

1373

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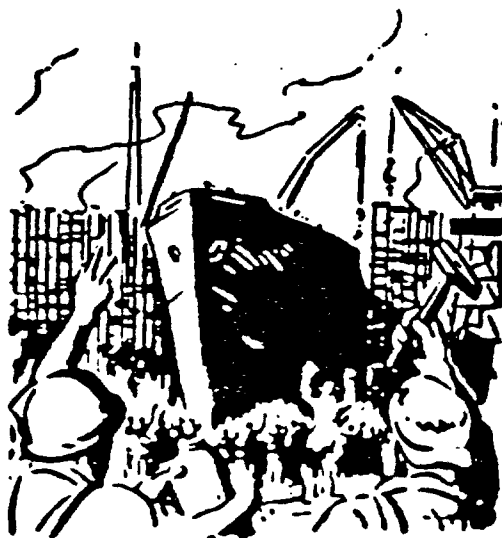
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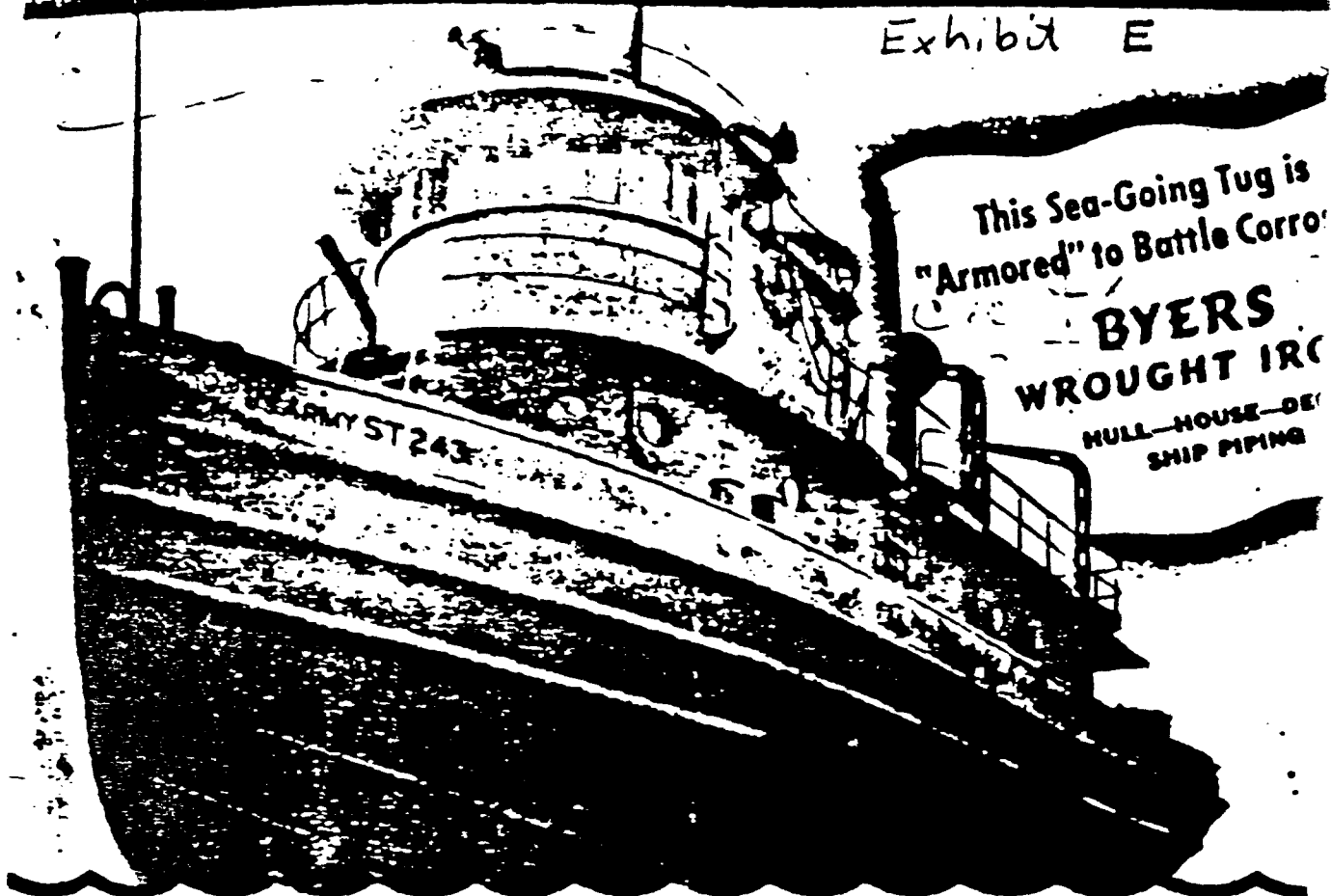
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Exhibit E



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Built by Livingston Shipbuilding Company and owned by Transportation Corps, War Department, this 85-foot tug is equipped to battle an ever present enemy—corrosion. Hull, deck, deck-house and many important ship piping services are Byers Wrought Iron. The tug is an all-welded job, has a gross tonnage of 140, and is powered with a 720 SHP Diesel.

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Our General Catalog will give you complete dimensional information on wrought iron plates, and piping, and will be helpful in your design work. May we send you a copy?

