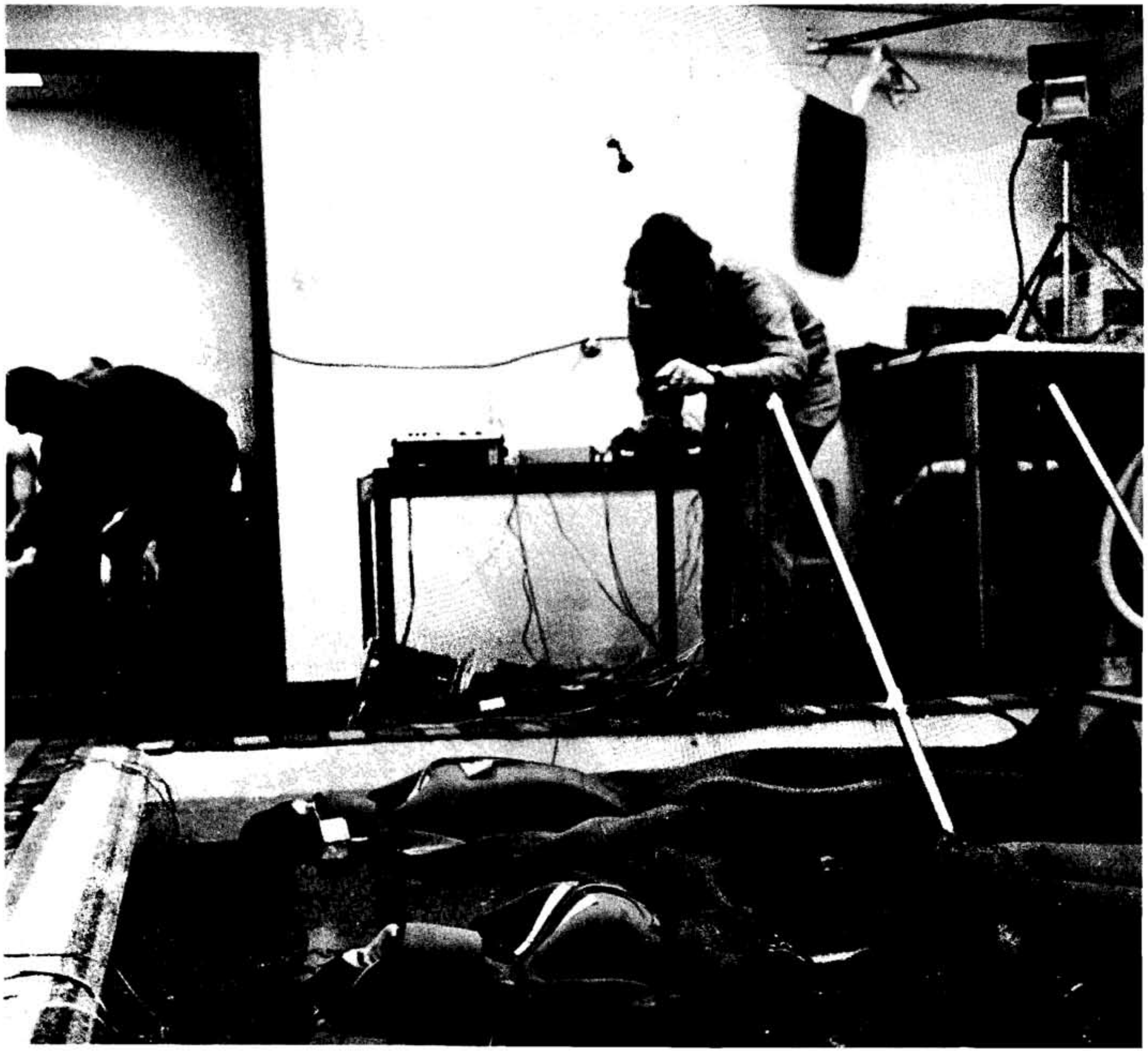
Proceedings
of the Marine Safety Council



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Test subjects float for several hours in a pool of ice water to determine the performance of exposure suits. Note the number of sensor wires. Story begins on page 187. Photo courtesy of the Merchant Vessel Inspection Division, U.S. Coast Guard.

Exposure Suits

LCDR William M. Riley
Merchant Vessel Inspection Division
U.S. Coast Guard

U.S. Coast Guard-approved exposure suits, unlike some foreign models of "immersion suits," are intended to be worn **instead** of a life preserver. The suits provide flotation as well as warmth. In spite of this, some vessel personnel have the mistaken impression that a life preserver should be worn over the exposure suit. This is not practical.

Before the adoption of the latest amendments to the International Convention for Safety of Life at Sea (SOLAS 74), several nations were developing separate philosophies for garments variously referred to as "survival suits," "immersion suits," and "exposure suits." Some of these suits were merely dry suits with no insulation or flotation, intended to enhance the value of warm clothing worn underneath, and requiring a life preserver to provide flotation. Some were insulated but did not provide enough flotation. Some provided flotation but not insulation. The United States took the position that seamen should have a single garment which, in one piece, would provide all the protection needed. The extra time required to don layers of clothing or ancillary devices to complete the outfit could well cost a life.

As a result, the SOLAS amendments effective in 1986 speak of "immersion suits" which may be insulated and/or non-buoyant. This was a compromise in the treaty to accommodate the suits already approved in other countries for use on board their vessels. The United States approves only insulated, buoyant immersion suits as the exposure suits for use on our vessels and mobile offshore drilling units.

Full-length view of an exposure suit. (Photo provided by Merchant Vessel Inspection Division, U.S. Coast Guard.)

Present designs of exposure suits will not turn an unconscious wearer face up in the water because the arms, being buoyant, act as outriggers to make the suit equally stable either face up or face down. The suits are tested to ensure that a conscious wearer can turn from a face-down to a face-up position within 5 seconds. The foam material which provides insulation in the arms is also buoyant, so it will be difficult to design a suit which will right an unconscious wearer. Until some manufacturer solves this design problem, the SOLAS Convention will continue to require that traditional life preservers be carried in addition to exposure suits.

Except for operations in tropical waters, crew members should get into the habit of wearing exposure suits routinely for abandon-ship drills. Any time the water temperature is below 60°F, you will be in grave danger if you find yourself in the water without an exposure suit. On some warm day, call the engine room and ask the engineer on watch what the sea water temperature is, according to the temperature gauge on one of the sea chest intakes. You may be surprised.

There may be emergency situations, such as firefighting, in which you want to wear a life preserver because the exposure suit hampers your mobility too much. This is a judgment call you will have to make based on the circumstances and your experience with exposure suits. Bringing an exposure suit to the scene to change into if the damage control situation deteriorates into abandonment is a good idea, but it has some drawbacks. Once you make the decision to abandon ship, you may not have time or a safe place in which to remove the life preserver and put on the exposure suit. There may not be room to do so in the lifeboat. One solution to this problem is the thermal protective aids which will be required in the lifeboat after July 1, 1986. These devices can be donned over a life jacket in the cramped quarters of the lifeboat and will provide insulation only. Most of the crew, wearing exposure suits, could proceed to the lifeboats while the emergency squad, wearing lifejackets, fights the fire or performs other damage control. When and if the emergency squad gives up the ship, they can join the rest of the crew in the lifeboat and don a thermal protective aid. Specifications for thermal protective aids are now in draft form and will be published as soon as possible. If necessary, the draft specification will be used to approve devices to meet the July 1, 1986, deadline.

Test subject demonstrates buoyancy of the exposure suit. (Photo provided by Merchant Vessel Inspection Division, U.S. Coast Guard.)

