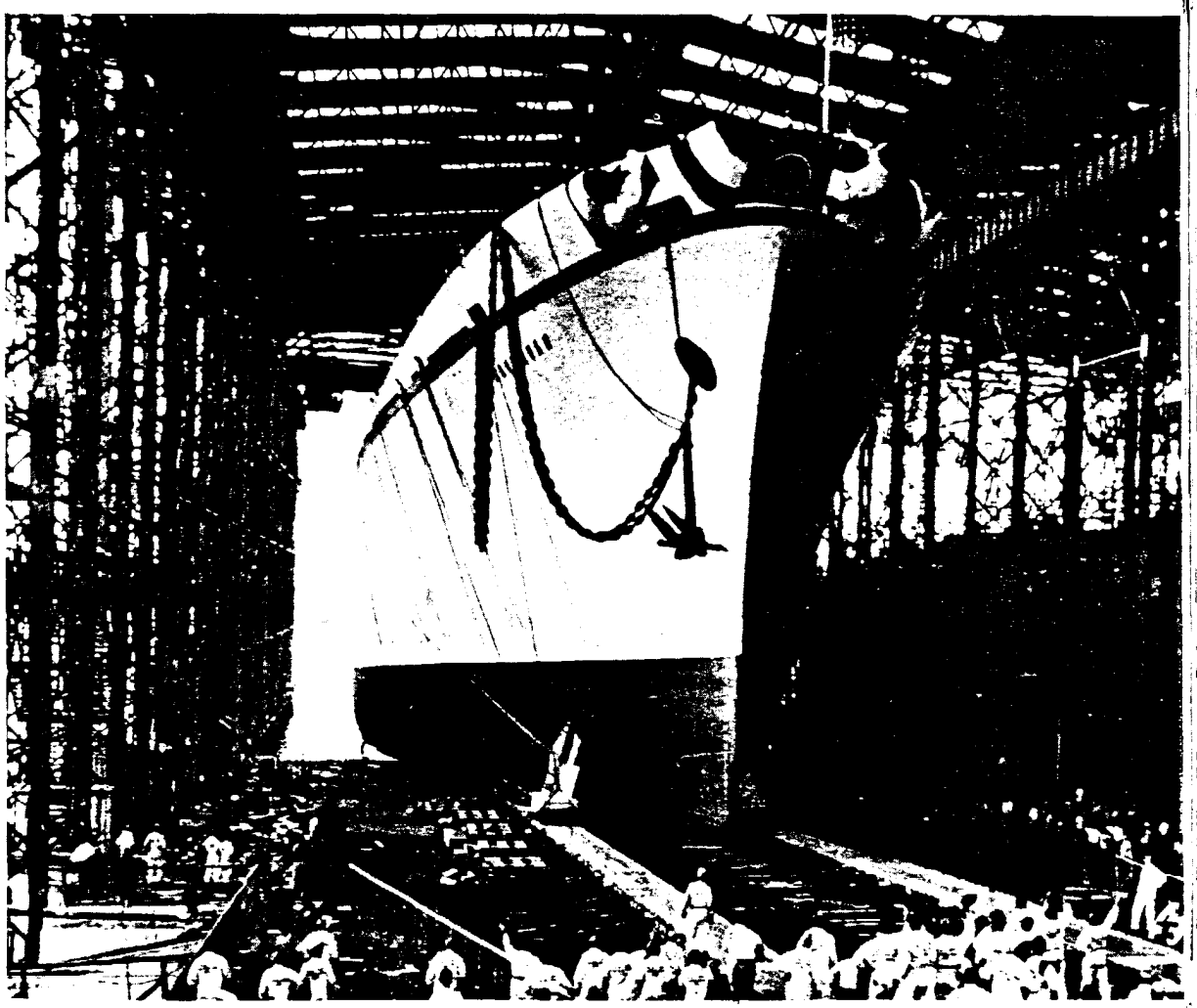
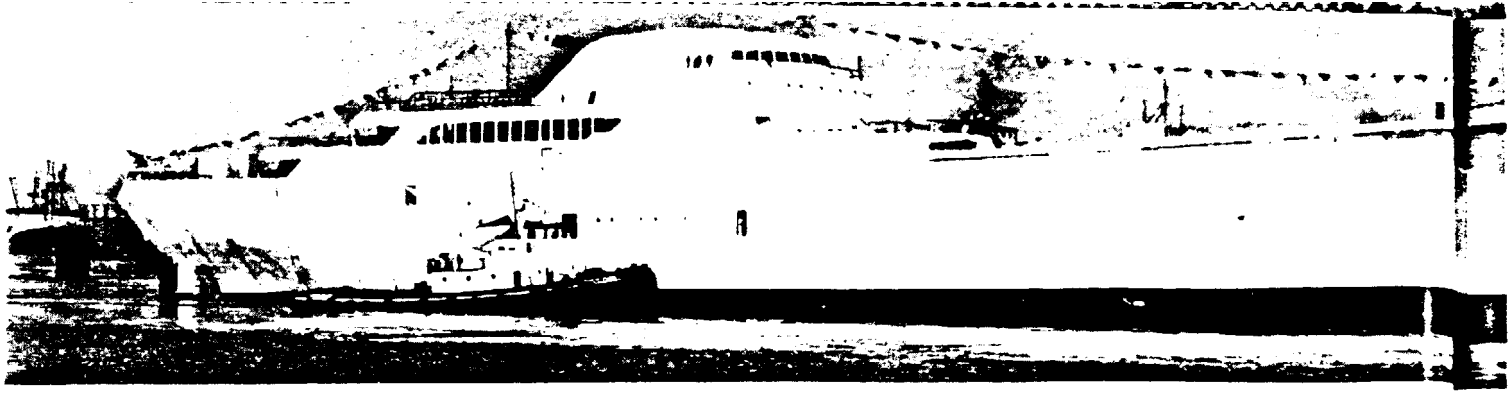
Lead

