strut bearing of a submarine.

lubricant possessed corrosion-inhibiting properties and could be used for all topside lubrication.

Obviously, a grease is the only thing we can use for the periscope. Because it is a grease, we class this as thick film lubrication and before going any further a few elementary characteristics of greases will be mentioned. Lubricating greases in their simplest form are mineral oils thickened with soaps. The type and quantity of soap used in conjunction with the mineral oil selected determine the nature of the grease. The principal difference between an oil and a grease lies in flow characteristics, the soap converting the oil from a viscous liquid to a plastic solid and endowing it with the ability to "stay put" at the point of application. As a matter of interest, some of the types of greases together with applications, advantages, and limitations are shown in table 1.

Although greases can be manufactured which meet most of the requirements of submarine lubrication, the problem remains a tough one. Postwar improvements in lubricants, particularly those of a synthetic nature, and the use of new types of packing may provide the answers. Design changes of the vessel, such as the elimination of the long grease lines, thereby reducing the pumpability requirement, will also help. However, we have not reached the perfect solution as yet, and the situation probably will be complicated by deeper submergence depths. It looks like a long-time job calling for the continuous cooperation of the lubricant manufacturers and the shipbuilders.

Gun Slides

A problem of similar interest was that of lubricating the gun slides on surface craft. From the lubrication standpoint, this mechanism is a journal bearing having axial motion only. Again the lubricant must meet heavy demands. It must lubricate at the high temperatures encountered under rapid fire, it must be adhesive, and, most important, it must resist removal by moisture so that it will protect the slide against corrosion in the presence of salt air.

These conditions are difficult to meet satisfactorily. The "stay-put" characteristic of greases makes them most suitable. It was once common practice to remove the heavy grease and apply a slushing oil prior to firing, making two lubricants necessary where one should do. This practice was manifestly impractical under war conditions.

Figure 6 shows tests being made at sea off the coast of Japan during World War II to determine the resistance of a gun slide lubricant to removal by salt-water washing.

Diesel Engine Bearings

During World War II the American Diesel engine industry demonstrated its ability to expand production to such an extent that by the end of the war we had in operation in our Navy several million more horsepower in Diesels than in all other types of propulsion. With such an expansion there were a number of to-be-expected headaches and many of them appeared to be lubricating problems. We will present only two very typical cases, in each of which film failure was caused by mechanical defects through no fault of the lubricating oil. The second case brings out an oil film characteristic of such

FIGURE 5.—Photograph showing grease lines on periscope structure of a submarine.

TABLE 1.—*Types of Greases*

Base	Appearance	Application	Advantages	Limitations
Calcium (lime)	Range from soft to hard-depending on soap content.	General purpose; compression grease cups, gear boxes, used in grease guns.	Insoluble in water	Not suitable at temperatures above 175° F. or at high speeds; not suitable for preservation purposes.
Sodium (soda)	Stringy or fibrous	For all types of bearings operating at high speeds and temperatures.	High melting point; good adherence; will remain on rotating surfaces at high speeds.	Soluble in water and will wash off readily; not suitable for preservation purposes.
Mixed base (calcium-sodium).	Smooth, stringy at high temperatures.	For high-speed bearings in the presence of moisture.	High melting point; water repellent.	Same in part as in individual soaps used; not suitable for preservation purposes.
Mixed base (calcium-lead)	Smooth and buttery	For slush-on lubrication of gears, highly loaded sliding or rolling surfaces, and equipment exposed to salt spray.	Tenacious and will adhere to surfaces under heavy loads; insoluble in water and good corrosion preventive properties.	Not suitable for long-term storage; will create drag at low temperatures unless applied as thin film.
Aluminum	Brilliant and transparent in appearance.	High-speed gears	Insoluble in water and has good adhesive qualities.	Not suitable for bearings where the temperature is likely to reach 170° F.; not suitable for preservation purposes.
Lithium	Smooth and buttery	Bearing surfaces enclosed gear boxes, grease fittings.	High melting point, insoluble in water, wide range of operating temperatures, suitable for preservation purposes.	

significance as to warrant its inclusion.

Wrist pin bearings.—After World War I, we started a building program of large submarines. Fortunately for operations in the Pacific during World War II, we were successful in carrying out this program, for we learned a number of useful things about submarine engine design and lubrication. We learned that, with the full cooperation of the submariners, naval architects, marine engineers, ship and machinery builders, all the things that we originally thought would require a 4,500-ton boat to do off the coast of Japan could be done in a boat half that size. It took about seven stages to get the answer but we had it when we went into the construction phase for World War II.

FIGURE 6.—Salt water-washing tests of gun slide lubricants being conducted on U. S. S. *Alabama*.

The 2,500-ton class submarines, the first ones built, had 2,500 horsepower two-cycle engines of crosshead design in which the pressure on the wrist pins was always down. The crosshead bearings operated well originally and continued to operate satisfactorily even after modification of the piston to provide for heavier head construction. Later, when the wear on the pins and bearings became excessive and replacement was necessary, it proved next to impossible to run in a new wrist pin and bearing under normal operating conditions. Ships were delayed for months in navy yards and, when new parts were installed at sea, operations were by no means dependable. Fleet Admiral Nimitz, the then division commander and an old Diesel engineer, found the situation far from acceptable. Many modified designs, some suggested by Admiral Nimitz himself, were tried. The most promising of the design changes was to grind a flat on the pin, only three-eighths-inch wide, but still sufficient to set up a semblance of a wedge action.

Another cure was to lap the pin and then burnish it between oak blocks until it really had an ultra-smooth finish. The search extended over a 5-year period and there are many ideas as to what made operation possible. The very smooth finish was the best in the opinion of many and it is the one of importance in this example.

World War II found this same make of engine installed in one of the submarine tenders. The engines were overhauled and all wrist pins replaced early in the war. Troubles began to develop while proceeding towards the war zone following overhaul. After about 4 days' operation, the wrist pin bearings would wipe and fail, apparently due to lack of lubricant. Yet the bearing was identical in design to that previously used, was provided with interconnected oil grooves, had positive oil pressure, was using the proper lubricant, and had been fitted correctly. The manufacturer's representative present communicated full details to the factory. Numerous replacement bearings were flown out by air cargo. For 8 months this valuable ship with her complement of 1,400 men was unable to fulfill her mission. A lubrication officer, ordered to the vessel, dragged his fingernail across one of the wrist pins after a failure at sea, and realized that the surface was not finish-ground or lapped. The sequence of events leading to bearing failure was then evident, and so was the solution. The pins were lapped on board ship and no further difficulties were experienced.

What had been happening is illustrated in figure 7. The roughness of the wrist pin was more than could be tolerated by the thin film of lubricant. The hardened pin was milling its way down into the relatively soft babbitt of the bearing to a point where the diameter of the working part of the bearing was approaching that of the wrist pin. This restricted the oil flow through the bearing with consequent over-heating, followed, of course, by bearing failure.

Here we have a situation where at least a partial cure for an admittedly difficult lubricating job was found and lost within a 10-year period. Wrist pin lubrication in a two-cycle Diesel is classed as thick film on the assumption that the surfaces are

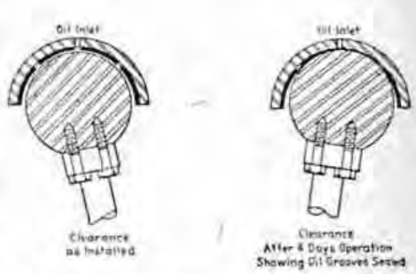


FIGURE 7.—Diagrammatic sketch showing effect of rough wrist pin on bearing clearance on large two-cycle Diesel engine.

properly finished and that, at the high operating loads and speeds, the inertia forces will reverse the load on the pin and allow the oil film to build up. We know, however, that we are frequently in the thin film zone. Various expedients to eliminate the necessity of maintaining an oil film such as needle-type bearings have been tried. They too have their drawbacks and in most instances we have returned to the sleeve-type bearing or bushing.

Irregularities of a few ten-thousandths of an inch are important in dealing with an oil film. Small matters like surface roughness, general mechanical imperfections, elastic deformation, thermal expansion, and tiny abrasive particles assume their true significance when considered in relation to the thickness of this film. Under the most favorable conditions of thick film lubrication the thickness of the film will be on the order of a few thousandths, and for thin films it may be as little as a few one-hundred thousandths of an inch. Any design changes where oil films are affected must be looked at with a magnifying glass.

Connecting-rod bearings.—Diesel connecting-rod bearings under favorable conditions are examples of true thick film lubrication of a journal rotating in a bearing. There is, however, in each revolution the periodic gas load which imposes a shock load on the bearing material as the intensity of the stresses varies.

In one of the widely used two-cycle Diesel engines employed in submarines, destroyer escorts, submarine tenders, and other vessels during the war we had an epidemic of connecting-rod bearing failures. The problem was of particular interest because new detergent-type Diesel engine lubricating oil, known as Navy Symbol 9000 series oil, had but recently been adopted for use in all Diesel engines in the Fleet. Many believed this new lubricant caused intergranular corrosion or etching which contributed to the bearing failures. However, it soon became evident that the lubrication itself was satsifactory. The bearings failed because the loads transmitted through the oil film were greater than the fatigue strength of the bearing materials.

The bearings were of the precision type, machined at the factory for installation without hand fitting. The bearing material was a high lead babbitt hardened with calcium and cast in a steel shell. This type of bearing had been in service for many years prior to the war and gave a reasonable average life in service of 5,000 hours or better. There were occasional early failures, however, and when one occurred, the ensuing contact between the steel back of the bearing and the crankshaft resulted in a scored crankshaft. Means were developed to grind the journals undersize without removing the crankshaft from the engine, but this meant carrying an assortment of connecting-rod bearing spares. The decision to go to a bronze-backed bearing seems to have been unanimous at that time.

As usual a number of related things happened about coincident with the change-over to the bronze bearing shell. The war came along; production was greatly expanded; tolerances were not held as closely as was customary in peacetime; clearances pyramided; it was even hinted that refinery practices had been changed, and we were not receiving the same lubricating oil. From all that speculation you may gather that the situation was pretty bad, and it was. Average life dropped from better than 5,000 to about 1,500 hours with some failures as low as 400 hours.

FIGURE 8.—Bearing failure due to stress concentrations incident to lack of support in the area of the oil groove.

The objective had been accomplished; when a bearing failed, it did not score the crankshaft, but the cure was worse than the disease. The fact that we kept going and that the situation was so little known outside the forces actually concerned is a high tribute to the engine and bearing manufacturers and to the operating crews. In spite of the best efforts of everyone, it was necessary occasionally to send ships into operations or submarines on patrol without perfect bearings or adequate spares. The operating forces learned to spare the engines as much as possible under these conditions. As far as we know, there was no actual casualty to a ship attributable to this situation, but of course there was a terrific loss of availability for operations.