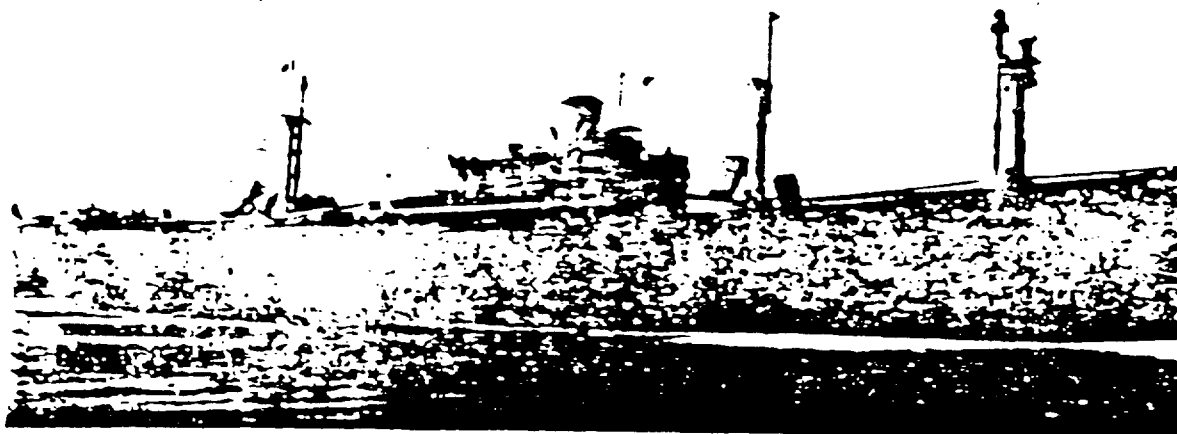
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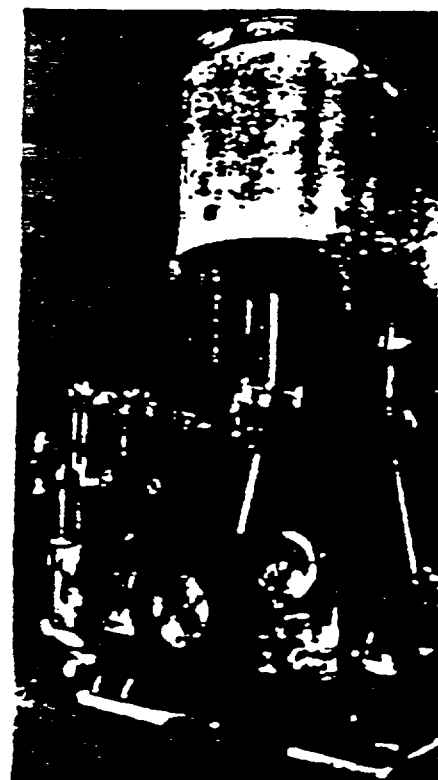
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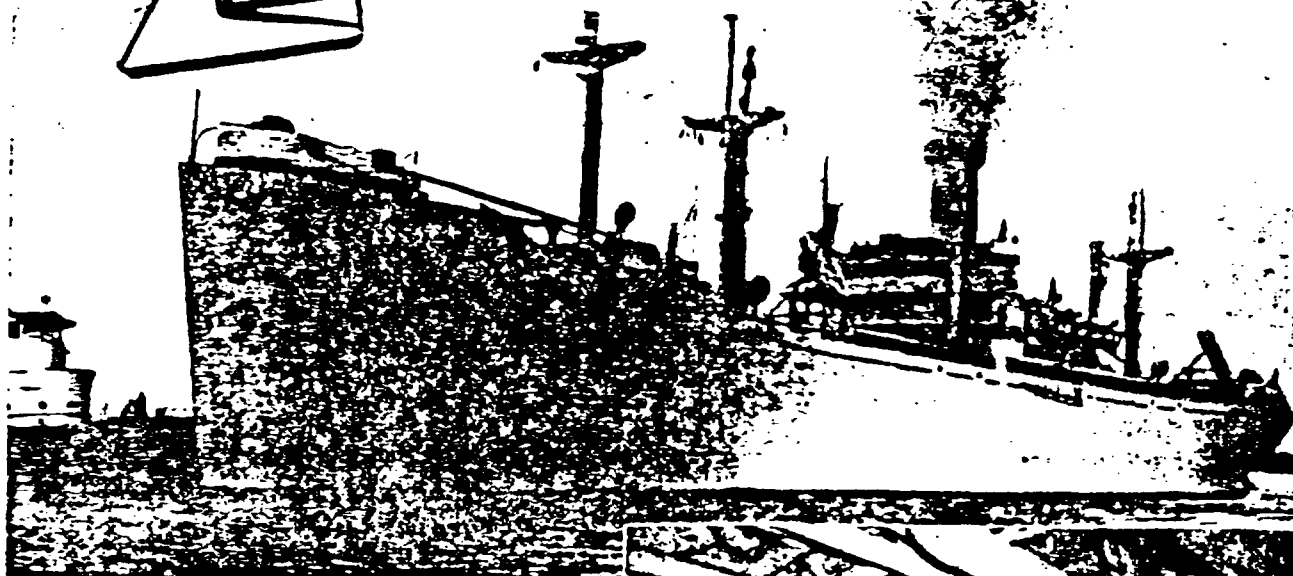
Liberty ship engine built by General Motors Corporation for U.S. Navy service

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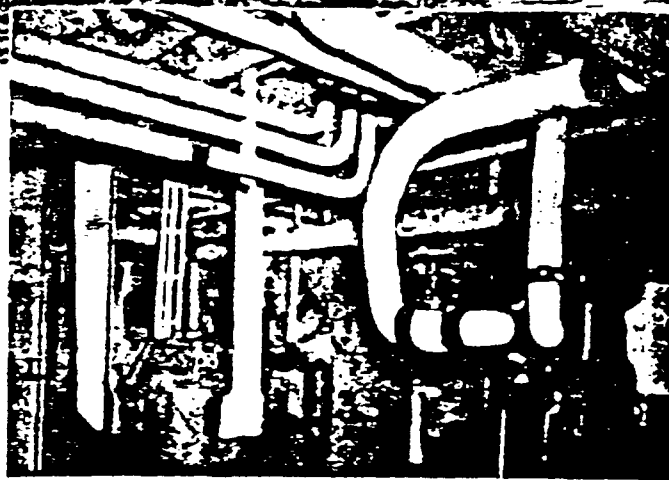
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Every intricate bend of the steam piping to pumps and apparatus in the engine room of this cargo vessel is tailored uniformly with K&M "Featherweight" 85% Magnesia. This widely used pipe covering combines the high insulating properties of basic Carbonate of Magnesia with strong Asbestos Fibres, and is designed for pipes carrying temperatures up to 600° F. It is extremely light in weight and it delivers maximum efficiency.