VOLUME TWENTY-THREE 1959 NUMBER THREE



The N.S. SAVANNAH, world's first nuclear-powered ship, slides down the way at New York Ship's Camden shipyard. Over 500 tons of lead are used in shielding the vessel's power source.



THE SAVANNAH, SHIELDIN

WHEN the N. S. SAVANNAH begins her sea trials next year, a sailor or passenger standing on the main deck will receive no more radiation from the pressurized water reactor beneath his feet than he does from the sky. This extremely low level of radiation was chosen deliberately as the design target for our first nuclear ship. To achieve this performance, the designers at New York Shipbuilding Corp. worked out a container and shielding system without the help of established codes, specifications, or even precedents. Their choice of shielding materials narrowed down to lead, concrete — both ordinary and dense types — water, and polyethylene.

The containment vessel for the reactor steam plant is a steel pressure vessel averaging two inches thick, and has a stubby capsule shape like a druggist's gelatin capsule that has been shortened. Its 35 foot diameter almost equals the height of a three-story house. It is 51 feet long.

The radiation shield is divided into two parts. The first, which surrounds the nuclear reactor and is designed primarily to slow down and stop neutrons, is composed of a shell of water thirty-three inches thick and approximately three inches of lead. The second, which surrounds the entire containment vessel, is composed of a concrete wall extending to the mid plane of the container, and a shell of lead four to eight inches thick and polyethylene, covering the upper half.

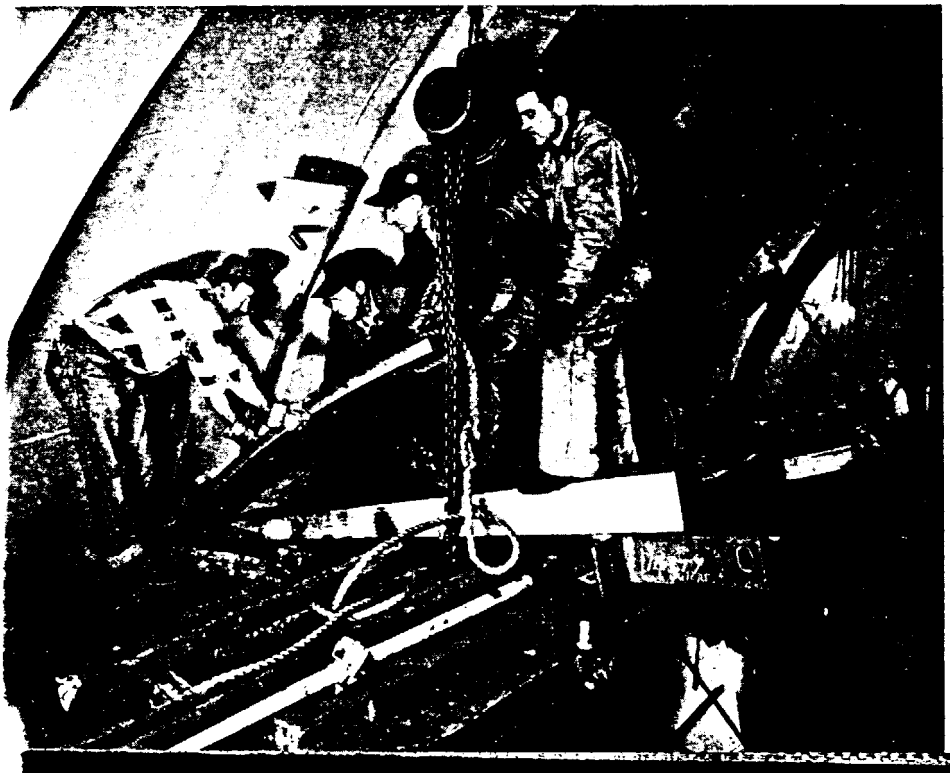
On one hand, designers were faced with their self-imposed conservative permissible radiation level; on the other, the need to be sparing in their addition of weight and bulk to the vessel. And, in addition, they worked with an awkward configuration from a radiation and mechanical viewpoint.