Naturally, the manufacturer, forces afloat, and the experiment station were working on the problem. All of them arrived at essentially the same conclusion of stress concentration in the bearing metal. Figure 8 shows what happened to one of the bearings because of these concentrations incident to the lack of support afforded across the oil groove by the bronze shell. If the situation had not been complicated by the concentrations due to machining, diagnosis would have been easy. Once the diagnosis was made, correction was difficult only because of the magnitude of the supply problem. A steel back overlaid with a high melting point alloy such as bronze or copper-lead, which in turn was overlaid with a low-friction bearing material gave protection to the crankshaft in case of failure and support to the bearing when operating normally.

From the standpoint of lubrication, the ability of an oil film to transmit loads even greater than the strength of metals is an important factor which is not always fully appreciated. Pitting in gear teeth or in roller bearings is an example. There is a tendency to think of oil in bulk and as a liquid rather than as a film transmitting high unit forces. These forces can be shock as well as steady loads. An oil may be selected to minimize this particular effect and, in a simple mechanism, this may well be worth doing. However, in a mechanism as complex as a Diesel engine, it is usually better to approach the specific problem involved from a mechanical standpoint.

ROLLER THRUST BEARINGS

By way of contrast to the several cases involving journal-type bearings, let us consider as the first case of thin film lubrication the performance of an antifriction type thrust bearing used in destroyer escorts. These large roller thrust bearings scored and failed for no discernible cause, and this was so baffling for a while that the sequence of events could well have been a mystery story entitled "The Case of the DE Thrust Bearings." Everything from foaming of the lubricating oil to metallurgy of the rollers was blamed for the difficulty. The solution was so simple that we hesitate to relate it.

The first destroyer escort, built in a west coast navy yard, held its full-power run early in 1943. The run was interrupted by failure of one of the thrust bearings, which, upon examination, showed heavy scoring and galling of the rollers and races. Failure was attributed to foreign matter in the bearing. The second escort similarly was unable to maintain full power for any length of time before the temperature of the bearings became excessive. It was thought that the oil was too heavy, but the same symptoms resulted when using a lighter oil. It was believed also that foaming of the lubricating oil reduced the flow to the bearing, resulting in high temperatures, expansion, and consequent seizure.

Upon the recommendation of the bearing manufacturer's representative, the spacer ring on the bearing was made slightly larger than originally provided and subsequent power runs were made successfully. The larger spacer ring also proved satisfactory in the bearings of the next escort built. However, later in the year, in the builder's trials of another vessel of this class, seizure of a bearing occurred within an hour after the full-power run had started. The appearance of this bearing indicated that one of the rollers had chipped and a spare roller was installed. The whole mechanism was cleaned thoroughly, oil was circulated through the bearing prior to getting under way, and careful observations were made during the following run. Again, after only 20 minutes at full power, the oil temperature took a sharp rise and the shaft was stopped to prevent further damage.

The bearing manufacturer, although unable to ascertain the exact reason, felt that the failure was due to insufficient lubrication and, possibly, foreign materials in the lubricant. Since the oil passed through two cleaners between the sump and the bearing and since the machinery log indicated proper oil pressure had been maintained throughout all the tests, the building yard did not agree.

The question of bearing clearance had been discussed repeatedly but always dismissed after the manufacturer pointed out that the destroyer escort bearings were installed with exactly the same clearances between rollers and races as that of the bearings satisfactorily used in the tugs. However, the point that was overlooked, and this for a considerable period of time, was that the full-power shaft speed of the destroyer escorts was about four times the maximum shaft speed used in the tugs. Redesigning the bearing with additional clearance to allow for the expansion at higher speeds and temperatures eliminated further trouble with the scoring of these rollers.

Here is an excellent illustration of how easily serious difficulties may be introduced into well-designed and proved mechanisms by simple changes in operating conditions. In all fairness it should be pointed out also that the unusually high shaft speed on the destroyer escorts was a design change after the bearings and shafting were ordered. For various reasons, mostly supply and ease of construction, the power was reduced, the reduction gear eliminated, and full-power speed came out at the unusually high figure of about 600 revolutions per minute. This case also emphasizes the importance of dimensional clearance and lubricant supply to anti-friction bearings operating at medium or high speeds. Under any circumstances, the combination of high loading and high speed creates a condition which must be controlled carefully to allow heat dissipation and avoid rubbing of the parts.

Turbine Floating Shaft Piston Couplings

Toward the close of World War II a serious complaint arose from a large number of fast battleships and aircraft carriers. This concerned troubles with the flexible gear-type couplings installed between the turbines and the turbine reduction gear sets. New refueling methods had made possible longer periods at sea at high operating speeds and thus the coupling received harder service than encountered in peacetime operation. The teeth of some of these couplings, which were a dental or spline type, showed high tooth wear and scoring due primarily to the sliding action from fore and aft motion. The couplings were lubricated with 2190–T turbine oil from the gear cases.

The earlier attempts to rectify the trouble were based on the erroneous assumptions that the amount of lubricant supplied was inadequate. Accordingly, oil jets and dams were installed at each end of the coupling to raise the oil level on the coupling teeth. The modification produced no beneficial results. As the pace of the war stepped up, wear on the couplings became of major concern.

A closer look at the problem disclosed that the lubrication of this type of coupling is not dependent upon the formation of fluid films, as in the case of journal bearings. Therefore, a greater depth of oil around the gear teeth was of no help. Actually, poorer results could be expected because the dams formed a pocket for the dirt which the natural centrifuging action of the rotating coupling might throw out of the oil. This trapping of dirt could cause the gear teeth to lock.

The situation became so critical that consideration was given to the possibility of installing built-in baffles or seals in order to use an extreme pressure lubricant in the couplings. Such a product might be expected to reduce tooth wear and scoring, and it was possible that the increased viscosity of the special lubricant might reduce slightly the spalling of the teeth. The big objection to this modification was the major design change required to provide for positive segregation of the special lubricant from the turbine oil. Contamination of the turbine oil with such a product could not be tolerated. So this idea was rejected and it was concluded that only 2190–T turbine oil could be used.

A study of the design and metallurgical aspects of couplings giving trouble and those not giving trouble disclosed two major differences. The troublesome couplings were manufactured from a mild type of steel with no hardness specifications whatsoever. Worse than that, the unit loading on the gear teeth was double that called for by good design practice, even had special alloy steels been utilized. The trouble-free couplings were made from alloy steels with minimum hardness specifications and lower unit pressures. The adequate solution was apparent: couplings with redesigned teeth to provide better load distribution and a change of metal to insure adequate tooth hardness were essential.

This case clearly illustrates the importance of preliminary design. When machinery is designed and built in such a way as to impose loads beyond the strength or hardness of the metals, you will most certainly run into difficulty under severe operating conditions. It is sometimes possible to save these situations in a simple machine where a special lubricant can be adopted but not when they form a part of a complex mechanism where lubricant characteristics are fixed by other considerations. And frequently you can make a bad matter worse by changing the lubricant or the system.

Battleship Main Battery

The coupling problem was not the only one that came to light on the battleships. Under the stress of continuous operations and with heavier loads on the mechanisms brought about by automatic control, turrets of these ships provided lubrication engineers with a number of problems, each of which brought out quite different lubrication requirements.

Turret roller paths and training gears—The 16-inch gun turrets of modern battleships weigh well over 1,600 tons each and they are supported by large spool-shaped roller bearings about 22 inches in length. These larger roller bearings roll on a circular roller path which is about equal in width to the maximum thickness of the turret barbette. Flanges at the ends of the rollers take the horizontal loads imposed by the ship's motion and the reaction of firing.

Severe requirements are placed on this roller path assembly. It must provide ease and speed of train with low expenditure of power; it must absorb heavy shock or inertia loads during firing and in heavy weather. The lubricant used must adhere to the roller and roller path, must form films of sufficient thickness to provide protection against rusting from salt water, and should have extreme pressure properties to prevent undue scuffing and abrasion of the roller flange when rubbing against vertical sides of the roller path.

During the important bombardment operations of 1944, many of the battleships, including the U. S. S. *Alabama*, U. S. S. *Indiana*, U. S. S. *Massachusetts*, U. S. S. *North Carolina*, and others, reported that the lubricants used were not meeting these requirements. The principal complaint was that the gear grease supplied, which was Navy Specification 14–L–8, would not provide a film that would protect the rollers from rusting. Although this was an adhesive-type grease possessing extreme pressure properties and was recommended also for the lubrication of the training rack and pinion gears, it was not standing up to the water washing which resulted when sea water splashed underneath the turret aprons.

Crews of various ships became dissatisfied with the unsatisfactory performance. Some of them even began to experiment with substitutes, a common one being a mixture of cup grease with petrolatum and graphite. The problem became so general that it was necessary to assign specialists to investigate it, even though the vessels involved were operating with Task Force 58 off the Japanese home islands. Conflicting reports were obtained from the several ships, and even from different turrets of the same ship. Thus it was decided to conduct some comparative tests in the four turrets of the U. S. S. *Alabama*. This would permit comparing the recommended product with the shipboard mixtures under actual operating conditions. The investigation disclosed the following points of interest:

1. All the roller path lubricants, when thinned out on the roller path by turret training, failed to provide a sufficiently thick and corrosion-resistant film to inhibit rusting, if sea water was present. Furthermore, the evaporation of the sea water lying on top of the grease films left a salt deposit which became ground into the grease with subsequent turret operation. This meant further rusting of the roller path.

2. In view of the deficiencies of the products available, the only protection afforded the roller paths against corrosion from sea water was judged to be the installation of a sheet-metal watershed installed above the roller paths.

3. The semifluid roller path lubricant, NS 14–L–8, was superior to the shipboard mixtures in that it provided more protection to the roller flanges and vertical thrust faces of the roller paths, particularly when contrasted for the cup-grease-type products. (The underlying reason for the preference of certain vessels for the cup-grease-type product was not its lubricating or rust-inhibiting properties, but because it reduced the "housekeeping" required around the barbettes. The 14–L–8 product did not possess sufficient nonflow properties for satisfactory roller path lubrication and the drip about the turret was messy.)

4. The application of a semifluid product such as NS 14–L–8 to the roller path required smearing this lubricant on the roller path by hand or by paddle application and some better method of application would be desirable.

Coincident with the investigation of the roller paths a study was made of the lubrication of turret training racks and pinion gears. In a number of the turrets, these large vertical spur gears, which train the turrets in azimuth, were spalling. It appeared that the drip characteristic of the 14–L–8 grease was the fault. This proved partially true although a close study revealed that the automatic control which had been placed on these ships caused the train mechanism to "hunt" with terrific shock loadings. This meant that the rack teeth acted like stops and required a rather heavy film of lubricant to cushion the shock. Failure of the lubricant to adhere to the teeth, either because of its flow characteristic or because of the continual squeezing-out during operations in automatic control, often left the mechanism without the necessary cushion.

Here again the shipboard operating crews attempted to devise a mixture which would meet the requirements. As had been the case for the roller paths, the 14–L–8 product which had been recommended was superior to those tried by the shipboard personnel; however, in both cases the designs of the mechanisms had given insufficient consideration to the lubrication requirements, particularly as to the method of application and distribution of the lubricant to the frictional surfaces.