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K&M "Featherweight" 85% Magnesia is giving this same kind of dependable service—these same heat and fuel savings—in power plants and industrial process plants all over the country. In fact, from the time 85% Magnesia Insulation was first developed by K&M more than sixty-five years ago, the name "Featherweight" has been a byword for quality with plant operating men.

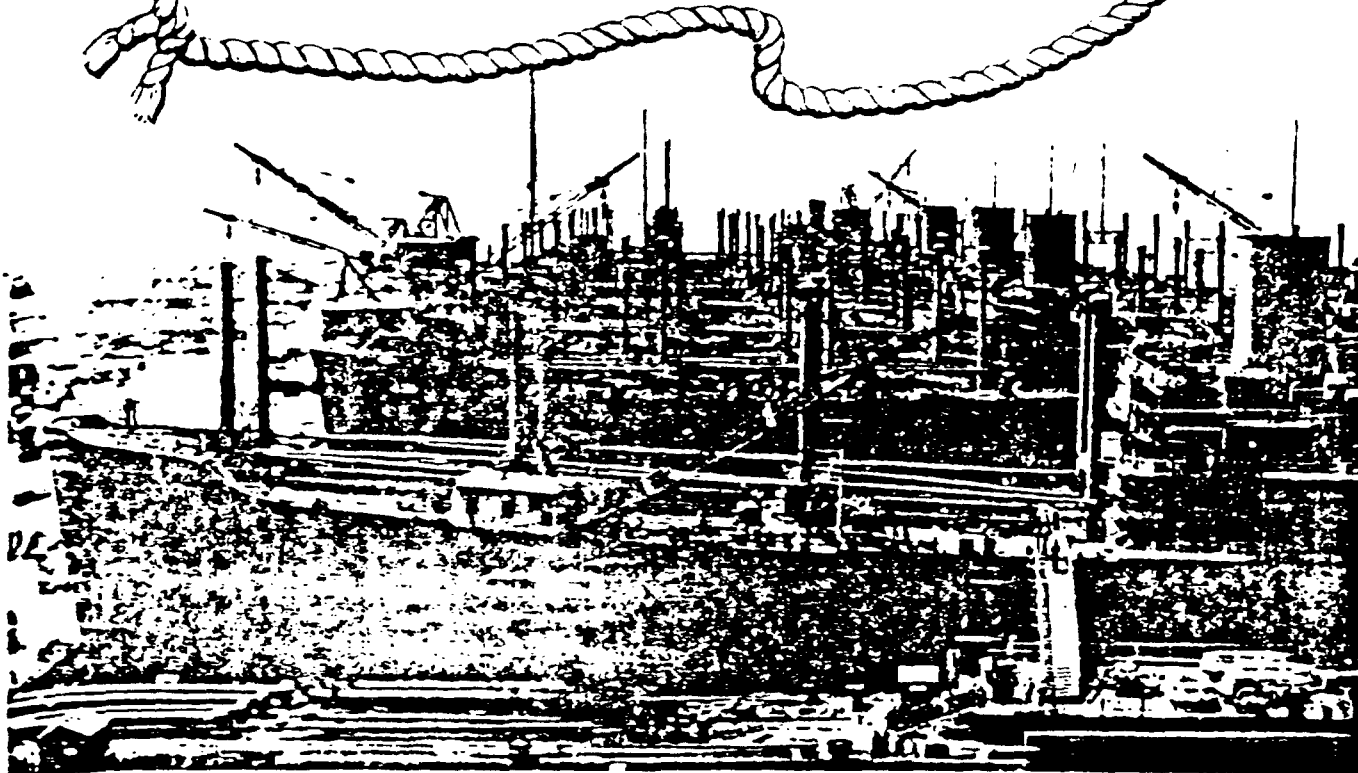


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Liberty Ship Program Completed

This is the eighth and concluding article of the series dealing with the production time of Liberty ships. Previous articles appeared in the following issues: October, 1942; June, 1943; April, May, June and September, 1944; and February, 1945.

The completion this month of the last of the various types of Liberty ships brings to a successful conclusion the world's greatest effort in the direction of mass production of duplicate seagoing vessels. This building program, sponsored by the Maritime Commission and beginning early in 1941 when the first keel was laid, produced 2710 ships of 19,467,441 gross tons and 28,764,361 deadweight tons, with triple-expansion reciprocating steam engine propelling machinery developing 6,775,000 indicated horsepower. This fleet of new ships is two and one-half times greater than the entire prewar merchant fleet under the United States flag which then totaled 11,617,200 deadweight tons; in fact, it is 25 percent larger than the prewar fleet of the British Empire which totaled 22,133,400 deadweight tons.

Of the total built, 2,224 were practically cargo ships and in their construction it is possible to make an excellent comparison of the production involved at each shipyard. This group of vessels was completed in an average of 61.9 days each, from laying to delivery. Liberty ships have been or converted to many special-purpose types, including colliers, boxed aircraft transports, oil tank carriers with specially reinforced decks, hospital ships, merchant seaman training schoolships, troop transports, and several types of special naval auxiliaries, such as radar repair and maintenance ships.