Another common misconception is that exposure suits are fireproof. The flame exposure test currently used for approval of exposure suits involves suspending the suit over a pan of burning gasoline for 2 seconds, then extinguishing the suit after 6 seconds if it is burning, and inspecting it for damage. This test is predicated on the assumption that if a man wearing the suit is exposed to a flash fire and the suit ignites, either the wearer or others close by will douse the flames within a matter of seconds. Exposure suits now on the market may continue to melt and burn slowly until totally consumed. For this reason, the suit should not be worn as part of the "fireman's outfit."

The SOLAS amendments going into effect on July 1, 1986 specify that an immersion suit "must not sustain burning or continue to melt after being totally enveloped in a fire for 2 seconds." Again, our regulations will have to be revised to incorporate this change.

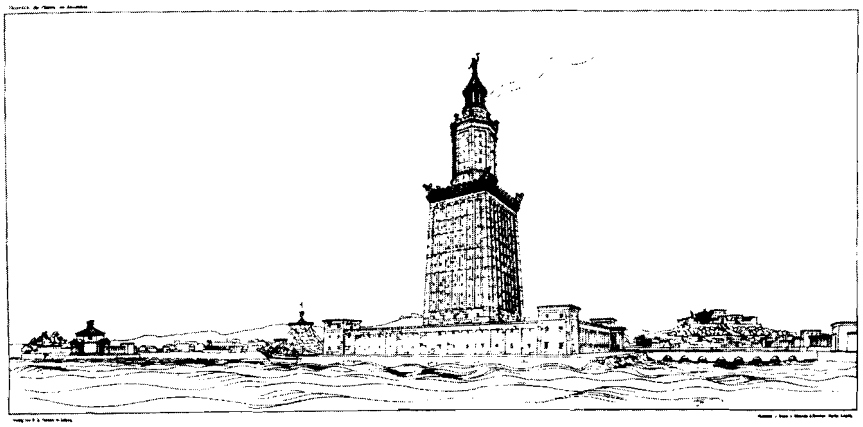
Ancient Lighthouses

The earliest known lighthouses were built by the Sybians and Cushites of Lower Egypt. These towers were, like early bridges, used as temples and held in great reverence by seafarers who made sacrifices in them. It is supposed that the inner walls of these buildings were engraved with charts and that the lightkeepers were priests who also taught seamanship, pilotage, astronomy, and hydrography. The lights were provided by wood fires that burned in iron braziers in the form of interlaced dolphins suspended from the towers with long poles.

Legend has it that the Colossus of Rhodes was a lighthouse insofar as the figure Apollo held a torch aloft upon which a fire was lit at night to guide ships into harbor. The figure was about 100 feet high and made of bronze. Lighted or not, it must have been a sea-mark, standing as it did with legs astride the entrance to Rhodes harbor. Built in about 300 B.C., it stood for 80 years before being toppled by an earthquake.

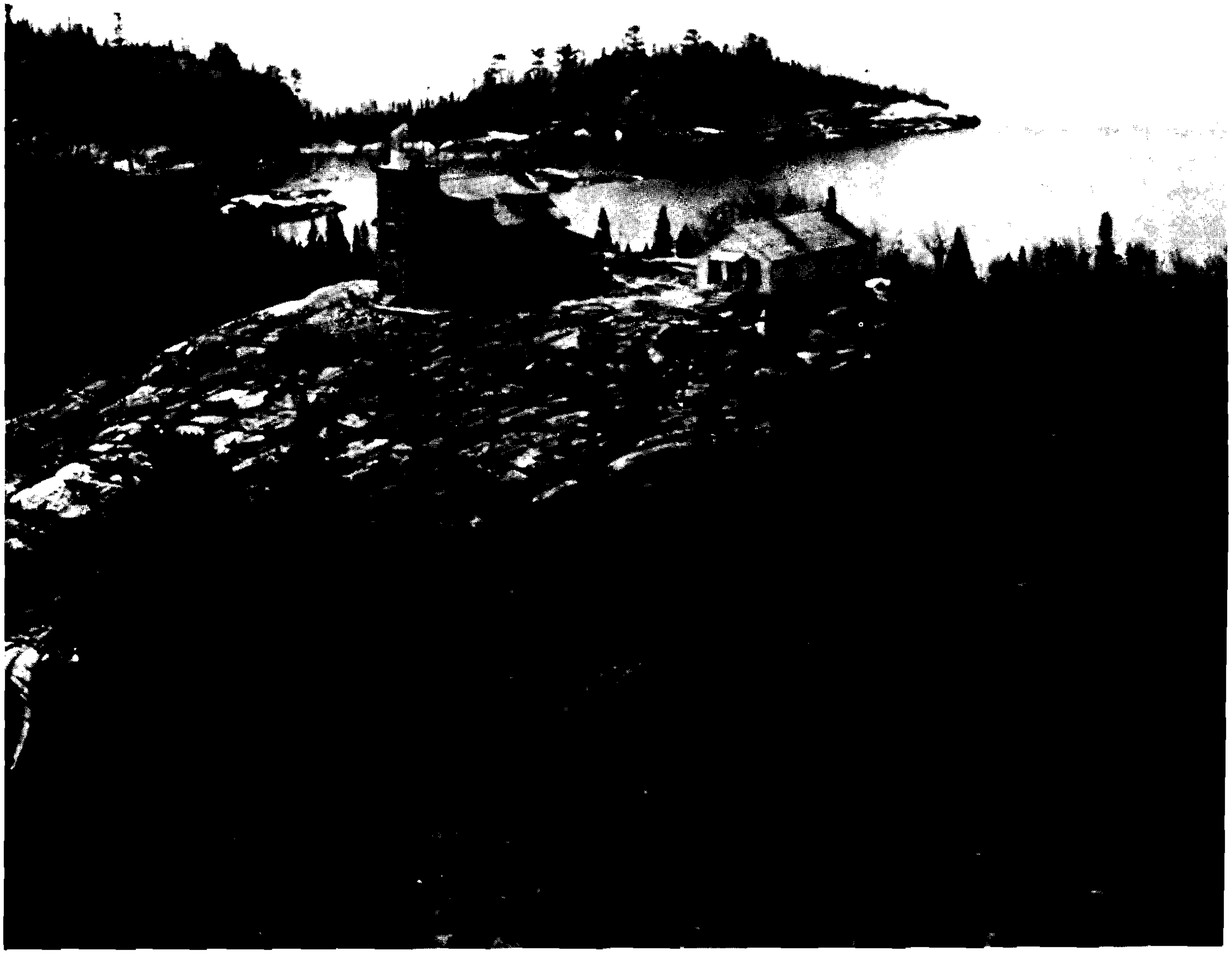
The renowned Pharos of Alexandria received its name from the island on which it was built, and there can be no doubt that it was a lighthouse. Built on a base of 100 square feet, it was 450 feet high and carried an open fire that could be seen for 29 miles. The building, started in 261 B.C. by Sostratus of Cnidus in the reign of King Ptolemy II (283 - 247 B.C.), took 19 years to complete. On it was inscribed, "King Ptolemy to the gods, the saviors for the benefit of sailors." Pharos, according to some historians, was destroyed by an earthquake in the 13th century A.D. It ranked as one of the seven wonders of the world, comparable in size with the Great Pyramid. No other lighthouse in history rivals it in size or in its 1,500 years of service.

The present-day term of "pharology," the science of optics and acoustics associated with lighthouse engineering, comes from the word "pharos," which was a term generally applied to early Egyptian lighthouses. *(**A History of the Lighthouse**, P. Beaver, Peter Davies Ltd, London, 1971. Reprinted with permission from Imperial Oil Limited's **Safety Bulletin**, February 1985, p. 8. Additional information and photograph supplied by the U.S. Coast Guard Historian's Office.)*



Lighthouses in early history were lighted with beacon fires as was Pharos of Alexandria, shown here in a photolith (printed from glass negative). Lines under the photo read: (left) "Verlag von D.G. Teubner in Leipzig"; (right) "Photolith u. Druck v. Giesceke & Devrient Berlin, Leipzig;" (top left) "Thiersch, der Pharos von Alexandria."