Gun elevating crews.—During late 1944, a number of the new battleships and cruisers, including the U. S. S. *Missouri* and U. S. S. *Wisconsin*, reported trouble in the elevation mechanism of their 16-inch main battery guns. In each case the elevating screw threads were scored and bronzed on the thrust sides, resulting in rough operation of the guns. This situation became so serious that it was necessary to bring out these large replacement parts by air. Three of the elevation screws of the U. S. S. *Astoria* were renewed at one time and many of the fast battleships carried a replacement screw lashed on deck for emergency use.

The elevation mechanism design consists essentially of an elevating screw and an oscillating nut. The screw is an alloy steel shaft with external square-cut threads, the upper end of which is attached to the gun by a pivot and the lower end of which extends through the oscillating nut. The bronze internal threads of this nut engage those on the shaft. Through a gear drive the nut rotates about the screw causing it to move up or down thus elevating or depressing the guns. The bronze surfaces of the nut pass over the steel surfaces of the screw with sliding contact, but there is no opportunity for the formation of fluid films between the loaded faces of the threads.

This type of mechanism had been a standard installation in the Navy and had operated satisfactorily for many years. The troubles encountered were due to the increased accelerations under improved automatic control and long-continued use as in shore bombardments. Under these conditions, the mechanism was subject to repeated high unit loads during firing and to rapid reversals in elevation as the guns were kept on the target, particularly in heavy seas. This increased severity of operation was sufficient to bring the frictional surfaces into such solid contact that bronzing of the steel elevating screw and galling of the oscillating nut resulted. The lubricants used were straight mineral oils obtained on specifications NS 1047, 2135, and 3050.

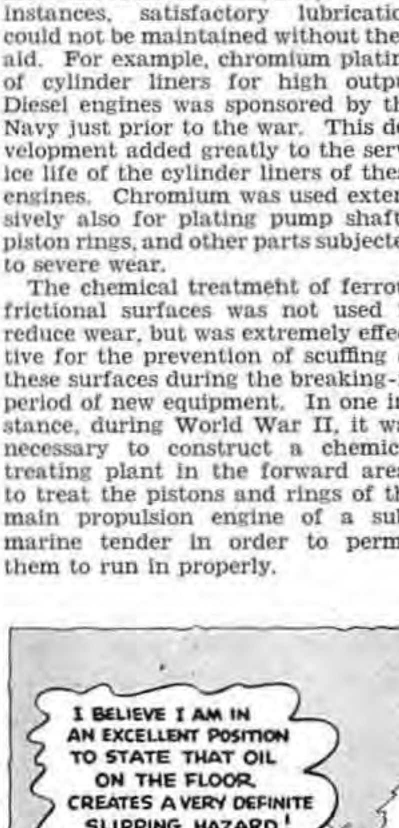
For many years it has been known that steel on bronze surfaces contacting one another under conditions of high load are not subject to the formation of fluid films and require lubricants of high oiliness value specific to this bearing metal combination [4]. Light-bodied straight mineral oils are not adequate for lubricating under these conditions. The Bureau of Ordnance recognized the specific requirements of worm gear lubricants for this very metal combination and had installed a worm gear lubricant testing machine at the Naval Gun Factory for evaluating the service performance requirements of such products. The lubricant so tested and approved as meeting the oiliness requirements for worm gear mechanisms found aboard ship was distributed under specification OS 1400. Yet, when the worm took the form of an elevating screw and the worm gear became the oscillating nut with internal threads instead of external teeth, the significance of the oiliness value for steel on bronze surfaces was not recognized, particularly for a mechanism that had been operating satisfactorily for years.

Tests using OS 1400 gear oil, as a trial lubricant, were conducted on the U. S. S. *Indiana* in January, 1945, during gunnery operations in automatic control. While using this product, no scratching, galling, or bronzing occurred on the faces of the elevating screws—rather the surfaces commenced to acquire a polish which was the desired condition. The pumpability and adhesion of the lubricant were found satisfactory. The higher viscosity of OS 1400 provided additional cushion under conditions of shock load and reversal of direction. This product also possessed favorable flow characteristics at low operating temperatures, rendering it suitable for use in the Arctic regions. Based on these findings the lubricant was placed on trial immediately on six additional vessels reporting trouble. Five months later it was recommended that the product be used on all turret gun elevating screw threads, including those of cruisers.

The turret lubrication cases discussed all derive from increased severity of operations incident to wartime conditions plus some increase in loading due to improved drive mechanisms. The difficulty of predicting, during peacetime, conditions which will prevail in a theater of war is no new problem and hardly one for which we are ever likely to have a very satisfying answer. Still, we did pretty well with most of the engineering developments which anticipated the last war. Today we are making an even greater effort through the Operations Development Force which is endeavoring continually to subject new ideas to simulated service conditions. Theoretically, we should have less need for lubrication specialists in the next war because of this. Practically, with the continued increase in the complexity of ships, we shall probably have more problems of this nature with which we will be confronted at sea.

So much for the case histories. This paper would not be complete, however, without some mention of metallic and chemical coatings used so widely during World War II on frictional surfaces [5] [6]. While not strictly classed as a lubricant in themselves, they assist the metallic surfaces to withstand extreme pressures which normally rupture or remove the lubricant film, and, in many instances, satisfactory lubrication could not be maintained without their aid. For example, chromium plating of cylinder liners for high output Diesel engines was sponsored by the Navy just prior to the war. This development added greatly to the service life of the cylinder liners of these engines. Chromium was used extensively also for plating pump shafts, piston rings, and other parts subjected to severe wear.

The chemical treatment of ferrous frictional surfaces was not used to reduce wear, but was extremely effective for the prevention of scuffing of these surfaces during the breaking-in period of new equipment. In one instance, during World War II, it was necessary to construct a chemical treating plant in the forward areas to treat the pistons and rings of the main propulsion engine of a submarine tender in order to permit them to run in properly.



The employment of these coatings is being extended both by the Navy and by industry and it is anticipated that their future use will become general as higher output engines and heavier loaded, smaller mechanisms are designed for both industrial and military use. Perhaps such coatings will reduce the number of lubricating problems.

Conclusion

As pointed out in the beginning of this paper, these cases are principally personal experiences of the authors. It is our belief that almost every manufacturer supplying equipment to the Navy has had similar experiences with his equipment. We hope that this paper will make our information available to more people, and that our friends, whose equipment may be identifiable from some of the cases, will understand and approve of our aims.

There are some obvious conclusions for the operating and maintenance personnel which can never be repeated too often.

(1) Keep the oil clean. An oil film won't tolerate much in the form of dirt before trouble starts.

(2) Use the lubricant the instructions call for. If you think it's not right, tell the manufacturer, the oil company, or your employer. If the problem is peculiar to you, they will send you a specialist. The chances are someone has already gone through it and an answer is available.

(3) Don't try experimenting with different oils when you run into trouble. You may cure the immediate problem and start a more serious one. Of course you can make a bad situation worse in a hurry.

(4) Be as sure as you can that the lubricant is actually reaching the point to be lubricated, in proper quantity and at the proper time.

For the machinery and ship designers and senior engineering personnel probably the truest conclusion is that, if you are human and doing something, you will make mistakes. However, that's not very constructive, so let's add a few with which the operating and maintenance personnel shouldn't have to worry.

(1) There are many things an oil can do besides reduce friction. The designer should be familiar with the characteristics of available lubricants and take advantage of their properties where possible. It is the less obvious jobs we expect the lubricant to do which lead to the more extensive troubles.

(2) In selecting the lubricant for a job, we must consider not only the machine but the machine's environment. There is an old saying that

salt water is good for only one thing—to float ships. The proper lubricant inhibited to prevent rusting in salt air can help offset the fact that we haven't anything better to float ships on.

(3) The lubricating film is a part of the machine structure since it transmits many of the individual and collective forces which make the machine operable. It can transmit shock or vibratory forces or reduce fatigue stresses by spreading the load. In some cases, it assists in damping or silencing.

(4) When you get repeated reports of trouble from the field, don't blame dirty oil.

(5) A lubricant can't correct for faulty design, but in borderline cases it can help and perhaps keep operations going while design changes are made.

(6) There are some difficult lubrication spots where the lubricant must be given all the help possible in the form of special finishes or special materials by the machine designer.

(7) Design the lubricating system to be automatic if possible. Where that isn't practicable, make it convenient and easy for hand lubrication.

There are a wide variety of oils available in Navy Department and Federal Government specifications. There are many more listed in the lubrication manuals published by the companies of the oil industry. These should meet all of the normal needs of a machinery designer. There are situations, of course, which can be improved if a new lubricant is specified.

The Engineering Experiment Station is the Navy's major testing agency for lubricants, and, conversely, lubricants are a major field of the Engineering Experiment Station. A set of the Station's machines for testing greases under moderate loads at high speeds and temperatures is pictured in figure 9. In conjunction with the oil companies and machinery suppliers and under the direction of the Bureau of Ships, the Station carries out studies and tests leading to fewer but better lubricants and to improved efficiency, capacity, and life of the equipment offered to the Navy. With the wider range of operating conditions (as, for instance, tests in a large cold room going down to −85° F.) and the increased number of things we want the lubricant to do, the chances of getting fewer lubricants don't seem too good but we are all agreed that we are getting better ones.

This paper will have served its purpose if it emphasizes to those responsible for machinery design the need for the application of the science of lubrication during the design and experimental stages, and to those responsible for operation and maintenance the desirability of calling on lubrication engineers for assistance when failure to obtain satisfactory performance appears to be due to poor lubrication.

Admiral T. A. Solberg, U. S. N., Chief of the Office of Naval Research, has said that the next war will be fought with weapons not yet invented. It is fairly safe to conclude that many of these weapons and the vessels which carry them into conflict will be lubricated with products or by systems not yet developed. It is our hope that they will be designed and built with a better understanding of the principles of lubrication and their service application.

FIGURE 9.—Some of the high-speed spindles for testing greases in roller bearings at various temperatures, U. S. N. Engineering Experiment Station.

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FRONT COVER PICTURE—S. S. *CONSTITUTION*

The S. S. *Constitution* is shown going down the ways at the Bethlehem Steel Shipyard in Quincy, Mass., on Saturday, September 16, 1950. The *Constitution* of 26,000 gross tons is the sister ship of the S. S. *Independence* which was launched on June 3 this year. It is the first trans-Atlantic passenger vessel to be named for "Old Ironsides," the ship-of-the-line U. S. S. *Constitution*, now permanently berthed at the nearby Boston Navy Yard.

The S. S. *Constitution* is 683 feet in length, and has a breadth of 89 feet. When ready for service it will draw about 30 feet of water and measure about 30,000 displacement tons. The main engines now in place are geared turbines designed to develop 55,000 horsepower that will turn twin 27-ton propellers. The most powerful engines yet fitted in an American passenger vessel are guaranteed by the builders to drive the liner at 25 knots on the trial run next spring. Cruising speed will be 22½ knots, sufficient to enable the liner to make trans-Atlantic runs on the southern route between New York and Gibraltar in 6 days and to land passengers in Naples on the eighth day and at Cannes and Genoa on the ninth day.