The construction cost of the 2710 vessels was \$5,400,000,000 and to this must be added the

TABLE 1.—NUMBER AND TONNAGE OF LIBERTY SHIPS CONSTRUCTED, BY TYPE

Type	No.	Gross tons	Dead weight tons
Cargo—EC2-S-C1	2580	18,544,475	27,417,600
Collier—EC2-S-AW1	24	159,432	2,400,000
Tank Carrier—ZEC2-S-C2	8	57,408	79,140
Aircraft Transport—ZEC2-S-C5	36	258,336	347,000
Tanker ZET1-S-C3	62	447,790	655,110
Totals	2710	19,467,441	28,764,361

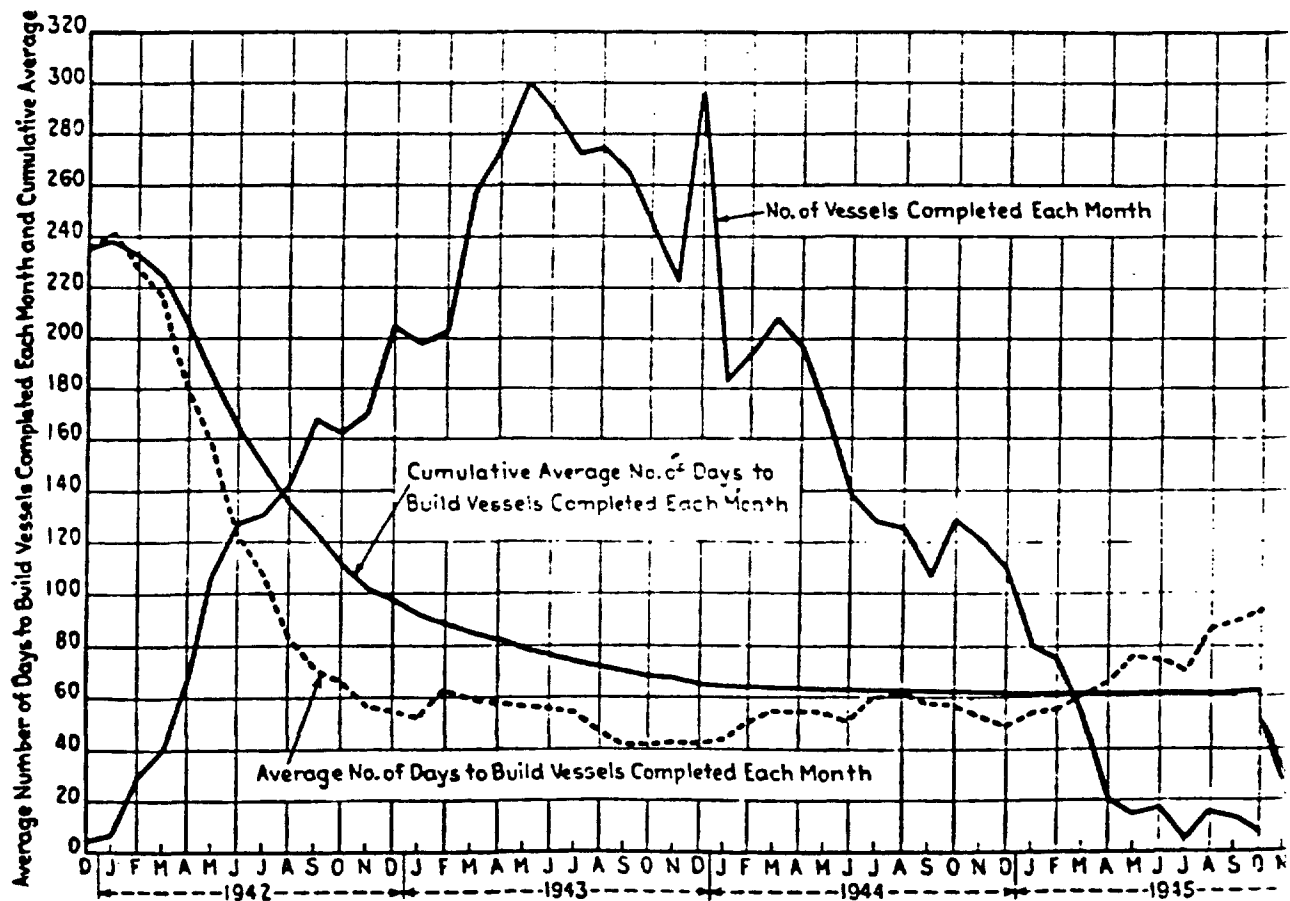


CHART SHOWING NUMBER OF LIBERTY CARGO SHIPS COMPLETED EACH MONTH, 1941-1945; AVERAGE NUMBER OF DAYS TO BUILD VESSELS COMPLETED EACH MONTH; CUMULATIVE AVERAGE NUMBER OF DAYS TO BUILD VESSELS COMPLETED

TABLE 2.—NUMBER AND AVERAGE TIME TO COMPLETE LIBERTY SHIPS CONSTRUCTED BY EACH SHIPYARD 1941-1945

Shipyard	No. of ways	Date first keel laid	Number completed					Total	Average No. of days per vessel to build
			1941	1942	1943	1944	1945		
			(a)	(c)	(c)	(c)	(c)		
Atlantic Coast									
Moham-Fairfield Shipyard, Baltimore, Md.	16	4-30-41	1	77	192	114	—	384	53.8
Jones Construction Co., Brunswick, Ga.	6	7-6-42	—	—	21	53	11	85	79.7
Everland Shipbuilding Corp., So. Portland, Me., West Yard	6	9-24-41	—	12	40	48	29	129	77.2
Everland S. B. Corporation, (S), So. Portland, Me., East Yard	7	9-8-42	—	—	51	52	19	124	68.1
Everland Shipbuilding Co., Wilmington, N. C.	9	5-22-41	—	51	75	—	—	126	64.8
James River Shipbuilding Co., Jacksonville, Fla.	6	8-15-42	—	—	25	51	6	82	77.6
Seacoast Shipbuilding Company, Savannah, Ga.	6	5-22-42	—	—	36	44	8	88	85.6
					(e)				
Ch. Kaiser Co., Providence, R. I.	6	6-27-42	—	—	6	5	—	11	208.7
Total	62		1	142	446	367	64	1020	68.1
Gulf Coast									
Sam D. D. & S. B. Co., Mobile, Ala.	12	7-28-41	—	(b) 18	2	—	—	20	137.5
				(b)				(h)	
Shipbuilding Company, New Orleans, La.	8	10-1-41	—	28	35	40	9	132	82.8
Jones Construction Co., Panama City, Fla.	6	7-9-42	—	—	21	53	28	102	83.6
Houston Shipbuilding Corp., Houston, Texas	9	7-18-41	—	32	74	83	19	208	68.4
Total	35		—	78	132	196	56	462	78.8
Pacific Coast									
Forma Shipbuilding Corp., Los Angeles, Cal.	14	5-24-41	—	(b) 109	166	31	—	306	60.7
				(e)					
Ship Company, Vancouver, Wash.	12	4-15-42	—	2	8	—	—	10	80.4
				(b)					
Ship Corporation, San Francisco, Cal.	6	6-27-42	—	5	10	—	—	15	112.2
Shipbuilding Corp., Portland, Ore.	11	5-19-41	1	113	197	11	—	322	44.9
Marante Metals Corp., Yard No. 1 (d)	7	5-12-42	—	30	92	16	—	138	48.3
Marante Metals Corp., Yard No. 2	12	9-17-41	—	63	187	101	—	351	41.1
Total	62		1	322	660	159	—	1142	49.6
Grand Total	159		2	542	1238	722	120	2624	61.9