For the next several issues, the **Proceedings** *will be publishing a series of articles on the Great Lakes which originally appeared in the March 1985 issue of the* **EPA Journal.** *The Editor wishes to thank Susan Tejada, Associate Editor of the* **EPA Journal,** *for her invaluable assistance in coordinating this series.*



Lake Superior's Huron Island, site of this lightstation, shows evidence of its glacial origins. Official photo, U.S. Coast Guard Ninth District.

The Five Sister Lakes: A Profile

Jack Lewis
Assistant Editor, EPA Journal

Lake Superior, Lake Michigan, Lake Huron, Lake Erie, Lake Ontario: five sister lakes, five "Great Lakes." And the word "great" is not at all inappropriate to describe their size and their importance. Consider the following facts:

- Together the Great Lakes form the largest surface expanse of fresh water in the world (94,560 square miles).

- All five of the Great Lakes are ranked among the fifteen largest lakes in the world: in terms of surface area, Lake Superior ranks second, Lake Huron, fifth; Lake Michigan sixth; Lake Erie, eleventh; and Lake Ontario, fourteenth.

- Completion of the St. Lawrence Seaway in 1959 connected the Great Lakes to form the largest freshwater transportation network in the world. This deep waterway stretching 2,200 miles from Duluth, Minnesota to the Atlantic Ocean handles over 350 million tons of cargo every year.

- United States and Canadian cities along the shores of the Great Lakes comprise the largest industrial complex in the world. More than 40 million people — 15 percent of the Canadian population — live and work in these communities. Some experts predict that a single Great Lakes megalopolis will one day extend all the way from Milwaukee to Toronto.

Formation of the Lakes

The natural processes that formed the Great Lakes began at least 32,000 years ago. Huge masses of ice, known as the Wisconsin glaciation, carved out lake beds as they advanced south over the surface of North America. The glaciers began receding approximately 18,000 years ago. By 5,000 B.C., the Great Lakes had assumed roughly their present form. But even at 7,000 years of age, the Great Lakes are considered "young" compared with lakes in other parts of the world.

The Great Lakes flow eastward down to the sea. Lake Superior and Lake Michigan are 600 feet above sea level, while Lake Ontario — below Niagara Falls — has an elevation of 250 feet. A canal now takes shipping around Niagara Falls between Lake Erie and Lake Ontario, but for centuries the Falls posed a major barrier to navigation of the Great Lakes.

Indian canoe travel was the most ambitious form of shipping the Lakes witnessed for most of their long history. Various tribes contended for control of the region. The powerful Iroquois tribes monopolized Lake Ontario, Lake Erie, and Lake Huron, while the Chippewa dominated Lake Superior. Lake Michigan was home to several tribes: the

Winnebago, the Sauk, the Menominee, and the Miami.

Legend has it that another primitive tribe of warriors, the Vikings, reached the Great Lakes during the Middle Ages, but the authenticity of presumed Viking artifacts found in Ontario and Minnesota has been subject to question.

The Lakes Are Discovered

The Westerner generally credited with discovering the Great Lakes is the French explorer Samuel de Champlain. He stood on the shores of Lake Huron in 1615, but the discovery received scant attention in his journal. Champlain's objective had not been to discover a new lake. Like Columbus before him, he was obsessed by the quest for an ocean route to China.

Champlain's quest for a passage to China was still continuing in 1634 when he ordered Jean Nicolet to explore the "Lake of the Illinois," now known as Lake Michigan. Nicolet carried with him in his birch canoe a robe of Chinese damask. As he neared the shores of Green Bay, he put the damask over his buckskins. Nicolet hoped he would soon be conferring with Chinese merchants. Much to his disappointment, only Indians were on hand to greet him when he stepped ashore.

French exploration of the Great Lakes never led to China, but it did lead to the foundation of a massive new colony known as Canada. Jesuit missionaries, who played a great role in settling the Canadian wilderness, called the Great Lakes "seas of sweet water." At the time, this was not poetic hyperbole. Before the onslaught of the Industrial Revolution, the Great Lakes **were** "seas of sweet water."

The founder of Detroit, Antoine de la Mothe Cadillac, also marveled at "the sparkling and pellucid water" of the Great Lakes. Cadillac regarded the shores of the Great Lakes, circa 1701, as a latter-day Garden of Eden: "The banks are so many vast meadows where the freshness of these beautiful lakes keeps the grass always green. These same meadows are fringed with long and broad avenues of fruit trees which have never felt the careful hand of the watchful gardener; and the fruit trees, young and old, droop under the weight and multitude of their fruit, and bend their branches towards the fertile soil which has produced them."

After another great Frenchman, the Chevalier de La Salle, claimed the Mississippi River for Louis XIV, the French Empire in North America extended all the way from Nova Scotia west to Lake Superior and south to the Gulf of Mexico. French domination of the northern half of that empire ended less than a century later when Britain scored a resounding victory in the French and Indian Wars of 1754-1763. As the price of her military defeat, France had to cede both Canada and the Great Lakes to Britain.