The giant hull is divided into 15 watertight bulkhead zones. There are two separate engine rooms. Safety features meet or exceed the world's highest standards. There are six alternate methods of steering the vessel. Extensive automatic and manual fire alarm, fire detecting and fire fighting systems are installed.

BACK COVER PICTURE—USCGC *EAGLE*

From the bowsprit of the Coast Guard Cutter, *Eagle*, new training bark for cadets at the Coast Guard Academy, New London, Conn., the ship exhibits its manifold gear. To the trained eye of sailors, this photograph illustrates the well-ordered arrangement of the infinitely complex sea-going "furniture," necessary to the handling of a big sailing vessel. The 300-foot *Eagle* on her way to America from Bremerhaven, Germany, where she was taken over from the defunct German Navy, made stops at the Madeiras and at Bermuda. Here she is shown in mid-Atlantic. During the war this ship was the German training vessel for their naval officers, and was named *Horst Wessel*.

NUMBERED AND UNDOCUMENTED VESSELS

The table below gives the cumulative total of undocumented vessels numbered under the provisions of the act of June 7, 1918, as amended (46 U. S. C. 288), in each Coast Guard district by customs ports for the quarter ending 30 September 1950. Generally speaking, undocumented vessels are those machinery-propelled vessels of less than 5 net tons engaged in trade which by reason of tonnage are exempt from documentation. They are also those motorboats and motor vessels of 5 net tons and over used exclusively for pleasure purposes which are not documented as yachts or those of less than 5 net tons which by reason of tonnage, are not entitled to be so documented.

Coast Guard district	Customs port	Total	
1 (Boston)	(4) Boston	16,123	
	(1) Portland, Maine	11,340	
	(2) St. Albans	2,877	
	(5) Providence	4,455	34,795
2 (St. Louis)	(45) St. Louis	17,084	
	(12) Pittsburgh	2,430	
	(34) Pembina	85	
	(35) Minneapolis	6,475	
	(40) Indianapolis	4,284	
	(42) Louisville	4,000	
	(43) Memphis (part)	7,940	
	(46) Omaha (part)	500	
	(47) Denver	5	42,803
3 (New York)	(10) New York	48,754	
	(6) Bridgeport	8,853	
	(11) Philadelphia	21,172	78,779
5 (Norfolk)	(14) Norfolk	16,318	
	(13) Baltimore	23,157	
	(15) Wilmington, N. C	8,575	48,050
7 (Miami)	(18) Tampa (part)	22,832	
	(16) Charleston	1,924	
	(17) Savannah	3,397	
	(49) San Juan	443	
	(51) St. Thomas	83	28,679
8 (New Orleans)	(20) New Orleans	19,996	
	(18) Tampa (part)	807	
	(19) Mobile	8,233	
	(31) Port Arthur	4,014	
	(22) Galveston	10,665	
	(23) Laredo	2,073	
	(24) El Paso	5	
	(43) Memphis (part)	76	45,869
9 (Cleveland)	(41) Cleveland	14,185	
	(7) Ogdensburg	6,563	
	(8) Rochester	8,701	
	(9) Buffalo	8,234	
	(36) Duluth	4,181	
	(37) Milwaukee	12,512	
	(38) Detroit	29,055	
	(39) Chicago	8,319	91,750
11 (Long Beach)	(27) Los Angeles	8,878	
	(25) San Diego	1,714	
	(26) Nogales	99	10,691
12 (San Francisco)	(28) San Francisco	20,559	20,559
13 (Seattle)	(30) Seattle	32,819	
	(29) Portland, Oreg	9,720	
	(33) Great Falls	1,049	
	(46) Omaha (part)		43,588
14 (Honolulu)	(32) Honolulu	3,434	3,434
17 (Juneau)	(31) Juneau	6,762	6,762
Grand total			455,759

Observations of the Old Mariner

SP on a chart means "spherical buoy" and *not*, as it's usually misread, a spar buoy.

The guy who makes fun of you is only trying to cut you down to his size.

PACK A LIGHT

WANTED—ONE ENGINE ROOM BELL?

Once in a while one hears an accident which appears to be the result of sheer stupidity on the part of the person in charge of the operation and who may or may not be one of the victims of the accident. This is not always the case as occasionally some hidden factor justifies the methods used. There seems to be no possible excuse, however, for the actions of the person who caused the accident described here.

It seems that a chief engineer had decided to make an engine-room bell by cutting off the bottom of a CO_2 cylinder. He placed the cylinder in the ship's lathe and started cutting near the foot of the container for the purpose of removing its bottom. He had gone some distance into the metal when he called the third assistant engineer to the lathe for the purpose of pointing out the excellence of the metal which was being removed by the lathe tool.

At this moment, either because the cylinder had not been fully discharged or, possibly, had not been discharged at all, the weakened extinguisher exploded.

The chief engineer suffered scalp wounds, severe concussion, possible skull fracture, and possible fractured ribs. The third assistant engineer incurred a badly lacerated right arm and numerous cuts about the body. The ship was diverted to the nearest port where the patients were hospitalized.

It is difficult to understand how a man, who holds a license as chief engineer, lacked the foresight which permitted him to cut into a pressure vessel without having first determined that all pressure had been relieved. Would it not have been a simple test to have opened the valve and made sure that all pressure had been relieved? Imagine what would have happened if it were an oxygen cylinder that was being cut into.

All that can be said is that the chief engineer and the third assistant were very lucky to have escaped death.

DEATH BY ASPHYXIATION

An American seaman was asphyxiated by carbon dioxide gas in a cargo tank of an American tanker. The vessel, while approaching the harbor of a foreign port, was discharging ballast water from her tanks preparatory to taking a cargo of molasses on board.

Just previous to this, the chief pumpman had informed the chief mate that the main cargo valve in one of the cargo tanks was stuck. The chief mate, on watch at the time, directed the pumpman to wait until he could inspect it. The chief mate when relieved then obtained a wheel wrench, and was proceeding forward to inspect the valve when he heard cries for help coming from the direction of the particular cargo tank with the faulty valve. Hurrying to the tank the mate observed the pumpman about 12 feet from the bottom, delirious from the effects of the gas, pounding his forehead against a rung of the ladder. Grabbing only a lifeline, the mate entered the tank in an attempt to rescue the pumpman. About this time the chief engineer also arrived at the scene and he, too, entered the tank to assist the chief mate in an effort to help rescue the pumpman. Before they were able to get a line around the pumpman's body, both the chief mate and chief engineer were forced to abandon their efforts, due to excessive gas fumes and return topside because they had no breathing apparatus on. Shortly after, the pumpman lost his hold on the ladder and fell to the bottom of the tank in approximately 2 feet of water.

At the sound of the general alarm the crew came up with a fresh-air hose mask and an oxygen breathing apparatus. After a number of unsuccessful attempts to enter the tank with the fresh-air hose mask, one of the crew succeeded in entering the tank equipped with an oxygen breathing apparatus. A line was secured around the unconscious man and he was brought up to the deck.

Artificial respiration and other first-aid measures were started immediately and shore doctors were called. Shortly thereafter shore doctors came aboard with a pulmotor, but in spite of all efforts taken, the pumpman failed to regain consciousness. He was pronounced dead after 5 hours of resuscitation.

Why did this man lose his life? He lost his life because he failed to heed, not one safety rule, but a number of them. He failed to secure himself to a tended lifeline; he failed to have a safety watch provided; he failed to wear any breathing apparatus and worst of all, he failed to obey the order of the chief mate, "to wait until he could inspect it."

ALWAYS THE UNEXPECTED

NOTE: The Coast Guard has been sponsoring a special safety program for its own vessels and shore establishments. This article was published in the Coast Guard's "Engineer's Digest" for information of Coast Guard personnel and is reprinted herein to illustrate that a definite safety program and a study of accidents is worthwhile in (1) improving working conditions and (2) reducing accidents.

In almost every accident report there is an intimation by someone that "If this had not happened—" or "the injured man should have known—" or a comment which indicates that the accident was unintentional. There are many ways in which a careless person can become an injured liability by doing essentially the same things that a careful person would do. There is always one minor little mistake, or failure, or disregard of basic principles of self-preservation which makes the difference. They may seem slight and unimportant but these differences mean higher injury rates and reflect an attitude entirely lacking in safety-consciousness. They do not mean that the injury was incurred deliberately.

A district safety officer advised printing of the following example of the misuse of hand power tools in the hope that the information may prevent similar occurrences: A seaman aboard a cutter was using a power sander to remove paint from the main deck. The ship rolled as he was changing his position and he pulled the sander against his knee while trying to regain his balance. He remained in sick bay for 5 days and then was put on light duty.

In the above case it is believed that the ship could have been expected to roll, resulting in the man's losing his balance if his position were not steady. If he had been sufficiently safety conscious he would have shut off the power to the sander while he was shifting position. This fact was evidently obvious to the deck bo's'ns mate or the commanding officer, which is considered some kind of a victory for the safety program; early accident reports assumed that the only solution was to eliminate all personnel who sustained injury.

Accidents are defined as unforeseen or unplanned occurrences which interfere with orderly progress of an activity. Preventing them consists largely of the common-sense application of an assumption that, "Forewarned is forearmed." With better planning and the encouragement of safety consciousness all operations will be more efficiently performed, and up to 90 percent of our injuries will simultaneously be eliminated.

Notwithstanding the many and various means personnel will discover for injuring themselves, Coast Guard accidents set definite patterns and fall into a few well-defined groups. The trend of accidents throughout 1949 is shown in the accompanying diagram. It is believed that the trends indicated point the way for accident prevention efforts in the service.

A reasonable degree of safety, in any operation however hazardous, cannot be achieved by cooperation. Participation is the key to the passageway leading to a lower injury rate. It is the job of the safety officer to coordinate the efforts of the participants and demonstrate the manipulation of this key.

ACCIDENT DISTRIBUTION

An analysis of the accidents reported during the month of May is printed herewith to illustrate the seriousness of the problem. The trends shown by this particular month or any given month will not necessarily establish a comprehensive and true picture of service-wide tendencies. When all the monthly summaries are viewed together they show surprising agreement as to the cause of Coast Guard injuries.

Elevated surfaces (gangplanks, ladders, etc.)—7

Stepped from or missed location of gangplank (fatal); stepped off dock during darkness, apparently the gangplank had been removed to prevent strangers from boarding (fatal); failure to use handrails when descending hatch and stairway (2); slipped on wet deck; fell over small cliff when taking short cut in poorly lighted area (fatal); using makeshift platform to work from.

Floating units—5

Weight of body listed boat, catching foot between rail and top step; fell overboard while boat made turn, failed to wear life jacket (fatal); motor lifeboat capsized, all members of crew failed to wear life jackets (2 injured, 1 fatal); while relieving grounded yacht, civilian was struck in the face with monkey fist of heaving line; released preventer line too quickly due to misunderstanding of orders.