(a) Time to construct includes the day of keel laying.

(b) Part of contract cancelled to permit tanker construction.

(c) Facilities employed part of year on special naval type ships.

(d) Yard previously built 30 similar ships for Great Britain.

(e) Part of contract suspended to permit construction of special Navy type vessels.

(f) Does not include 30 Liberty type tankers constructed.

(g) Does not include 32 Liberty type tankers constructed, and 24 Liberty colliers.

TABLE 3.—LIBERTY EC-2 CARGO SHIPS COMPLETED EACH MONTH AND AVERAGE NUMBER OF DAYS TO BUILD

Month	Number of yards producing	Number built each month	Monthly average time to complete	Cumulative number of ships constructed	Cumulative average time to complete	Month	Number of yards producing	Number built each month	Monthly average time to complete	Cumulative number of ships constructed	Cumulative average time to complete
January, 1941	2	2	236.0	2	236.0	January, 1944	12	73	44.0	1855	64.5
February, 1941	2	3	241.3	5	239.8	February	13	78	50.7	1933	63.9
March	5	12	227.8	17	232.1	March	13	83	55.2	2016	63.5
April	5	16	217.7	33	225.6	April	13	79	55.1	2095	63.2
May	5	26	179.2	59	205.6	May	12	67	54.5	2162	63.0
June	8	43	155.4	102	184.7	June	10	55	51.4	2217	62.7
July	9	51	122.4	153	164.3	July	10	51	59.5	2268	62.6
August	10	52	108.4	205	150.4	August	9	50	61.6	2318	62.6
September	11	57	82.9	262	136.0	September	9	43	58.1	2361	62.5
October	10	67	70.1	329	122.8	October	9	51	56.9	2412	62.4
November	11	65	66.0	394	113.6	November	8	48	53.1	2460	62.2
December	11	68	56.0	462	102.0	December	8	44	48.8	2504	62.0
January, 1943	12	82	55.0	544	97.9	January, 1945	8	32	54.0	2536	61.9
February	13	79	52.6	623	92.3	February	8	30	55.4	2566	61.8
March	14	81	62.1	704	88.9	March	6	21	60.2	2587	61.8
April	14	103	59.5	807	85.2	April	3	8	66.2	2595	61.8
May	15	110	58.1	917	81.9	May	4	6	76.1	2601	61.8
June	15	120	57.6	1037	79.1	June	2	7	73.8	2608	61.8
July	15	115	56.1	1152	76.8	July	1	2	70.0	2610	61.9
August	15	109	53.8	1261	74.4	August	2	6	80.0	2616	61.9
September	14	110	46.8	1371	72.1	September	2	5	89.0	2621	61.9
October	12	106	42.2	1477	70.0	October	2	3	91.0	2624	61.9
November	12	98	42.6	1575	68.3						
December	11	89	43.2	1664	66.9						
Total	12	118	42.0	1782	65.3						

Note: These figures do not include 62 Liberty ship tankers and 24 Liberty ship colliers.

Using the shipyards in which the ships were constructed, which was more than \$300,000,000. Over 10,000 tons of steel were used in their construction. All of the Liberty ships have been constructed at new emergency-built shipyards, a total of eighteen shipyards participating in the program, with 150 ways, although all of these ways were not

utilized continuously for the building of Liberty ships, some being devoted to the construction of other types of vessels at various times. All of these emergency-created shipyards are owned by the Government and are now scheduled to be sold, dismantled or otherwise disposed of in the near future. Stretching along the Atlantic coast from Maine to Florida are eight of these yards with 62

TABLE 4.—COMPARATIVE TIMES FOR COMPLETING CERTAIN LIBERTY CARGO SHIPS AT EACH OF THE EMERGENCY BUILDING YARDS, AND OTHER DATA

[illegible]

* Does not include 30 Liberty tankers built at California Ship; 32 Liberty tankers and 24 colliers built at Delta Ship. Yards had previous experience in building 30 vessels of similar type for British Government.

TABLE 5.—GROUPING OF LIBERTY SHIPS COMPLETED BY NUMBER OF DAYS AT EACH OF THE EMERGENCY BUILDING YARDS AND (OTHER DATA

[illegible]

building ways, including the largest of the Liberty ship building yards, the Bethlehem-Fairfield Shipyard with 62 ways. On the Pacific coast, located in California, Washington and Oregon, are six Liberty building yards with 62 ways. Along the Gulf coast, in Alabama, Florida, Texas and Louisiana, are four more of these yards with building berths. Many of these yards have constructed other types of vessels since completing their contracts for Liberty ships.