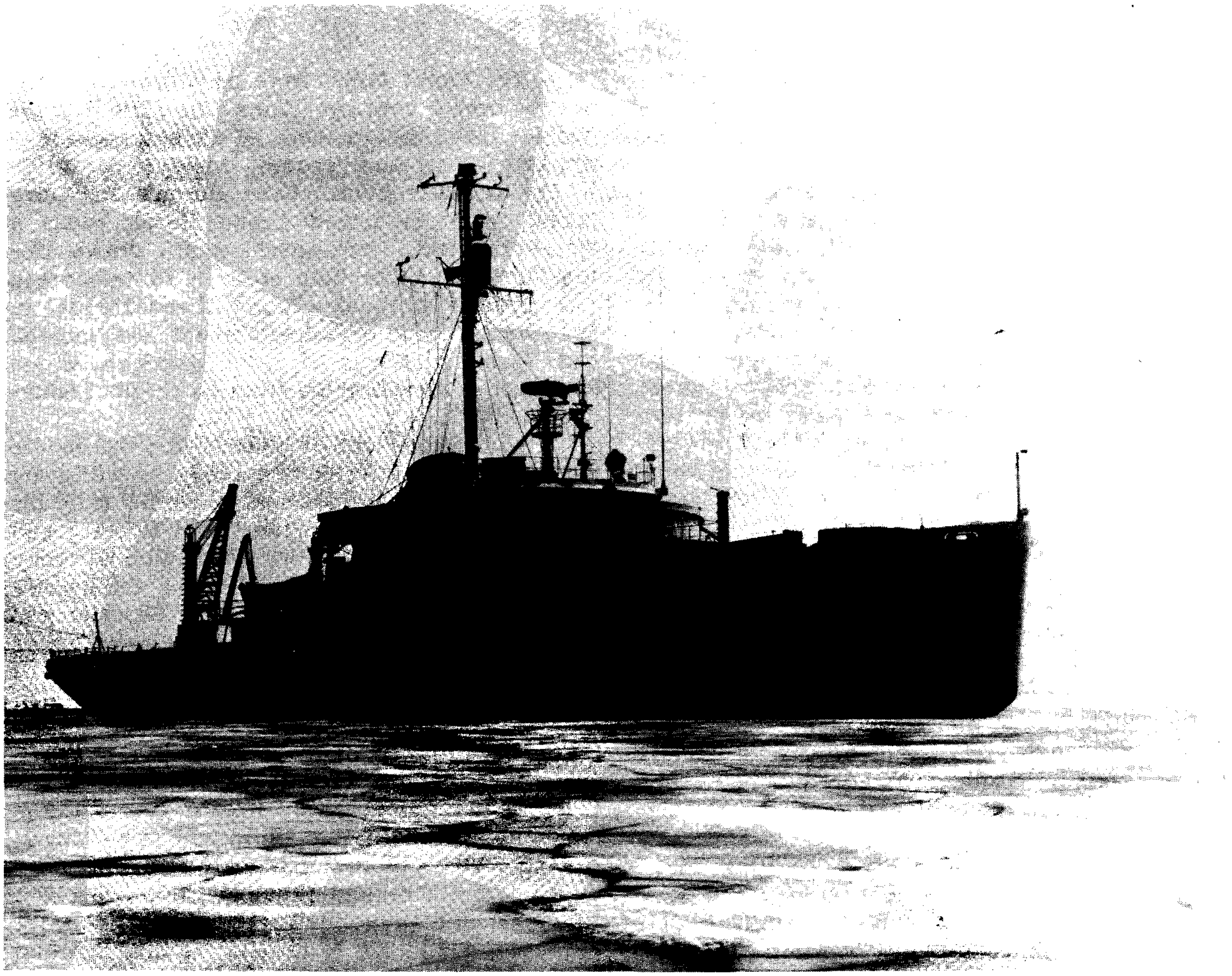
War Ends British Control

The next great historical upheaval in the region was the American Revolution. During the early years of the Revolution, colonial rebels ended British control of the lands between the Great Lakes and the Ohio River. Other raids secured American positions in western New York and northwestern Pennsylvania. The Great Lakes themselves saw only minor naval skirmishes during the Revolution.

American victory deprived the British of their brief hegemony over the Great Lakes. The Treaty of Paris, concluded in 1783, used the Lakes to raise a natural barrier between the fledgling United States and British Canada. The treaty gave the rebels exclusive control of Lake Michigan and divided the other four Great Lakes right down the middle.

The War of 1812 unleashed the last outbursts of violence along the boundary separating the United States from Canada. In September 1813, American and British forces clashed in a major naval battle on Lake Erie. The Americans, led by Commodore Oliver Hazard Perry, emerged the victors. For the first time in their history, the British were forced to surrender an entire naval squadron. "We have met the enemy, and they are ours," Commodore Perry reported in words destined to become as famous as his victory.

The recipient of Perry's immortal dispatch was General William Henry Harrison, already famous for his 1811 victory over the Shawnee chieftain, Tecumseh, at Tippecanoe Creek, Indiana. Together Harrison and Perry proceeded to drive the British from Detroit. In October 1813 they subjected the enemy to a final defeat on the Thames River in Ontario. In 1840 "Tippecanoe" Harrison was elected President of the United States. But a fatal chill he caught at his inauguration made Harrison's ten-



The Coast Guard Cutter MACKINAW, homeported in Sheboygan, Michigan, is a familiar sight on the Great Lakes as it breaks ice each winter. Official photo, U.S. Coast Guard Ninth District.

ure in office the briefest in American history.

Since 1813, the relationship between the United States and Canada has been extraordinarily peaceful. The Rush-Bagot agreement of 1817 and the Boundary Waters Treaty of 1909 laid solid groundwork for U.S.-Canadian harmony. Both countries take pride in the fact that no armaments have been deployed along their common border in nearly a century.

Industry and Trade Develop

The century and a half between the War of 1812 and the opening of the St. Lawrence Seaway in 1959 was a period of stupendous commercial and industrial development in the Great Lakes region. The Erie Canal, completed in 1825, connected Lake Erie with the Hudson River and the major Atlantic seaport of New York City. Starting in 1829, freight traffic between Lake Erie and Lake Ontario was able to skirt Niagara Falls via the Welland Canal. The year 1848 marked another transportation milestone: Lake Michigan was joined to the Mississippi River when the Illinois Waterway was completed.

An equally vital breakthrough occurred in 1854 when an all-rail network at last connected New York to the Great Lakes trading town of Chicago. That tiny frontier outpost was to mushroom into a metropolis over the next century, its population increasing 150 percent. Railroads also hastened the development of other communities near the Lakes. Almost overnight, trains supplanted ships as the preferred mode of passenger travel. Many an ill-fated vessel had met its ruin on the tempestuous and unpredictable waters of the Great Lakes.

Freight traffic on the Lakes, however, continued to grow by leaps and bounds. Mineral riches, such as copper and iron ore, moved in increasing quantities from the more rustic northern Great Lakes to the urban manufacturing centers of Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York. To accommodate this growing volume of raw materials and finished products, heavier steamboats began crowding out the sailing ships that had once reigned supreme on the Lakes.

Technology and progress were "king" elsewhere in the Great Lakes. Duluth, Chicago, Detroit, Toledo, Rochester, and Buffalo all prospered as the nineteenth century gave way to the twentieth. One of the greatest industrial centers in the world — Gary, Indiana — did not even exist when the twentieth century began; all of its phenomenal growth has occurred since 1905. Today the American and Canadian cities bordering the Great Lakes comprise the largest industrial complex in the world.

U.S.-Canadian cooperation was to reach its peak in the 1950s. Planning and construction of the monolithic St. Lawrence Seaway drew the two countries together in an uncommon mission: completion of the largest freshwater transportation network in the world. When it opened in 1959, the Seaway was acclaimed as one of the wonders of modern engineering.

Tourism

The Great Lakes have been drawing visitors for over a century. Lake Ontario's Niagara Falls — long the mecca of honeymooners — remains by far the greatest natural attraction in the entire region. Lake Huron's Mackinac Island, with its fabled Grand Hotel, ranks a distant second. Birdwatchers are drawn like the flocks of birds they observe to temperate Lake Erie, with its abundance of aquatic plants. Spectacular sand dunes ornament the Indiana and Michigan shores of Lake Michigan, which has receded considerably from its original boundaries.

Less frequented by tourists is Lake Superior, which is protected from overcrowding by its remote northern location. Superior is by far the most magnificent of the Great Lakes — and is still the purest. With its 3,000 miles of rocky coastline, it ranks as the largest freshwater lake in the world. In legend, Lake Superior was the home of the Indian gods, America's answer to Mt. Olympus. These Indian spirits are still said to haunt Superior's Apostle Islands, which were immortalized by Henry Wadsworth Longfellow in "The Song of Hiawatha."

Nature rules the world of Great Lakes tourists, but the everyday life of Great Lakes residents is, for good or ill, in human hands. It will take years of concerted effort on the part of all the states and provinces bordering the Lakes to save them for future generations. If the Great Lakes are to remain "Great," nothing less will do.

"The tech manual states: 'Push the thingamajig as you turn the do-funny'. . . ."

Safety Learned from Drill Rigs

A comparison of drill rigs and merchant vessels will show differences in command organization as well as those of design and operation. In contrast to the one-master tradition of the merchant vessel, drill rigs follow a dual system in which changes of operation include an exchange of masters. For example, when a drill rig arrives at an offshore location, the responsibility for the rig changes from a "barge master," or rig mover," to a "toolpusher." Self-propelled drill rigs will have licensed mariners as their masters, similar to the requirements of tankers and cargo vessels. But the barge master of a towed drill rig would not have to hold a license to comply with Coast Guard regulations; the operator of a towed drill rig would not likely retain a licensed master if the regulations would permit performance of the same job by an unlicensed person, such as an able-bodied seaman. Professional qualifications aside, it is the ship-oriented barge master who, with a riding crew, sees to the navigation and safety of the drill rig during moves when it is not drilling in an oil field. Even this method of moving a drill rig is subject to change now that some operators employ lifting ships to carry their rigs — "dry towing" — so as to reduce the hazards of prolonged towing. But once on location in a drilling block, the rig's day-to-day operations fall to the toolpusher, a line of work not learned on merchant vessels.