Stationary power machinery—5

Unauthorized use of power grinder (inexperience); failure to wear goggles when ripping planks; lack of guard or failure to use pusher stick while passing material over cutter head of jointer; cleaning press rolls while in motion; equipment not designed for type of work.

Materials and equipment handling (by hand)—5

Slipped on oily surface while handling heavy material; lifting in unsafe position (2); using sharp meat hooks as kitchen utensil hangers; insufficient help.

Private vehicles (mil.)—5

Too fast for conditions; arm struck sign when making hand signal; fatigue; mechanical failure; inattentiveness.

Fires—3

Mattresses stored against light bulb; undetermined, possibly due to bad storage or to dry vegetation too close to building; flareback caused by low voltage to ignition transformer.

Mechanical handling equipment—3

Defective manually operated boat hoist; finger was caught between pawl and cogs when attempting to operate air lift with one hand and engage the safety latch with the other; stepped in path of crane car.

Working surfaces—2

Failure to remove nails from scaffold material as razed; loose gear lying in poorly lighted passageway.

Portable power tools—1

Failure to turn off power when shifting position while sanding deck.

Hand tools—1

Overreaching.

Buoys—1

Buoy not properly secured, rolled with movement of tender, men working in unsafe position under existing conditions, seaman jumped overboard to avoid being struck (fatal).

Hot substances—1

Overturned heated lead pot.

Miscellaneous—4

Sport, altercation, etc.

TOTAL—43.

It is often said a person has a successful life by doing little things well. This is aptly illustrated by the many small safety precautions you are urged to take before proceeding with the job at hand—not only for your own protection but also for the shipmates who may be with you.

When the cook is injured at sea all hands may suffer because the substitute may not be a cook, but just another "hash slinger." Then too, who enjoys eating "hand-outs" for a week or two? In one case reported the chief cook decided to go on deck for a little fresh air. The deck department had just completed oiling down a portion of the deck with fish and fuel oil, but failed to rope off the area or to provide deck boards or to place signs showing that the deck was slippery. When the ship rolled unexpectedly the cook's feet flew out from under him and he landed in the embarrassing prone position. Not only was the cook's dignity offended but he suffered severe injuries; namely, a fractured hip and spine. Thus, for the want of a few small things, a man was seriously injured which may cripple him for life. Safety and the use of little things are very important and can mean the difference between being able to carry on your chosen work or being a cripple. The choice is yours! Not only for yourself but your shipmate's life as well.

"They Said It..."

"The only prudent action to pursue at this time is to design and build readily adaptable types of passenger and modern cargo ships that can serve both in peace and in war."

In response to an inquiry the Chief Counsel of the Coast Guard has said that "Your inquiry as to what constitutes a lawful command is answered by stating that the Coast Guard, in the absence of any known court decision as to the definition of the term 'lawful command' as used in shipping articles and in R. S. 4696, interprets that term, so far as the duties of a master are concerned, to mean any command given by the master of a vessel of the United States to subordinate crew members to carry out any duty, contractual or otherwise, which in his judgment is necessary in connection with the navigation or operation of the vessel on her voyage, including the care, comfort, and safety of the crew or passengers aboard the vessel or the care, protection, and safety of the cargo laden aboard."

Amendments to Regulations

TITLE 3—THE PRESIDENT

Executive Order 10173

REGULATIONS RELATING TO THE SAFEGUARDING OF VESSELS, HARBORS, PORTS, AND WATERFRONT FACILITIES OF THE UNITED STATES

By virtue of the authority vested in me by Public Law 679, 81st Congress, 2d Session, approved August 9, 1950, which amended section 1, Title II of the act of June 15, 1917, 40 Stat. 220 (50 U. S. C. 191), and as President of the United States, I hereby find that the security of the United States is endangered by reason of subversive activity, and I hereby prescribe the following regulations relating to the safeguarding against destruction, loss, or injury from sabotage or other subversive acts, accidents, or other causes of similar nature, of vessels, harbors, ports, and waterfront facilities in the United States, and all territory and water, continental or insular, subject to the jurisdiction of the United States, exclusive of the Canal Zone, and the said regulations shall constitute Part 6, Subchapter A, Chapter I, Title 33 of the Code of Federal Regulations; and all agencies and authorities of the Government of the United States shall, and all state and local authorities and all persons are urged to, support, conform to, and assist in the enforcement of these regulations and all supplemental regulations issued pursuant thereto:

Subchapter A—General

PART 6—PROTECTION AND SECURITY OF VESSELS, HARBORS, AND WATERFRONT FACILITIES

SUBPART 6.01—DEFINITIONS

Sec.
6.01-1 Commandant.
6.01-2 District Commander.
6.01-3 Captain of the Port.
6.01-4 Waterfront facility.

SUBPART 6.04—GENERAL PROVISIONS

6.04-1 Enforcement.
6.04-5 Preventing access of persons, articles or things to vessels or waterfront facilities.

Sec.
6.04-7 Visitation and search.
6.04-8 Possession and control of vessels.
6.04-11 Assistance of other agencies.

SUBPART 6.10—IDENTIFICATION AND EXCLUSION OF PERSONS FROM VESSELS AND WATERFRONT FACILITIES

6.10-1 Issuance of documents and employment of persons aboard vessels.
6.10-3 Special validation of merchant marine documents.
6.10-5 Access to vessels and waterfront facilities.
6.10-7 Identification credentials.
6.10-9 Appeals.

SUBPART 6.12—SUPERVISION AND CONTROL OF EXPLOSIVES OR OTHER DANGEROUS CARGO

6.12-1 General supervision and control.
6.12-3 Approval of facility for dangerous cargo.

SUBPART 6.16—SABOTAGE AND SUBVERSIVE ACTIVITY

6.16-1 Reporting of sabotage and subversive activity.
6.16-3 Precautions against sabotage.

SUBPART 6.18—PENALTIES

6.18-1 Violations.

AUTHORITY: §§ 6.01-1 to 6.18-1, inclusive, issued under the act of June 15, 1917, 40 Stat. 220, 50 U. S. C. 191, as amended by Pub. Law 679, 81st Cong., 2d Session, approved August 9, 1950.

SUBPART 6.01—DEFINITIONS

§ 6.01-1 *Commandant.* "Commandant" as used in this part, means the Commandant of the United States Coast Guard.

§ 6.01-2 *District Commander.* "District Commander" as used in this part, means the officer of the Coast Guard designated by the Commandant to command a Coast Guard District.

§ 6.01-3 *Captain of the Port.* "Captain of the Port" as used in this part, means the officer of the Coast Guard, under the command of a District Commander, so designated by the Commandant for the purpose of giving immediate direction to Coast Guard law enforcement activities within the general proximity of the port in which he is situated.

§ 6.01-4 *Waterfront facility.* "Waterfront facility" as used in this part, means all piers, wharves, docks, and similar structures to which vessels may be secured, buildings on such structures or contiguous to them, and equipment and materials on such structures or in such buildings.

SUBPART 6.04—GENERAL PROVISIONS

§ 6.04-1 *Enforcement.* (a) The rules and regulations in this part shall be enforced by the captain of the port under the supervision and general direction of the District Commander, and all authority and power vested in the captain of the port by the regulations in this part shall be deemed vested in and may be exercised by the District Commander.

(b) The rules and regulations in this part may be enforced by any other officer of the Coast Guard designated by the Commandant or the District Commander.

§ 6.04-5 *Preventing access of persons, articles or things to vessels or waterfront facilities.* The captain of the port may prevent any person, article or thing from boarding or being taken on board any vessel or entering or being taken into any waterfront facility when he deems that the presence of such person, article or thing would be inimical to the purposes set forth in § 6.04-8.

§ 6.04-7 *Visitation and search.* The captain of the port may cause to be inspected and searched at any time any vessel or waterfront facility or any person, article or thing thereon, within the jurisdiction of the United States, may place guards upon any such vessel and waterfront facility and may remove therefrom any or all persons, articles or things not specifically authorized by him to go or to remain thereon.

§ 6.04-8 *Possession and control of vessels.* The captain of the port may supervise and control the movement of any vessel and shall take full or partial possession or control of any vessel or any part thereof, within the territorial waters of the United States under his jurisdiction, whenever it appears to him that such action is necessary in order to secure such vessel from damage or injury, or to prevent damage or injury to any vessel or waterfront facility or waters of the United States, or to secure the observance of rights and obligations of the United States.

§ 6.04-11 *Assistance of other agencies.* The captain of the port may enlist the aid and cooperation of Federal, State, county, municipal, and private agencies to assist in the enforcement of regulations issued pursuant to this part.

SUBPART 6.10—IDENTIFICATION AND EXCLUSION OF PERSONS FROM VESSELS AND WATERFRONT FACILITIES

§ 6.10-1 *Issuance of documents and employment of persons aboard vessels.* No person shall be issued a document required for employment on a merchant vessel of the United States nor shall any licensed officer or certificated man be employed on a merchant vessel of the United States if the Commandant is satisfied that the character and habits of life of such person are such as to authorize the belief that the presence of the individual on board would be inimical to the security of the United States: *Provided*, That the Commandant may designate categories of merchant vessels to which the foregoing shall not apply.

§ 6.10-3 *Special validation of merchant marine documents.* The Commandant may require that all licensed officers and certificated men who are employed on other than the exempted designated categories of merchant vessels of the United States be holders of specially validated documents. The form of such documents, the conditions, and the manner of their issuance shall be as prescribed by the Commandant. The Commandant shall revoke and require the surrender of a specially validated document when he is no longer satisfied that the holder is entitled thereto.

§ 6.10-5 *Access to vessels and waterfront facilities.* Any person on board any vessel or any person seeking access to any vessel or any waterfront facility within the jurisdiction of the United States may be required to carry identification credentials issued by or otherwise satisfactory to the Commandant. The Commandant may define and designate those categories of vessels and areas of the waterfront wherein such credentials are required.

§ 6.10-7 *Identification credentials.* The identification credential to be issued by the Commandant shall be known as the Coast Guard Port Security Card, and the form of such credential, and the conditions and the manner of its issuance shall be as prescribed by the Commandant after consultation with the Secretary of Labor. The Commandant shall not issue a Coast Guard Port Security Card if he is satisfied that the character and habits of life of the applicant therefor are such as to authorize the belief that the presence of such individual on board a vessel or within a waterfront facility would be inimical to the security of the United States. The Commandant shall revoke and require the surrender of a Coast Guard Port Security Card when he is no longer satisfied that the holder is entitled thereto. The Commandant may recognize for the same purpose such other credentials as he may designate in lieu of the Coast Guard Port Security Card.