The first of the Liberty ships were finished late in September 1941, shortly after the attack upon Pearl Harbor by the Japanese, when the Bethlehem-Fairfield Shipyard and the Oregon Shipbuilding Corporation each completed one vessel. In the following year the tempo increased rapidly and 542 were finished. The peak

for the production of Liberty cargo ships, as will be noted from Table 2, was in 1943 when the entire eight Liberty building yards were producing this type vessel and 1238 ships were completed, or almost four every day. In 1944, production of Liberty ships began to taper off, due to the diversion of some of the yards to the building of Victory ships, but 722 Liberties were completed, or two every day. In 1945, to the end of his building program, 120 Liberty ships were finished the eight yards still producing this type of vessel.

Pacific coast shipyards built 1142 Liberty cargo ships, 30 Liberty tankers, while Atlantic coast yards completed 1020, and the Gulf yards 462 Liberty cargo ships, Liberty tankers, and 24 Liberty colliers. Not only were more Liberty ships constructed by Pacific coast yards than in the other regional districts, but the Pacific coast yards completed their part of the program first, in 1944, while the other two districts were still working up to the end of the schedule in 1945. Pacific coast Liberty shipbuilders as a group achieved the best average production time per vessel, turning out their quota of the cargo ship type in the remarkably low average time of 49.6 days each. Atlantic coast yards had next best average production time of 68.1 days per vessel, while 78.8 days per ship was the average time consumed by the Gulf plants.

To the J. A. Jones Construction Company shipyard Brunswick, Ga., and the Todd-Houston Shipbuilding Corporation at Galveston goes the rather dubious honor of producing the two ships consuming the greatest construction time, requiring 332 and 333 days, respectively. However, there were some extenuating circumstances. The Permanente Metals Corporation No. 2 yard at Diamond, Cal., built a Liberty ship in eight days, the shortest time of any, closely followed by the Oregon Shipbuilding Corporation, which produced a vessel in thirteen days. The greatest number of Liberty ships was built by the Bethlehem-Fairfield Shipyard, which turned out 384 in an average of 53.8 days each before being diverted to the construction of Victory ships. The first ships constructed at each of the eighteen yards averaged more than 1,000,000 man-hours time but in some cases this was later cut to as low as 300,000 man-hours for succeeding ships.

Probably the most revealing of the tables is Table 5, in which will be noted the remarkable production rate achieved by the Oregon Shipbuilding Corporation. A total of 150 ships were built at the Portland yard in thirty days or less and of these 23 were constructed in fifteen days or less. The No. 2 yard of the Permanente Metals Corporation built 157 ships in thirty days or less. Only three other yards were able to build vessels in thirty days or less and they finished eight vessels in this time, this including two at the No. 1 yard of the Permanente Metals Corporation, one by the North

Carolina Shipbuilding Company, and five by Bethlehem-Fairfield Shipyard.

During the war about 150 Liberty ships were sunk as a result of enemy action while others have been ordinary marine casualties. Several hundred of the vessels have been registered under the flags of a number of foreign nations under Lend-Lease terms with ownership remaining vested in the United States Government.

Coast Guard Authority to Waive Compliance with Vessel Inspection Laws

The authority of the Coast Guard to waive compliance with the navigation and vessel inspection laws and regulations of the United States will expire December 31, 1945, unless the Second War Powers Act is extended by authority of Congress.

Waivers were issued during the war for a dual purpose: first, to insure that full utilization of vessels engaged in the war effort would not be impeded by the requirements of laws which were designed to regulate the peacetime operations of the merchant marine, and, second, to bring this about without the outright repeal of peacetime requirements so that they could still be made applicable in situations in which they did not operate to the detriment of the war effort.

The Secretary of the Navy granted a general waiver of all the navigation and vessel inspection laws administered by the Coast Guard conditioned upon findings by the Commandant of the Coast Guard that an application of the waiver would be necessary in the conduct of the war or attributable to conditions created by the war.

The extent to which waivers assisted in expediting the movements of vessels during the war can be appreciated when it is realized that the only vessels that are exempt from inspection are those ships owned outright by the United States and used for public purpose, except those owned or operated by the Maritime Commission.

Among the more important general waivers were those issued on the following: annual inspections; construction, conversion and equipment, including waivers on auxiliary boilers, cast iron valves, control valve for smothering systems, electric cable for telephone, escape hatches and crash panels, flanges, lighting distribution panels, hours of work on tugs and WSA vessels; lifeboats, life floats, life preservers, and life rafts; lights and signals on vessels; load lines; employment of aliens; and various other matters involving merchant vessel operation.

In addition to these general waivers made by the Commandant, specific waivers were made by District Coast Guard Officers and Coast Guard merchant marine details overseas covering individual cases where the delay in sailing of a vessel was regarded as a hindrance to the war effort.

The Coast Guard, while advocating a return to prewar requirements at the earliest opportunity, is well aware of the situation that can develop if the authority to grant waivers is not renewed. The Service, therefore, favors the issuance of waivers in cases of necessity to keep the maximum number of vessels running with the minimum amount of inconvenience to the operators.

It is believed the industry is cognizant of the advantages derived from the issuance of the waivers during the war. It is for the general interest of the ship operators, therefore, that information concerning the possible expiration of waivers on December 31, 1945, is made known.

boken, N. J., which is injected into the combustion chambers of the boilers where it is vaporized to a gas which chemically attacks the deposits on the fire sides of the boiler tubes. By chemically removing such deposits and keeping the tubes clean and bright, the decks are kept free from soot. The thermal efficiency of the boiler is also improved, reducing fuel costs, and stack fires are eliminated.

Insulation Saves Fuel

The importance of insulating all steam and refrigeration lines aboard ship for greater economy of operation has long been recognized. But now the fuel shortage re-



emphasizes the conservation of fuel supplies.