Unlike factories ashore where most industry favors daylight hours, a toolpusher is in continuous charge of an activity resembling a miniature city, a city engaged in the operation of drilling, the flow of supplies, the exchange of crews, the emergency services of shore-based contractors, and the round-the-clock work of all personnel aboard the rig. To aid this "city" overseas, the authority granted a toolpusher by the rig's operator extends to such things as daily expenses of $100,000 for extra payment of such unusual things as barrels of exotic mud, bags of cracked walnut shells, special tools —almost anything, in fact, to tilt the luck of the toolpusher in the direction of bringing in another gusher. During bad weather, the decision to stay on station and take the risk of continued drilling, or to cap the well and pull out, would be made by the toolpusher. Altogether, the search for oil has saddled the toolpusher with a list of responsibilities like no other in any of the world's industries.

Now add to this busy scene the Coast Guard, with its reminders for the toolpusher to attend to both the safety training of all persons on the rig and to the lifesaving equipment they would use in an emergency. Unfortunately, this call for attention — backed up as it is by rules in the Code of Federal Regulations — adds more tasks for the toolpusher, who does not lack things to do. Some drill rig operators improve this situation for their toolpushers by engaging safety engineers for roving assignments aboard a number of drill rigs; for large organizations, this becomes a worldwide activity. But in the end, despite the assistance of staff personnel, the toolpusher remains a marked man, a key figure in a large venture that dictates his working day to the task of finding oil with occasional attention to the safety of the people under his charge.

The Coast Guard is aware of the split attention caused by the above hard-driving situation; clearly, the effort of drilling for oil pushes lifesaving equipment to a

Figure 1

Typical Hand Brake with External Brake Band (altered)

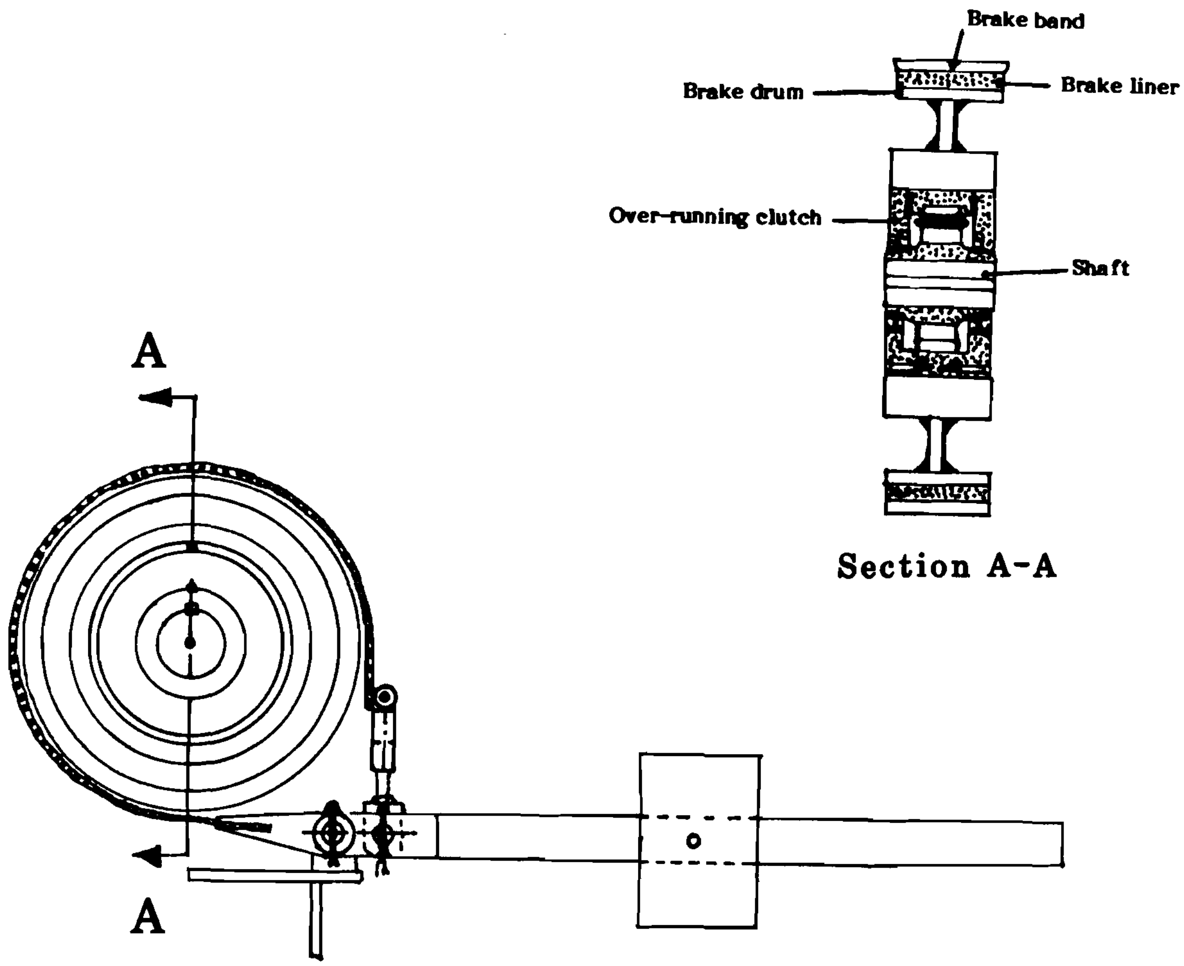


Figure 1 (except for Section A-A) is printed with permission from Lake Shore Drawing 2D3-1089 (Rev. A), Lake Shore, Inc. Section A-A is reprinted with permission from Hilliard Bulletin 231, November 1969, published by the Hilliard Corporation.

lower level of interest. Other than drastic changes following an actual disaster — a fire and blowout — there is little chance of any management or regulatory changes in the future that would cause a toolpusher to shift his attention from oil to lifesaving equipment. Individuals lacking the drive to find oil do not find employment as toolpushers.

The reality of this situation is not lost on the Coast Guard. The difficulty hinges on communicating with drill rig personnel to make them more knowlegeable of their lifesaving equipment. Despite the unusual things found in offshore oil drilling, the response of rig personnel to instructions concerning their lifesaving equipment should be the same as that of industrial workers ashore, where people in chemical plants and refineries also face hazards on a daily basis.