§ 6.10-9 *Appeals.* Persons who are refused employment or who are refused the issuance of documents or who are required to surrender such documents, under this subpart, shall have the right of appeal, and the Commandant shall appoint Boards for acting on such appeals. Each such Board shall, so far as practicable, be composed of one Coast Guard officer, one member drawn from management, and one member drawn from labor. The members drawn from management and labor shall, upon suitable security clearance, be nominated by the Secretary of Labor. Such members shall be deemed to be employees of the United States and shall be entitled to compensation under the provisions of section 15 of the act of August 2, 1946 (5 U. S. C. 55a) while performing duties incident to such employment. The Board shall consider each appeal brought before it and, in recommending final action to the Commandant, shall insure the appellant all fairness consistent with the safeguarding of the national security.

SUBPART 6.12—SUPERVISION AND CONTROL OF EXPLOSIVES OR OTHER DANGEROUS CARGO

§ 6.12-1 *General supervision and control.* The captain of the port may supervise and control the transportation, handling, loading, discharging, stowage, or storage of explosives, inflammable or combustible liquids in bulk, or other dangerous articles or cargo covered by the regulations entitled "Explosives or Other Dangerous Articles on Board Vessels" (46 CFR Part 146) and the regulations governing tank vessels (46 CFR Parts 30 to 38, inclusive).

§ 6.12-3 *Approval of facility for dangerous cargo.* The Commandant may designate waterfront facilities for the handling and storage of, and for vessel loading and discharging, explosives, inflammable or combustible liquids in bulk, or other dangerous articles or cargo covered by the regulations referred to in § 6.12-1, and may require the owners, operators, masters, and others concerned to secure permits for such handling, storage, loading, and unloading from the captain of the port, conditioned upon the fulfillment of such requirements for the safeguarding of such waterfront facilities and vessels as the Commandant may prescribe.

SUBPART 6.16—SABOTAGE AND SUBVERSIVE ACTIVITY

§ 6.16-1 *Reporting of sabotage and subversive activity.* Evidence of sabotage or subversive activity involving or endangering any vessel, harbor, port, or waterfront facility shall be reported immediately to the Federal Bureau of Investigation and to the captain of the port, or to their respective representatives.

§ 6.16-3 *Precautions against sabotage.* The master, owner, agent, or operator of a vessel or waterfront facility shall take all necessary precautions to protect the vessel, waterfront facility, and cargo from sabotage.

SUBPART 6.18—PENALTIES

§ 6.18-1 *Violations.* Section 2, Title II of the act of June 15, 1917, as amended, 50 U. S. C. 192, provides as follows:

If any owner, agent, master, officer, or person in charge, or any member of the crew of any such vessel fails to comply with any regulation or rule issued or order given under the provisions of this title, or obstructs or interferes with the exercise of any power conferred by this title, the vessel, together with her tackle, apparel, furniture, and equipment, shall be subject to seizure and forfeiture to the United States in the same manner as merchandise is forfeited for violation of the customs revenue laws; and the person guilty of such failure, obstruction, or interference shall be punished by imprisonment for not more than ten years and may, in the discretion of the court, be fined not more than $10,000.

(a) If any other person knowingly fails to comply with any regulation or rule issued or order given under the provisions of this title, or knowingly obstructs or interferes with the exercise of any power conferred by this title, he shall be punished by imprisonment for not more than ten years and may, at the discretion of the court, be fined not more than $10,000.

HARRY S. TRUMAN

THE WHITE HOUSE,
October 18, 1950.

[F. R. Doc. 50-9317; Filed, Oct. 18, 1950; 4:19 p. m., 15 F. R. 7005—10/20/50]

TITLE 19—CUSTOMS DUTIES

Chapter I—Bureau of Customs, Department of the Treasury

[T. D. 52583]

PART 4—VESSELS IN FOREIGN AND DOMESTIC TRADE

PART 26—DISCLOSURE OF INFORMATION

RECORDS OF ENTRY AND CLEARANCE OF VESSELS; DISCLOSURE OF INFORMATION CONCERNING IMPORTS AND EXPORTS

In order to protect the security of the United States by restricting the disclosure of information concerning movements of vessels and cargoes in foreign trade, the Customs Regulations of 1943 are amended as follows:

1. Section 4.95 of the Customs Regulations of 1943 (19 CFR 4.95), is hereby amended by deleting the last sentence and substituting the follow-

ing: "These records shall be indexed on customs Form 1404 or 1407 and shall be open to public inspection, except that during any period covered by a finding by the President under section 1 of title II of the act of June 15, 1917 (50 U. S. C. 191), amended by Public Law No. 679, 81st Congress, that the security of the United States is endangered by reason of actual or threatened war, or invasion, or insurrection, or subversive activity, or of disturbances or threatened disturbances of the international relations of the United States, no such record shall be disclosed to other than a party in interest without written authorization from the Commissioner of Customs."

(R. S. 161, 251, secs. 2, 3, 23 Stat. 118, as amended, 119, as amended, sec. 624, 46 Stat. 759; 5 U. S. C. 22, 19 U. S. C. 66, 1624, 46 U. S. C. 2, 3)

2. Section 26.7 (c) of the Customs Regulations of 1943 (19 CFR 26.7 (c)) is hereby amended to read as follows:

(c) During any period covered by a finding by the President under section 1 of Title II of the act of June 15, 1917 (50 U. S. C. 191), as amended by Public Law No. 679, 81st Congress, that the security of the United States is endangered by reason of actual or threatened war, or invasion, or insurrection, or subversive activity, or of disturbances or threatened disturbances of the international relations of the United States, information concerning imports and exports shall not be disclosed except as provided for in § 26.4.

(R. S. 161; 5 U. S. C. 22)

3. Treasury Decision 51364, approved December 6, 1945 (10 F. R. 14866), is hereby revoked. Attention is invited to the fact that § 26.7 (c), Customs Regulations of 1943, and the exception contained in the third sentence of § 4.95, Customs Regulations of 1943, as those sections are hereby amended, are now operative, in view of the finding of the President set forth in Executive Order No. 10173, dated October 18, 1950 (15 F. R. 7005).

[SEAL] FRANK DOW,
Commissioner of Customs.

Approved: October 20, 1950.

JOHN S. GRAHAM,
Acting Secretary of the Treasury.

[F. R. Doc. 50-9620; Filed, Oct. 30, 1950; 8:51 a. m., 15 F. R. 7295—10/31/50]

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

Chapter I—Coast Guard, Department of the Treasury

[CGFR 50-28]

LIGHTS FOR NONDESCRIPT VESSELS; MARINE REGATTAS OR MARINE PARADES

A notice regarding proposed changes in the Pilot Rules for Inland Waters and the Regulations for Marine Regattas or Marine Parades was published in the FEDERAL REGISTER dated August 25, 1950, 15 F. R. 5706, 5708, as Items I and XX on the Agenda to be considered by the Merchant Marine Council; and a public hearing was held by the Merchant Marine Council on September 20, 1950, at Washington, D. C.

The purpose for the new regulation to be added to 33 CFR 80.16 is to require lights to be displayed on nondescript vessels, such as pontoons, being towed or pushed in the harbors, rivers, or other inland waters of the United States which are to be the same as for scows. This new regulation is to adequately describe the lights required on nondescript vessels not otherwise provided for by the regulations.

The purpose for revising the regulations in 33 CFR Part 100 regarding marine regattas or marine parades is to provide a means whereby special regulations may be issued, if necessary, to assure safety of life on the navigable waters immediately prior to, during, and immediately after the marine regatta or marine parade, as well as to require under certain conditions the submission in advance of detailed plans of the proposed marine regatta or marine parade to the Commander of the Coast Guard District in which the event is proposed to be held.

By virtue of the authority vested in me as Commandant, United States Coast Guard, by Treasury Order No. 120, dated July 31, 1950, to promulgate regulations in accordance with the statutes cited with the regulations below, the following amendments to the regulations are prescribed which shall become effective ninety (90) days after date of publication of this document in the FEDERAL REGISTER:

Subchapter D—Navigation Requirements for Certain Inland Waters

PART 80—PILOT RULES FOR INLAND WATERS

LIGHTS FOR CERTAIN CLASSES OF VESSELS

Section 80.16 is amended by adding a new paragraph (i), reading as follows:

§ 80.16 *Lights for barges, canal boats, scows, and other nondescript vessels on certain inland waters on the Atlantic and Pacific Coasts.* * * *

(i) Other vessels of nondescript type not otherwise provided for in this section shall exhibit the same lights that are required to be exhibited by scows by this section.

(Sec. 2, 30 Stat. 102, as amended; 33 U. S. C. and Sup. 157)

Subchapter G—Marine Regattas or Marine Parades

PART 100—SAFETY OF LIFE ON NAVIGABLE WATERS DURING MARINE REGATTAS OR MARINE PARADES

Part 100 is amended to read as follows:

AUTHORITY: §§ 100.01 to 100.25 issued under sec. 1, 35 Stat. 69, as amended; 46 U. S. C. 454.

§ 100.01 *Definition.* The term "marine regatta" or "marine parade" for the purpose of the regulations in this part, is defined to be an organized water event of limited duration which is conducted according to a prearranged schedule and in which general public interest is manifested.

§ 100.05 *Submission of plans for marine regattas or marine parades to the Coast Guard.* (a) Organizations planning to hold marine regattas or marine parades, which, by their nature, circumstances, or location will introduce extra or unusual hazards to the safety of life on navigable waters shall submit detailed plans of such marine regattas or marine parades to the Commander of the Coast Guard District in which it is planned to hold them.

(b) The detailed plans shall include the following:

(1) Name and address of organization.

(2) Nature and purpose of the event.

(3) Information as to general public interest.

(4) Estimated number and types of watercraft participating in the event.

(5) Estimated number and types of spectator watercraft.

(6) A time schedule and description of events.

(7) A section of chart or scale drawing showing the boundaries of the event, various water courses or areas to be utilized by participants, officials, and spectator craft.

(c) Detailed plans shall be submitted no less than 15 days prior to the start of a marine regatta or marine parade unless the marine regatta or marine parade is of such a nature as to involve limitations on the use of a portion of the navigable waters by other interested parties, in which event the plans should be submitted not less than 60 days prior to the start of the proposed marine regatta or marine parade.

§ 100.10 *Procedure of District Commander upon receipt of plans.* (a) The Commander of a Coast Guard District who receives detailed plans of a proposed marine regatta or marine parade to be held upon the navigable waters within his district shall study them to determine whether the proposed marine regatta or marine parade may be held in the proposed location with safety to life on the navigable waters. As an aid to such study, the District Commander may, if he deems it necessary, hold a public hearing to determine the views of all persons interested in, or who will be affected by, the marine regatta or marine parade.

(b) Upon the completion of his study of the plans, the District Commander will notify the organization which submitted the plans:

(1) That the plans are approved, and the nature of the special local regulations, if any, which he will promulgate pursuant to § 100.15; or,

(2) That the interest of safety of life on the navigable waters require specific change or changes in the plans before they can be approved; or,

(3) That the plans are not approved, with reasons for such disapproval.