Carey 85 percent magnesia and Carey asbestos cement supplied by The Philip Carey Manufacturing Company, Lockland, Cincinnati, O., have long been standard materials for insulating these lines on ships. In fact, Carey insulations such as Carey Hi-temp No. 19 and 85 percent magnesia, in combination, can be used for equipment and lines where temperatures range as high as 1900 degrees F and are delivering excellent service on vessels all over the world.

Adding the Third Dimension to Air Conditioning

As soon as the shipping situation eases and vessels under the American flag begin to carry passengers as in the good old days, the passengers will travel in much greater comfort. One of the prime reasons for this comfort will be improvements and developments since the war in the theory and practice of air conditioning for ships. One of the basic functions of air conditioning systems, whether on land or sea, has been that the systems were designed for the circulation of air and either the cooling or heating of outside air taken into closed spaces. Air conditioning systems, however, did not provide for a most essential function—that of odor control. No matter how fast you circulate the air, the system recirculates all the odors of the space it services plus the odors of the mechanism.

On ship board the galley odors, bilge water odors and odors from the machinery and cargo penetrate to the passengers' cabins. To overcome this a new product which has proven highly successful in the

industrial field during the war is now being adapted to ships at sea. This is called Marine Airkem Chlorophyll Air Freshener and is composed of a complex group of substances from plants and activated chlorophyll. These aromatic substances of Marine Airkem when volatilized in-cubators bring objectionable odors under control. The activated chlorophyll restores to the air its freshness and gives it that pleasurable outdoors effect.

Marine Airkem was developed in the laboratory and perfected over many years of research. After extensive tests by the Research Department of Northwest University and D. W. D. Turner, Professor of Chemical Engineering at Columbia University, Airkem was put on the market. It has been used successfully on board naval hospital ships, submarines and Coast Guard vessels.

The units which evaporate Airkem into the air stream are easily engineered into existing air conditioning units whether large overall systems or small self-contained units are used. Another application is through evaporation from a 15½-ounce bottle supplied with a special wick. These bottles will take care of small spaces such as cabins on ships. A few minutes after a bottle has been opened all odors are controlled and the Marine Airkem gives a fresh air effect to the space.

All inquiries concerning this product should be addressed to the William W. Short Company, 274 Madison Avenue, New York 16, N. Y., which is national distributor of Marine Airkem.

Inclined-Port Rotating Pump Valve

The Sims valve, manufactured by the Sims Pump Valve Company, Inc., New York, is a practical, scientifically designed valve, adaptable to reciprocating pumps in all kinds and conditions of service. The Sims valves are guaranteed to overcome such troubles as valve slam or knock, seat-imprinting of disks, slip, valve stem and



spring breakage, and the steam waste they cause. They greatly reduce and usually entirely eliminate check valve slam and fluctuation in pressure so important in oil service pumps.

The complete Sims valve consists of five parts—the seat, disk, rotator, spring and stem. Instead of the usual straight ports the Sims valve seat has inclined ports, formed by ribs with rectilinear warped surfaces.

These are made in any size, pressed fit, or threaded flange flanges upon which they may be mounted on the pump landings. The valve must conform to whatever standard is found in reciprocating pumps.

Triple-Action Water Nozzles

New triple-action 86, 40, 100, 150 G. nozzles, manufactured by Rockwood Sprinkler Company, Mass., are available for service on 2½-inch fire hose lines. They are originally designed by Rockwood for the Damage and Fire Control of the Bureau of Ships and it is as standard for use on most naval vessels. Thousands of the nozzles are now on vessels of the Navy, Coast Guard, Marine Commission and Army Transport Corps, as well as in industrial plants.

This nozzle provides excellent action on fires in ordinary materials and gases.

Automatic Recirculating

The Hammel-Dahl Company, R. I., has brought out an automatic recirculating valve designed to prevent damage to centrifugal boiler feed pumps caused by water flashing to steam when the boiler feedwater regulator is closed. This is accomplished automatically by-passing a minimum flow of water from the boiler to the D. C. heater through a recirculating line. The units maintain a definite minimum flow of water through the boiler feed pump for all operating conditions.

The valves are fabricated for use in the existing piping and located to the discharge connection of the boiler. Two types of valves have been developed, one having direct connection and the other having offset connections to permit installation where interferences are encountered.

A recirculating flow rate indicator assembly is mounted at a level where it may readily be observed by the crew. It provides an instantaneous reading of the flow rate per minute of the volume of water by-passed through the recirculating line to the D. C. heater.