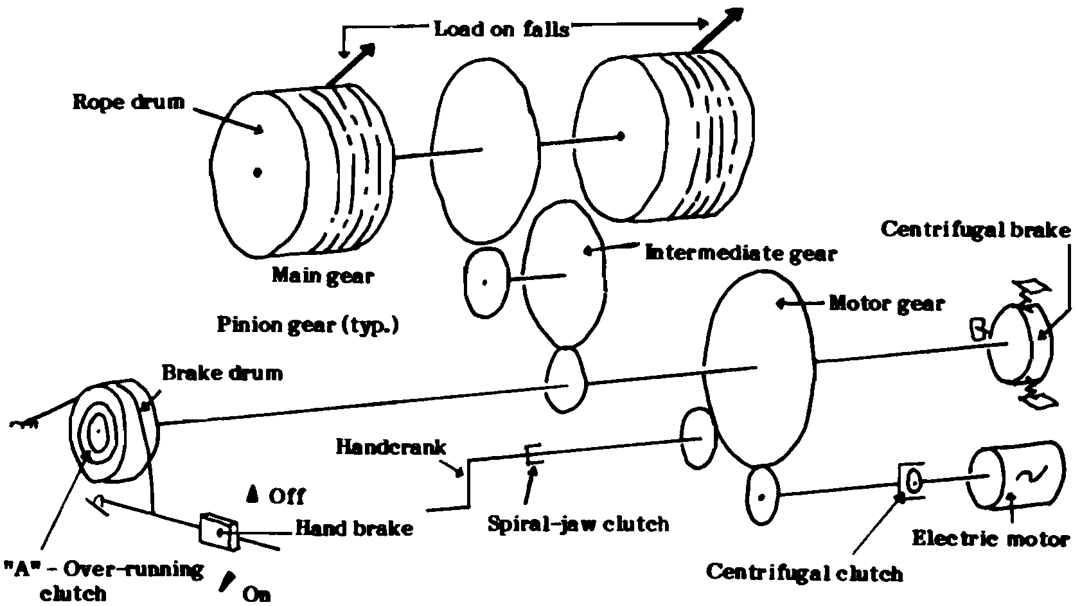
For the purpose of alerting drill rig personnel to possible hazards, what follows are summaries of recent incidents reported by marine inspectors of the Coast Guard. These concern the maintenance and use of the lifesaving equipment of drill rigs. If nothing else, they show the necessity for constant attention to the maintenance of equipment.

Case 1: Failure of a Winch To Operate Due to Rust

This occurred during an actual abandonment -- not a training exercise — on a large, nonself-propelled oil rig engaged in drilling in the Gulf of Mexico in waters approximately 1,800 feet deep. During a blowout and fire, some of the rig's personnel attempted to board and launch a lifeboat from a location on the stern adjacent to the machinery of the drilling floor. Unfortunately, the buildup of rust on the winch's brake drum was enough to prevent the release of the brake so that unreeling of the wire rope fall could lower the lifeboat. When these people saw that the lifeboat would not lower, they went down to liferafts in the water by man ropes and a Jacob's ladder. This abandonment caused a loss of life elsewhere on the rig but not to the personnel attempting to use this particular lifeboat.

The above incident took place in the fall of 1984, but the winch in question had not been operated since March of the same year, a lapse of about 6 months. A lack of maintenance appears to be the cause of this winch's failure to lower the boat. The inspection report tells the story: "During abandonment of the vessel, the boat failed to lower when the release cable was pulled. The cable moved freely and did raise the brake

Figure 2 Components of Lifeboat Winch



handle and counterweight... The brake drum had sufficient rust such that it could not turn freely within the brake band..." Later, when the personnel returned to the rig, "...the brake band was struck several times with a piece of pipe, and the boat lowered freely."

The location of this winch on the stern of the rig, adjacent to the machinery of the drilling floor, was not ideal. In such an area, the winch was often under attack by sprays of drilling mud and the soot of the diesel exhaust of the machinery, which is in more or less continuous operation. Under these conditions, the buildup of rust and debris under a brake band of the design shown in figure 1 is not surprising. A reading of the inspector's report, months after the incident, raises the question, "When the rig first began operating and the winch was seen to be in a bad location, couldn't its brake have been kept under a weatherproof cover?" A majority of "yes" answers to this by the toolpushers might signal the start of an improving situation.

Case 2: Inoperable Brake Releases Due to Paint

This involved the winch brake releases of two units, a lifeboat and a survival capsule, the primary means of escape for a mobile offshore drilling rig. As reported by the marine inspector, "During a routine drydock extension exam, the inspector decided to examine the mechanisms that release the boats from the rig. Neither could be operated from the boat." The same report, describing the survival capsule, says, "...the cable to the release mechanism was wasted away. The pulleys to the release cable were painted over and would not turn. The release mechanism was frozen up and had to be worked free by hand." Similarly, for the lifeboat's winch, "...The counterbalance to the release was painted over and could not be moved." This case is similar to Case 1 in that it concerns the release mechanisms of winch brakes. Fortunately, the Coast Guard inspector discovered and had the above conditions corrected before any mishap took place. The report makes it obvious that maintenance personnel of drill rigs should avoid painting such working parts as cables and pulleys. This error and wasted effort follows a worldwide trend in which unnecessary paint is often evident on the screw threads of valve stems, on the rubber gaskets of watertight doors, on instruction labels, on the wire rope of lifeboat falls, etc. Paint frequently interferes with the proper operation of the equipment.

Case 3: Improper Clutch Lubrication

Although differences exist in various makes of lifeboat winches, a need for an over-running clutch is common to all. This is the mechanical element "A" of figure 2, showing a lifeboat winch in basic detail.

The importance of correct lubrication for an over-running clutch will become evident to the reader from an understanding of the working of its internal parts. For reasons of brevity, an explanation of this is given with figure 3.

The over-running clutch is a vital element in the safe operation of a lifeboat winch because it makes lowering and hoisting separate and distinct. With an over-running clutch in the winch, its operator does not have to make a flying shift of the controls when changing from lowering to hoisting operations. A winch without an over-running clutch during hoisting would require its operator to hold the brake in the "off" position while instantaneously applying power, a shift which — if occurring while the lifeboat were still descending — would produce an abrupt reversal of rotation and dangerous overstressing of the gears and shafting.

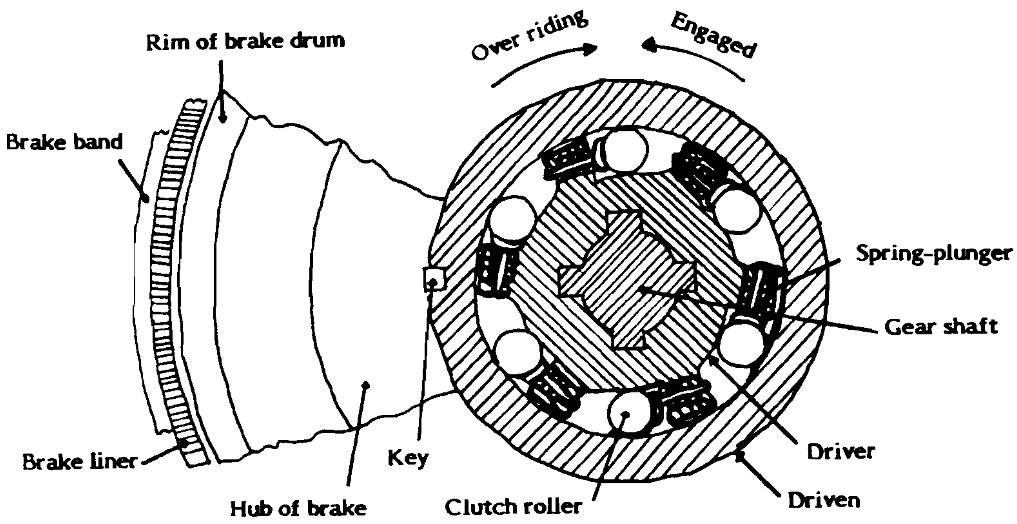
The small, internal parts contained in an over-running clutch may be described as "dainty." They will not function as intended if clutch maintenance does not follow the winch manufacturer's instructions. If the wrong grease or oil is applied to the clutch, the internal plungers and small springs might not push the rollers as intended. Their movement could become sticky with resulting clutch slippage and pay out of the falls when hoisting power stops. And the most paramount concern of all is that improper lubrication may cause a clutch to go berserk under freezing temperatures. At one time there did not appear to be any link between lubrication and temperature to indicate their influence on the operation of an over-running clutch; however, experience in arctic regions indicates otherwise. The Coast Guard is aware of three incidents involving clutch malfunction caused by freezing conditions. In one incident, a winch failed to keep its lifeboat hoisted. It smashed on the rig's supporting columns and fell into the water.