§ 100.15 *Special local regulations.* (a) The Commander of a Coast Guard District, after approving the plans for the holding of a marine regatta or marine parade within his district, is authorized to promulgate such special local regulations as he deems necessary to insure safety of life on the navigable waters immediately prior to, during, and immediately after the approved marine regatta or marine parade. Such regulations may include a restriction upon, or control of, the movement of vessels through a specified area immediately prior to, during, and immediately after the marine regatta or marine parade.

(b) After approving the plans for the holding of a marine regatta or marine parade upon the navigable waters within his district, and promulgating special regulations thereto, the Commander of a Coast Guard District shall give the public full and adequate notice of the dates of the marine regatta or marine parade, together with full and complete information of the special local regulations, if there be such. Such notice should be published in the local notices to mariners.

(c) The special local regulations referred to in paragraph (a) of this section, when issued and published by the Commander of a Coast Guard District, shall have the status of regulations issued pursuant to the provisions of section 1 of the act of April 28, 1908 (46 U. S. C. 454), as amended.

§ 100.20 *Patrol of the marine regatta or marine parade.* (a) The Commander of a Coast Guard District in which a regatta or marine parade is to be held may detail, if he deems the needs of safety require, one or more Coast Guard vessels to patrol the course of the regatta or marine parade for the purpose of enforcing not only the special local regulations but also for assistance work and the enforcement of laws generally.

(b) The Commander of a Coast Guard District may also utilize any private vessel or vessels to enforce the special local regulations governing a regatta or marine parade provided such vessel or vessels have been placed at the disposition of the Coast Guard pursuant to 14 U. S. C. 826 for such purpose by any member of the Coast Guard Auxiliary, or any corporation, partnership, or association, or by any State or political subdivision thereof. Any private vessel so utilized shall have on board an officer or petty officer of the Coast Guard who shall be in charge of the vessel during the detail and responsible for the law enforcement activities or assistance work performed by the vessel during such detail. Any private vessel so utilized will display the Coast Guard ensign while engaged in this duty.

§ 100.25 *Establishment of aids to navigation.* The Commander of a Coast Guard District will establish and maintain only those aids to navigation as he deems necessary to assist in the observance and enforcement of the special local regulations issued by him. Such aids to navigation will be in accordance with § 62.01-35 of this chapter. All other aids to navigation incidental to the holding of a marine regatta or marine parade shall be considered as private aids to navigation coming within the purview of § 66.01 of this chapter.

Dated: October 24, 1950.

[SEAL] MERLIN O'NEILL,
Vice Admiral, U. S. Coast Guard, Commandant.

[F. R. Doc. 50-9576; Filed, Oct. 27, 1950; 8:55 a. m., 15 F. R. 7266—10/28/50]

Equipment Approved by the Commandant

APPROVAL OF EQUIPMENT

[CGFR 50-26]

By virtue of the authority vested in me as Commandant, United States Coast Guard, by Treasury Department Order No. 120, dated July 31, 1950, the following approvals of equipment are prescribed, as required by the authorities cited with the specific items below, and the approvals shall be effective for a period of five years from date of publication in the FEDERAL REGISTER unless sooner canceled or suspended by proper authority:

DAVITS, LIFEBOAT

Approval No. 160.032/108/0, gravity davit, Type 22-24, approved for maximum working load of 11,500 pounds per set (5,750 pounds per arm), using 2 part falls, identified by General Arrangement Dwg. No. DG-101-1, Alt. F, dated December 10, 1948, and revised April 10, 1950, manufactured by Marine Safety Equipment Corporation, Point Pleasant, N. J.

Approval No. 160.032/118/0, aluminum gravity davit, Type LO-100, approved for maximum working load of 20,000 pounds per set (10,000 pounds per arm), using 2 part falls, identified by Arrangement Dwg. No. 3326 dated January 30, 1950 manufactured by the Welin Davit and Boat Division of Continental Copper and Steel Industries, Inc., Perth Amboy, N. J.

Approval No. 160.032/124/0, mechanical davit, aluminum, straight boom sheath screw, type B-11-A, approved for maximum working load of 2200 pounds per set (1100 pounds per arm), using 4 part falls, identified by General Arrangement Dwg. No. 3161-3 dated September 10, 1949, manufactured by Welin Davit and Boat Division of Continental Copper and Steel Industries, Inc., Perth Amboy, N. J.

(R. S. 4405, 4417a, 4426, 4481, 4488, 4491, 49 Stat. 1544, 54 Stat. 346, and sec. 5 (e), 55 Stat. 244, as amended; 46 U. S. C. 367, 375, 391a, 404, 474, 481, 489, 1333; 50 U. S. C. 1275; 46 CFR 160.032)

LIFEBOATS

Approval No. 160.035/261/0, 24.0' x 7.75' x 3.33' aluminum, oar-propelled lifeboat, 37-person capacity, identified by Construction and Arrangement Dwg. No. 3300, dated August 25, 1949, revised December 30, 1949, manufactured by Welin Davit and Boat Division of Continental Copper and Steel Industries, Inc., Perth Amboy, N. J.

Approval No. 160.035/203/1, 24.0' x 8.0' x 3.73' steel, oar-propelled lifeboat, 40-person capacity, identified by

Construction and Arrangement Dwg. No. 24–1, dated May 16, 1946, and revised July 5, 1950, manufactured by Marine Safety Equipment Corp., Point Pleasant, N. J. (Supersedes Approval No. 160.035/203/0 published in FEDERAL REGISTER April 1, 1948)

Approval No. 160.035/242/0, 26.0' x 8.25' x 3.37' aluminum, oar-propelled lifeboat, 48-person capacity, identified by Construction and Arrangement Dwg. No. 26–3, dated January 4, 1949 and revised July 24, 1950, manufactured by Marine Safety Equipment Corp., Point Pleasant, N. J.

(R. S. 4405, 4417a, 4426, 4481, 4488, 4491, 4492, 35 Stat. 428, 49 Stat. 1544, 54 Stat. 346, and sec. 5 (e), 55 Stat. 244, as amended; 46 U. S. C. 367, 375, 391a, 396, 404, 474, 481, 489, 490, 1333, 50 U. S. C. 1275; 46 CFR 160.035)

VALVES, SAFETY

Approval No. 162.001/137/0, Style HNA–MS–55, carbon steel body pop safety valve, flanged nozzle type, exposed spring fitted with spring cover, 1,500 p. s. i. primary service pressure rating, 650° F. maximum temperature, Dwg. No. HV–25–MS, issued June 3, 1950, and Dwg. No. D–28167 issued March 11, 1947, approved for sizes 1½", 2", 2½", 3", and 4", manufactured by Crosby Steam Gage and Valve Company, 43 Kendrick Street, Wrentham, Mass.

Approval No. 162.001/138/0, Style HNA–MS–56, carbon steel body pop safety valve, flanged nozzle type, exposed spring fitted with spring cover, 1,500 p. s. i. primary service pressure rating, 750° F. maximum temperature, Dwg. No. HV–25–MS, issued June 30, 1950, and Dwg. No. D–28167, issued March 11, 1947, approved for sizes 1½", 2", 2½", 3", and 4", manufactured by Crosby Steam Gage and Valve Company, 43 Kendrick Street, Wrentham, Mass.

Approval No. 162.001/139/0, Style HNA–MS–57, alloy steel body pop safety valve, flanged nozzle type, exposed spring fitted with spring cover, 1,500 p. s. i. primary service pressure rating, 900° F. maximum temperature, Dwg. No. HV–26–MS, issued June 5, 1950, and Dwg. No. D–28167, issued March 11, 1947, approved for sizes 1½", 2", 2½", 3", and 4", manufactured by Crosby Steam Gage and Valve Company, 43 Kendrick Street, Wrentham, Mass.

Approval No. 162.001/140/0, Style HNA–MS–58, alloy steel body pop safety valve, flanged nozzle type, exposed spring fitted with spring cover, 1,500 p. s. i. primary service pressure rating, 1,000° F. maximum temperature, Dwg. No. HV–26–MS, issued June 5, 1950, and Dwg. No. D–28167, issued March 11, 1947, approved for sizes 1½", 2", 2½", 3", and 4", manufactured by Crosby Steam Gage and Valve Company, 43 Kendrick Street, Wrentham, Mass.

(R. S. 4405, 4417a, 4418, 4426, 4433, 4491, 49 Stat. 1544, 54 Stat. 346, and sec. 5 (e), 55 Stat. 244, as amended; 46 U. S. C. 367, 375, 391a, 392, 404, 411, 489, 1333, 50 U. S. C. 1275, 46 CFR 52.65)

FIRE EXTINGUISHERS, PORTABLE, HAND, CHEMICAL FOAM TYPE

Approval No. 162.006/18/0, Alfco Model 3Fl Foam, 2½-gallon hand portable fire extinguisher, Assembly Dwg. No. 4X–1278, dated March 24, 1948, Alt. O, Name plate Dwg. No. 4X–444, dated August 26, 1946, Alt. P, manufactured by American-LaFrance-Foamite Corp., Elmira, N. Y.

Approval No. 162.006/19/0, Kidde Foam (Symbol AM), 2½-gallon hand portable fire extinguisher, Assembly Dwg. No. 4X–1279, dated March 24, 1948, Alt. O, Name plate Dwg. No. 4X–464, dated November 6, 1947, Alt. K, manufactured for Walter Kidde & Co., Inc., Belleville 9, N. J., by American-LaFrance-Foamite Corp., Elmira, N. Y.

Dated: September 27, 1950.

[SEAL] MERLIN O'NEILL,
Vice Admiral, U. S. Coast Guard, Commandant.

[F. R. Doc. 50–8639; Filed, Oct. 2, 1950; 8:47 a. m., 15 F. R. 6638–10/3/50]

TERMINATION OF APPROVAL OF EQUIPMENT

[CGFR 50–27]

By virtue of the authority vested in me as Commandant, United States Coast Guard, by Treasury Department Order No. 120, dated July 31, 1950, the following approval of equipment is terminated because the item of equipment covered is no longer being manufactured:

FIRE EXTINGUISHERS, PORTABLE, HAND, CHEMICAL FOAM TYPE

Termination of Approval No. 162.006/2/0, Foamex, 2½-gallon foam type hand portable fire extinguisher, Assembly Dwg. No. 4X–1080, Alt. H, dated June 3, 1946, Name plate Dwg. No. 4X–209, Alt. B, dated July 11, 1946, manufactured by American-LaFrance-Foamite Corp., Elmira, N. Y. (Approved FEDERAL REGISTER July 31, 1947)

CONDITIONS OF TERMINATION OF APPROVAL

The termination of approval of equipment made by this document shall be made effective upon the thirty-first day after the date of publication of this document in the FEDERAL REGISTER. Notwithstanding this termination of approval on any item of equipment, such equipment manufactured before the effective date of termination of approval may be used on merchant vessels so long as it is in good and serviceable condition.

Dated: September 27, 1950.

[SEAL] MERLIN O'NEILL,
Vice Admiral, U. S. Coast Guard, Commandant.