Process to Preserve Idle Fighting Ships Initiated by Navy

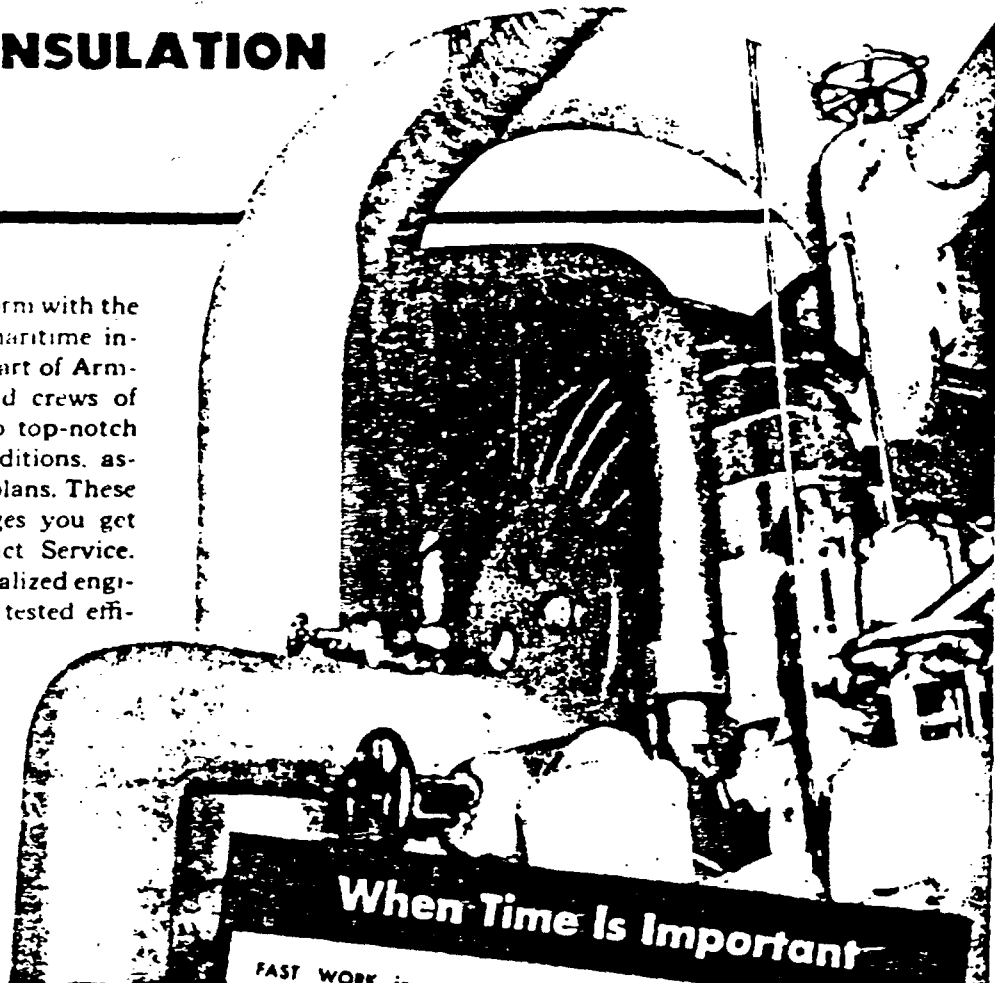
The 10,000-ton cruiser Brooklyn is being kept in temporary drydock at the Philadelphia Navy Yard on October 21, secured against deterioration by a dehumidification method.

Captain M. Gordon Donald, director of the Navy Bureau of Naval Facilities, said the newly-developed process would make it possible for the Navy to preserve hundreds of fighting ships for 20 years or longer.

The Brooklyn is serving as a model for the "dehumidification and preservation" program.

Your special requirements easily met by **ARMSTRONG'S CONTRACT SERVICE** **FOR HEAT INSULATION**

FLEXIBLE PLANNING, to conform with the practical necessities of each maritime insulation job, is an important part of Armstrong's Contract Service. And crews of experienced workmen, who do top-notch work even under difficult conditions, assure the success of Armstrong plans. These are only two of the advantages you get by using Armstrong's Contract Service. You also get Armstrong's specialized engineering skill and materials of tested efficiency. Furthermore, Armstrong takes full responsibility for every detail of the work. For complete details, write today to Armstrong Cork Company, Industrial Insulation Dept., 5201 Concord St., Lancaster, Penna. 



When Time Is Important

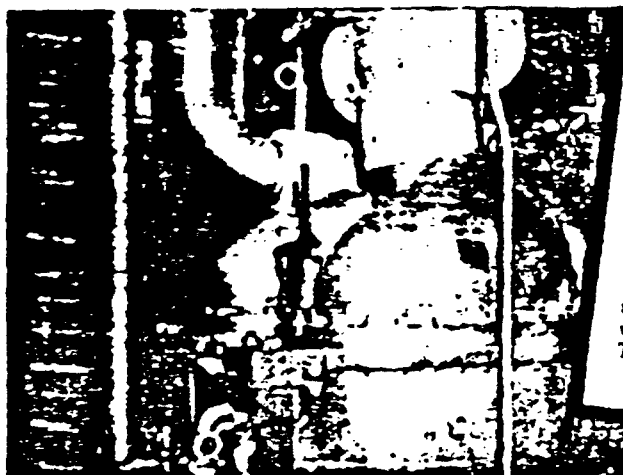
FAST WORK is necessary, in many cases, in insulating high-temperature equipment.

At the Navy's Precommissioning Center, Newport, R.I., virtually every type of equipment found on naval vessels was installed for instruction purposes. Speed was the order of the day, and Armstrong's Contract Service, working closely with the mechanical contractor, insulated the piping as soon as it was hung. As fast as lines were approved, insulation was installed on welds, unions, and flanges. The ability of Armstrong's

Contract Service to cooperate with other contractors was a big factor in getting the job done on time.

Above, main steam lines are shown covered with combination high-temperature and 85% Magnesia insulation, finished with asbestos cloth jacket sewed over asbestos paper.

At left is the 250 KW Turbo Generator, covered with 2" of plastic insulation and finished with hard surface asbestos. Also shown is the atmospheric relief valve, insulated with removable asbestos blankets and finished with asbestos cloth.



ARMSTRONG'S INDUSTRIAL INSULATION

**Complete Contract Service
For All Temperatures**

From 300°
Below Zero

To 2600°
Fahrenheit

Nature made Asbestos HERE IS HOW
KEASBEY & MATTISON IS MAKING IT
SERVE IN THE MARINE FIELD.

USS "Bunch" a Destroyer-Escort Vessel, built by the famous "DeLoe Hull-over-Propeller" by the DeLoe Shipbuilding Company, Bay City, Michigan. Keasbey & Mattison heat insulations installed by the Armstrong Cork Company.



K&M High Temperature Insulations

Save Steam and Power!



Keasbey & Mattison Asbestos products have seen extensive service in the Marine Field during the war. The above example is typical. The intricate network of steam lines, which are an essential part of the DE'S power plant, are completely insulated with K&M "Featherweight" 85% Magnesia and K&M Hy-Temp Covering.

K&M "Featherweight" 85% Magnesia Insulation is designed for temperatures up to 600°F. — Hy-Temp for temperatures to 1900°F. The proven quality and dependability that these K&M Insulations have shown at sea has also been apparent in every industrial use to which they have been put. In hundreds of plants throughout the country, these insulations are daily saving tremendous quantities of heat, fuel and power.



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