Conclusion

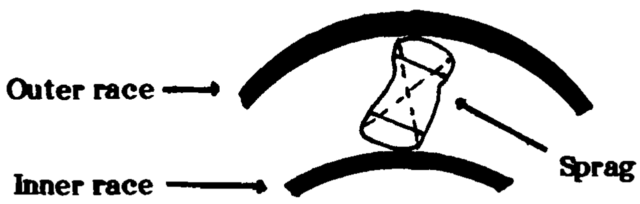
It is necessary to identify correctly all grease and oil lubricants and to check them for compliance with the instructions of the winch manufacturer before lubricating over-running clutches. When lubricating over-running clutches, maintenance personnel must not be permitted the luxury of thinking that one oil or grease is just as good as another; the small parts inside these clutches are of a size easily swamped by the wrong "gunk."

Figure 3 Over-running Clutches in Lifeboat Winches

(a) Details of Roller-type Over-running Clutch



(b) Details of Sprag Over-running Clutch



This "sprag" design is an alternate to the roller design shown above in (a). A circular row of sprags between concentric inner and outer races of the clutch performs the same wedging action as the rollers. Reversal of the rotation of the driver frees the sprags and permits the clutch to overrun.

(c) Summary of Operating Conditions

	Lifeboat Movement	Power	Hand-brake	Clutch Operation	Clutch Parts		Summary
					Driver segment	Driven segment	
(1)	Stopped	Off	On	Engaged	Stopped	Stopped	Torque on driver from weight of lifeboat (via gears) forces rollers into wedge-shaped spaces, thus locking driver to driven (outer race). But the 2 clutch segments can not rotate together because hand brake is "on." Boat does not move.
(2)	Lowering	Off	Off	Engaged	Rotating	Rotating	Same wedging action of rollers as in (1), but with handbrake "off," which permits the 2 clutch segments to rotate together, thus lowering the boat.
(3)	Hoisting	On	On	Over-running	Rotating	Stopped	"On" position of handbrake prevents driver (outer race) from rotating. But power from electric motor starts the driver rotating opposite to its hoisting direction. The driver's change of direction moves the rollers out of their wedging action and towards the springs. This over-running action permits the raising of the boat despite the brake's "on" position.

Figure 3 (a) is taken from the Standard Handbook for Mechanical Engineers, 7th ed., Theodore Baumeister, ed., and is printed with permission from the publisher, McGraw Hill Book Company. Figure 3 (b) is printed with permission from the 1967 catalog of the Formsprag Company.

Keynotes

Notice of Public Hearing and Extension of Comment Period

CGD 80-113 Lifesaving Equipment; Improved Standards for the Stability of Inflatable Liferafts (July 5)

On the basis of several written comments, the Coast Guard has decided to hold a public hearing on the Notice of Proposed Rulemaking published in the **Federal Register** on January 11, 1985 (50 FR 15580) dealing with requirements for improving the stability of the inflatable liferafts used aboard merchant vessels and drill rigs of U.S. registry. The public hearing is scheduled for Thursday, September 12, 1985, 9:30 a.m. to 12:00 p.m., in the U.S. Coast Guard Headquarters, Room 2415, 2100 Second Street, S.W., Washington, D.C. 20593. Comments should be mailed to the Marine Safety Council (G-CMC/21), U.S. Coast Guard Headquarters.

Requests for copies of NPRMs should be directed to the Marine Safety Council. The address is Commandant (G-CMC), U.S. Coast Guard, 2100 Second Street, SW, Washington, DC 20593; telephone (202) 426-1477. The office, Room 2110, is open between the hours of 9:00 a.m. and 4:00 p.m. Monday through Friday. Comments are available for inspection or copying during those hours.

 Hung M. Nguyen

Butadiene

During World War II, the United States was in short supply of natural rubber. Because butadiene could be used in producing synthetic rubber, the chemical's importance dramatically increased in the war years. The federal government built a huge butadiene industry which produced about 1,051,468,000 pounds of the compound by the year 1953. Today, butadiene is one of the largest tonnage organic chemicals produced. At one point, it was ranked as the thirty-second highest volume chemical produced in the United States.

Even though most people are unfamiliar with butadiene, its products play a major role in our everyday lives. For example, butadiene has been used as a blend with natural rubber in heavy-duty tires and with styrene in shoe-soling compounds and regular automobile tires. In addition, butadiene also combines with polymers of acrylonitrile to make nitrile rubbers which are used in oil seals.

Butadiene is normally shipped as a liquified compressed gas. It is colorless and has a gasoline-like odor. It is found in gases resulting from high-temperature decomposition of hydrocarbons and has been commercially recovered from the products of heavy oil cracking. Butadiene is soluble in alcohol and ether and is insoluble in water.

Since butadiene is a highly flammable gas or liquid, it must be kept under pressure or in insulated tanks below 35°F (1.67°C) during storage and in shipment. Otherwise, its vapor will combine with air to produce an explosive gas.

General experiments have shown that butadiene can be toxic. Exposure to the chemical in high concentration can cause narcosis, respiratory paralysis, and death. Symptoms include blurred vision; nausea; and dryness of the mouth, throat, and nose; followed by fatigue, headaches, vertigo, decreased blood pressure and pulse rate, and unconsciousness. At lower concentrations, butadiene may cause slight irritation to the skin and eyes.

If butadiene is splashed in the eyes or on the skin, the affected area should be rinsed with large amounts of water. If the chemical is inhaled, move the victim into fresh air and call a physician.

Persons handling butadiene should use a breathing device to avoid inhaling the vapor or fumes. They should also wear chemical-type safety goggles, rubber gloves, aprons, and shoes. In addition, all persons entering a butadiene tank should be equipped with a a self-contained breathing apparatus, rubber suit, rescue harness, and lifeline.

The U.S. Coast Guard regulates butadiene as a flammable compressed gas. The regulations governing it can be found in Part 151.05.1 of Title 46, Code of Federal Regulations. The International Maritime Organization includes it as a Class 2 chemical in its chemical code. The U.S. Department of Transportation regulates butadiene in Part 172.102 of Title 49. The International Maritime Dangerous Goods Code (IMDG) lists it on page 2033.

Hung M. Nguyen was a Second-Class Cadet at the Coast Guard Academy when this article was written. It was written under the direction of LCDR Thomas J. Haas for a class on hazadous materials transportation.

Chemical name:	Butadiene
Formula:	C_4H_6
Synonyms:	bivinyl biethylene 1,3-butadiene divinyl pyrrolylene vinyl ethylene
Physical Properties:	
boiling point:	-4.41°C (24.1 °F)
freezing point:	-108.90°C (-164°F)
vapor pressure:	
20°C (68°F)	1799 mm Hg
46°C (115°F)	75 psia
Threshold Limit Values (TLV)	
time weighted average:	1000 ppm; 2200 mg/m^3
short term exposure limit:	1250 ppm; 2750 mg/m^3
Flammability Limits in Air	
lower flammability limit:	2.00% by volume
upper flammability limit:	11.5% by volume
Combustion Properties	
flash point:	-41.3°C (-105°F)
autoignition temperature:	331.5°C (842°F)
Densities	
liquid (water=1):	0.621 at 20°C
vapor (air=1):	1.88 at 20°C
U.N. Number:	1010
CHRIS Code:	BDI
Cargo compatibility group:	30 (Olefins)

Nautical Queries

The following items are examples of questions included in the Third Mate through Master examinations and the Third Assistant Engineer through Chief Engineer examinations:

—ENGINEER—

1. Why is it good practice to have the frequency of the incoming alternator adjusted slightly higher than that of the loaded alternator when you are paralleling alternators?

A. Allow the machine to accept load immediately.
B. Prevent the machine from floating on the line.
C. Prevent the reverse power relay from activating.
D. All of the above.