[F. R. Doc. 50–8638; Filed, Oct. 2, 1950; 8:47 a. m., 15 F. R. 6638—10/3/50]

AFFIDAVITS

The following affidavit was accepted from September 15 to October 15, 1950:

The Hydraulic Press Mfg. Co., Mount Gilead, Ohio. Valves.

Navigation and Vessel Inspection Circular No. 4–50

UNITED STATES COAST GUARD,
WASHINGTON 25, D. C.,
July 13, 1950.

Subject: Filing of reports of crew shortages required by R. S. 4463.

1. Information regarding the requirements of R. S. 4463 and the method of filing the reports required thereby were previously stated in Navigation and Vessel Inspection Circular 3–48 (May 11, 1948). Circular 3–48 also contained information on outstanding waiver procedures. Because of the frequent changes it is necessary to make in the instructions regarding waivers and in view of the probable early termination of the waiver authority the matter of crew shortage reports is made the subject of this separate circular. The provisions relating to crew shortages and reports thereof are statutory and do not stem from any waiver of the navigation laws or regulations.

2. R. S. 4463 (46 U. S. C. 222) provides, among other things, for the establishment of a crew complement for every vessel subject to the inspection laws. This complement specifies the number of officers and seamen of various ranks and ratings considered necessary to the safe navigation of the vessel. Under R. S. 4463, a vessel for which a complement has been established is prohibited from being navigated prior to the filling of such complement by the signing on of the full crew called for thereby, that is, a crew which meets the requirements of the complement both as to number and quality. Furthermore, that statute requires such complements to be filled prior to the navigation of the vessel after the expiration of each

period for which a full crew is signed on.

3. R. S. 4463 outlines the conditions under which a vessel may be navigated in situations where the vessel is deprived of the services of any number of her crew during the period for which the full crew has been signed on. In such cases if the vacancies are filled with replacements of the same grade or a higher rating the vessel may, of course, continue to be navigated just as though no vacancies had occurred. She may be navigated without all positions occupied by such replacements only if (1) such services were lost through desertion or casualty; (2) such services were lost without the consent, fault or collusion of the master, owner or any other person interested in the vessel; (3) the master was unable to obtain replacements of the same grade or of a higher rating to fill the vacant positions; and, (4) it is the judgment of the master that the vessel is sufficiently manned.

4. For purposes of administration of R. S. 4463, the terms "desertion or casualty" shall be construed to include all circumstances beyond the control of the master, owner or any other person interested in the vessel which result in crew vacancies.

5. In cases where a vessel which has been deprived of the services of crew members through desertion or casualty is navigated with fewer crew members on board than the complement for the vessel calls for, or with replacements of lower grade or rating, R. S. 4463 requires that the master report such shortage and explain the cause thereof in writing to the Officer in Charge, Marine Inspection, within 12 hours of the arrival of the vessel at her destination.

6. The written report filed by the master of a vessel on which a crew shortage has occurred during the period for which the full crew has been signed on must contain the following information:

(*a*) The name and license or certificate number of each member of the crew who left the vessel.

(*b*) A statement of the cause of the shortage.

(*c*) The port and date on which the shortage occurred.

(*d*) A certification by the master that no replacements of the same grade or of a higher rating were obtainable and that in his judgment the vessel was sufficiently manned.

This written report must be filed *in duplicate* with the Officer in Charge, Marine Inspection, within 12 hours of the arrival of the vessel at her destination. This officer shall forward one of the copies filed with him to Coast Guard Headquarters without delay.

7. To reduce paper work and simplify the filing of crew shortage reports, Coast Guard Form CG-729 (revised), Report of Crew Shortages, is supplied to masters upon request to any Coast Guard Marine Inspection Office.

(S) MERLIN O'NEILL,
Vice Admiral, U. S. Coast Guard,
Commandant.
July 13, 1950.

ABOUT ELECTRICAL MACHINERY

Treat all electric circuits as though they were "hot" until you are *sure* they are dead.

Before closing a switch be sure you know about the circuit—Don't electrocute a shipmate!

Never b r i d g e a fuse—fuses are safety devices.

When working on motors or circuits, remove the fuses or, if possible, lock the switch open. Place a tag or sign on the switch to warn others that you are working on the line.

Be sure to ground the frame of portable electric tools before using them.

Stand on a dry rubber mat or board if possible when working on electrical equipment.

Never use emery cloth on commutators of motors and generators.

Do not use portable electric light or tools with loose connections or with frayed or worn cable.

Excessive sparking at the commutator or excessive heat in motors, generators, switches, etc., is a sure sign of trouble and should never be ignored or neglected.

Moisture or dampness and mechanical injury are the main causes of insulation failure.

Before using a steam or water hose in the engine room all possible precautions should be taken to prevent the stream from the hose being accidentally turned upon a switchboard, generator or other electrical equipment. The possibilities should be considered before pressure is applied to the hose and the person handling the hose should move cautiously to prevent slipping.

TOOLS AND EQUIPMENT

The tools and equipment placed aboard ship are put there for a purpose. As a member of the engine department you should know something about their use and care. Practically all tools are designed and built to do a certain job, such as the hammer, the cold chisel, the hacksaw, or the pipe wrench, etc., but to do their jobs the tools must be kept in good condition and they must be handled properly.

No attempt is made in this booklet to explain the use of special tools and equipment such as meggers, micrometers, bridge gages, lathes, and the like. Most of these have special instructions for their use. Hand tools such as are used every day in normal engine room and fire room operations are fairly simple in construction and their safe and effective use requires only that a person exercise reasonable care. The f o l l o w i n g suggestions should be carefully considered:

Keep all tools clean.

NATIONAL SAFETY COUNCIL

"The Coast Guard, in its safety-at-sea program, is concerned more with 'moral' safety than 'legal' safety. As an agency which believes human life is a precious thing, we cannot be satisfied with less."

Merchant Marine Personnel Statistics

INVESTIGATING UNITS

Coast Guard Merchant Marine Investigating Units and Merchant Marine Details investigated a total of 441 cases during the month of September 1950. From this number, hearings resulted involving 13 officers and 55 unlicensed men. In the case of officers, no licenses were revoked, 2 were suspended, 4 were suspended with probation granted, 2 were voluntarily surrendered, 5 cases were dismissed after hearing and 1 hearing was closed with an admonition. Of the unlicensed personnel, 8 certificates were revoked, 17 were suspended, 16 were suspended with probation granted, 3 were voluntarily surrendered, 2 were closed with an admonition and 8 were dismissed after hearing.

MERCHANT MARINE LICENSES ISSUED DURING SEPTEMBER 1950

DECK OFFICERS

		Region								Total	
		Atlantic Coast		Gulf Coast		Great Lakes and rivers		Pacific coast			
		O	R	O	R	O	R	O	R	O	R
Master	Ocean	12	79	4	21	0	3	5	41	21	144
	Coastwise	0	15	0	2	0	0	2	0	2	17
	Great Lakes	0	0	0	2	1	6	0	0	1	8
	B. S. & L.	8	39	1	2	1	3	0	11	10	55
	Rivers	0	4	0	3	3	10	1	0	4	17
Chief mate	Ocean	16	21	2	11	0	5	3	21	21	58
	Coastwise	0	1	0	0	0	0	0	0	0	1
Second mate	Ocean	16	36	5	10	0	7	5	25	26	78
	Coastwise	0	0	0	0	0	0	0	0	0	0
Third mate	Ocean	62	39	7	11	0	17	7	35	76	102
	Coastwise	0	0	0	0	0	0	0	0	0	0
Mate	Great Lakes	0	0	0	0	0	0	0	0	0	0
	B. S. & L.	2	2	0	1	0	0	1	6	3	9
	Rivers	0	0	0	0	10	4	0	0	10	4
Pilots	B. S. L. & R.	62	92	22	25	34	33	13	32	131	182
Master	Uninspected vessels	1	0	0	0	0	0	5	3	6	3
Mate	Uninspected vessels	0	0	0	0	0	0	0	0	0	0
Total		179	328	41	88	49	88	42	174	311	678
Grand total		507		129		137		216		989	

ENGINEER OFFICERS

			Atlantic Coast O	Atlantic Coast R	Gulf Coast O	Gulf Coast R	Great Lakes and rivers O	Great Lakes and rivers R	Pacific coast O	Pacific coast R	Total O	Total R
Steam	Chief engineer:	Unlimited	15	107	5	25	2	14	5	58	27	204
		Limited	0	41	0	12	1	22	0	6	1	81
	First assistant engineer:	Unlimited	11	45	1	12	0	7	4	18	16	82
		Limited	4	0	0	1	1	5	0	2	5	8
	Second assistant engineer:	Unlimited	18	73	8	16	2	22	9	38	37	149
		Limited	0	0	0	1	1	2	0	0	1	3
	Third assistant engineer:	Unlimited	56	72	7	20	3	28	5	43	71	163
		Limited	0	0	0	0	1	0	0	0	1	0
Motor	Chief engineer:	Unlimited	2	20	2	10	2	1	0	11	6	42
		Limited	6	26	4	8	3	3	6	11	19	48
	First assistant engineer:	Unlimited	0	4	1	2	0	1	0	2	1	9
		Limited	4	2	2	0	2	2	0	0	8	4
	Second assistant engineer:	Unlimited	2	2	1	2	0	1	2	3	5	8
		Limited	0	0	0	0	0	1	1	0	1	1
	Third assistant engineer:	Unlimited	38	79	0	16	1	32	0	49	39	176
		Limited	0	0	1	0	0	0	0	0	1	0
Uninspected vessels	Chief engineer		1	0	0	0	0	0	3	1	4	1
	Assistant engineer		0	0	0	0	0	0	2	0	2	0
Total			157	471	32	125	19	141	37	242	245	979
Grand total			628		157		160		279		1,224	

RADIO OFFICERS

Total 36

ORIGINAL SEAMEN'S DOCUMENTS ISSUED MONTH OF SEPTEMBER 1950

Region	(1) Staff officer	(2) Continuous discharge book	(3) U. S. merchant mariner's documents	(4) AB any waters unlimited	(5) AB any waters 12 months	(6) AB Great Lakes 18 months	(7) AB tugs and towboats any waters	(8) AB bays and sounds [1]	(9) AB seagoing barges	(10) Lifeboatman	(11) Q. M. E. D.	(12) Radio operators	(13) Certificate of service	(14) Tankerman
Atlantic coast	37	4	856	156	74			1		250	105	1	621	11
Gulf coast	7	14	214	41	10	3				16	22		184	18
Pacific coast	19	10	680	87	22	1				108	72	1	552	2
Great Lakes and rivers.	4	1	865	17	63	38			1	55	49		812	33
Total	67	29	2,615	301	169	42	0	1	1	429	248	2	2,169	64

[1] 12 months, vessels 500 gross tons or under not carrying passengers.

NOTE.—Columns 4 through 14 indicate endorsements made on United States merchant mariner's documents.

SAFETY IS NOT AN ACCIDENT!

SAFETY Is Planned and Ranks HIGH

Among the Requirements

of a

GOOD SEAMAN

U. S. GOVERNMENT PRINTING OFFICE: 1950