Reference: Hubert, Preventive Maintenance of Electrical Equipment

2. If clearance between piston and cylinder wall is excessive, piston slap will occur. The slap itself is caused by

A. alternating side thrust forcing the piston skirt against alternating sides of the cylinder wall.
B. breakdown of the lube oil film on the cylinder wall.

C. worn piston boss piston pin bearings.
D. fluctuating gas pressure in the combustion space.

Reference: NAVPERS, Engineman 3 & 2

3. In addition to being hazardous to personnel, gas leaks through a boiler casing can also

A. cause overheating of the uptakes.
B. impair the effectiveness of the air purge cycle.
C. cause improper atomization of fuel oil.
D. impair the operation of the high steam pressure limit switch.

Reference: NAV SHIP TECH MANUAL 9510

4. If you hear more than six short blasts and one long blast on the whistle supplemented by the same signal on the general alarm bells, you should

A. go to your lifeboat station.
B. start the fire pump.
C. break out the emergency gear for tank rescue.
D. secure from all drills.

Reference: 46 CFR 35.10-5

5. In fire fighting, the term "protecting exposures" means

A. protecting the fire fighters from direct exposure to the heat of the fire.
B. keeping flames from burning the tank vents.
C. protecting exposed areas of the superstructure from flames.
D. taking any and all necessary measures to prevent the spread of fire from the compartment of fire to any adjacent compartment not already on fire.

Reference: MARAD, Marine Fire Prevention, Firefighting, and Fire Safety

DECK

1. According to the Inland Navigation Rules, all of the following are engaged in fishing EXCEPT a vessel

A. setting nets.
B. trawling.
C. using a dredge net.
D. trolling.

Reference: International Rules

2. Which of the following portable fire extinguishers is classified as a type B-III extinguisher?

A. 12 gallon soda acid
B. 20 gallon foam
C. 30 pound carbon dioxide
D. 20 pound dry chemical

Reference: 46 CFR 34.50-5(c)

3. The perforated, elevated bottom of the chain locker, which prevents the chains from touching the main locker bottom and allows seepage water to flow to the drains, is called a

A. cradle.
B. draft.
C. manger.
D. harping.

Reference: Merchant Marine Officer's Handbook

4. What signal must you display at night on a docked tank barge to show that it is loading or discharging bulk liquid cargo?

A. Red light
B. Flashing amber light
C. ICC yellow light
D. Two orange lights

Reference: 46 CFR 35.30-1(a)

5. Which vessel is most likely to be loaded full but not down?

A. A bulk carrier loaded with heavy ore.
B. A general cargo carrier loaded with palletized cargo.
C. A tanker loaded with heavy grain.
D. A bulk carrier loaded with steel.

Reference: Sauerbier, Marine Cargo Operations

ANSWERS

ENGINEER
1-D;2-A;3-B;4-A;5-D
DECK
1-D;2-D;3-C;4-A;5-B

If you have any questions about "Nautical Queries," please contact Commanding Officer, U.S. Coast Guard Institute (mvp), P.O. Substation 18, Oklahoma City, Oklahoma 73169; telephone (405) 686-4417.

Marine Safety Council Membership

Rear Admiral Norman C. Venzke, Chief of the Office of Operations, retired from the Coast Guard on June 30, 1985.

A 1950 graduate of the Coast Guard Academy, Admiral Venzke served on seven ships in the Atlantic, Pacific, Arctic, and Antarctic, commanding two of them. His shore assignments were in the areas of general operations, readiness and training, including commanding troops in South Vietnam.

Admiral Venzke earned a Bachelor of Science degree in electrical engineering from the U.S. Naval Postgraduate School in Monterey, California. In 1973, he attended the Industrial College of the Armed Forces at Fort McNair in Washington, D.C. In 1974, he graduated from George Washington University with a Master's degree in administration. He holds a Merchant Marine License as Master of Steam or Motor Vessels of Any Gross Tons upon the Oceans.

His military awards include the Legion of Merit with combat "V", Meritorious Service Medal, and the Navy Commendation Medal.

Rear Admiral Clyde E. Robbins assumed command as Chief, Office of Operations, on July 12, 1985.

Rear Admiral Robbins graduated from the Coast Guard Academy in 1954. After serving for a year and a half aboard the cutter HALF MOON, he completed flight training at Pensacola, Florida, and Corpus Christi, Texas. He then served as an aviator in a variety of assignments, including tours in Florida, San Francisco, Canada, and Bermuda.

Following a 5-year tour at Coast Guard Headquarters in Washington, D.C., he served 3 years as a commanding officer of Air Station Washington, D.C. Rear Admiral Robbins took command of U.S. Coast Guard Base Galveston, Texas in June of 1974 where he remained for 2 years. Following his studies at the National War College in Washington, D.C., Rear Admiral Robbins was assigned as the Chief of the Programs Division at Headquarters in 1977. Moving to Boston in 1980, he became the Chief of the Operations Division of the First District and a year later assumed duties as Chief of Staff of that district.

continued next page

Rear Admiral Robbins was promoted to his present rank in June 1982 while serving at Headquarters as the Chief of the Special Staff Element for the Commandant. He assumed the duties of the District Commander, First Coast Guard District, May 25, 1983. On June 30, 1983, he became the Commander, Fourteenth Coast Guard District in Honolulu and in July of 1985 he moved to Headquarters, Washington to be the Chief, Office of Operations.

Rear Admiral Robbins holds a Bachelor of Science degree from the Coast Guard Academy and is a Distinguished Graduate of the National War College. He has been awarded the Legion of Merit, Meritorious Service Medal, Air Medal, Coast Guard Commendation Medal, President's Medal and the Secretary's Award for outstanding achievement in equal opportunity, among others.

A native of Columbia Cross Roads, Pennsylvania, and son of the late Howard and Lisle Robbins, Rear Admiral Robbins is married to the former Elizabeth P. Byrem of Hohokus, New Jersey. They have two children, Jennifer, a 1983 graduate of Temple University in Pennsylvania, now living in Philadelphia, and James, a 1983 graduate of the Coast Guard Academy, who is assigned to naval flight training.

Vessel Exemptions Termination Notice for Inland and International Navigation Rules

Several of the exemptions authorized in Rule 38 of the Inland and International Navigation Rules are due to expire during the next year. These exemptions were created to facilitate the transition from the requirements of the old International, Inland, Western Rivers, and Great Lakes Rules to those of the new Inland and International Rules. Some of these exemptions have time limits of 4 or 9 years after the effective date of the rules; others are permanent.

The Inland Rules' 4-year exemptions are due to expire on December 24, 1985 for all inland waters excluding the Great Lakes, which will expire on March 1, 1987. These exemptions deal with the range and color specifications of navigation lights. More information can be found in Inland Rule 38 paragraph d(i) and (ii) and Annex I.

The International Rules' 9-year exemptions are due to expire on July 15, 1986. These exemptions pertain to the horizontal and vertical positioning of navigation lights. They also deal with the requirements for sound signals. These exemptions are stated in International Rule 38 paragraph d(ii), e, f, and g. The technical information for lights is found in Annex I and for sound signals in Annex III of the Navigation Rules.

The Coast Guard considers the time allowed by these exemptions sufficient to provide for the effective and efficient transition to the new requirements. The Coast Guard has no plans to grant time extensions for these exemptions beyond those stated in Inland and International Rule 38.

Those who might be affected by the expiration of these exemptions are encouraged to examine Rule 38, Annex I and III of both sets of rules in COMDTINST M16672.2A, Navigation Rules International and Inland. If you have any questions, contact LTJG E. Zacharias, U.S. Coast Guard Headquarters, Navigation and Information Branch, phone (202) 245-0108.