More than 500 tons of lead were used in the shield. This was supplied in the form of sheets 6 x 3 feet and one or two inches thick. These were laminated around the steel container to build up the required thickness at each point. The cylindrical walls were preformed with a rolling jig, while those for the spherical ends were die formed. The significant advantages of this method over assembling the shield from poured slabs included savings in transportation, handling, and shaping.

After these plates were fastened to the steel studs, the joints were caulked with lead wool. The final step was horizontal welding to the steel structure.

Lead is the preferred material for radiation shielding because of its density. Shielding effect against the deadly gamma radiation is directly proportional to the density of the shielding material, and lead is the densest of all the commonly available materials. It therefore, provides the best protection per unit of shield thickness at moderate cost.

Subjected to both gamma radiation and neutron bombardment, lead, unlike water and many other substances will not itself become radioactive. Further, because of its smooth surface, it does not tend to gather dust and dirt particles of foreign matter that may become radioactive themselves. Finally, unlike aggregates such as con-



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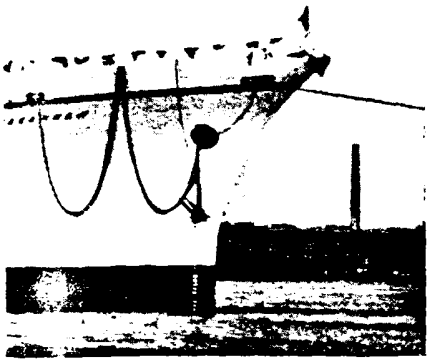
Lead sheets 6 x 3 feet and 1 or 2 inches thick were preformed to the cylindrical shape with a rolling jig. Spherical end sections were die formed. Significant savings over poured slab construction were attained.

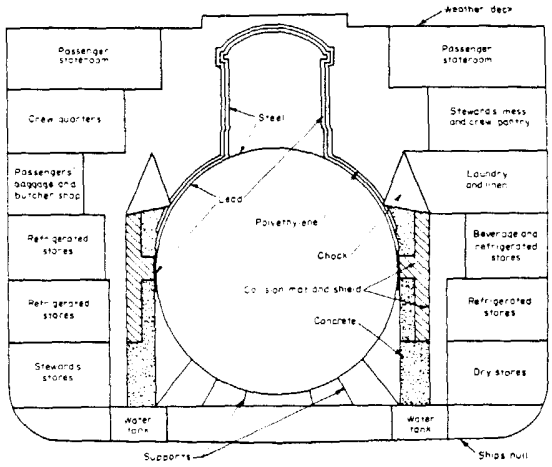


TWO TRAILBLAZING SAVANNAHS COMPARED

In 1819 the U.S.S. SAVANNAH was the first ship to use steam power on an Atlantic crossing. She made Liverpool from Savannah in 29½ days. Having refueled in Ireland (the Savannah carried only enough fuel for 89 hours of steaming) she approached the English coast without sails and belching smoke. Thinking her afire, the British revenue cutter KITE came to her assistance but could not catch her in the light wind. The Kite had to put a shot across her bow to stop our first ocean-going steamship.

USS SAVANNAH (1819)	NS SAVANNAH (1960)
320 tons (wood)	20,000 tons
steam & sail power	nuclear
5-6 knots	21 knots
250 mile cruising radius	350,000 miles

SAFETY



Diagramatic section of the Savannah amidships.

pure lead is dependably uniform ensity throughout.

owever, where shielding requirets are especially severe, it is usupreferred to combine lead and less dense shielding material. uently concrete, in a sandwich arement. This arrangement disthe stress over a larger surface. ding the concentration of excesweight on a small area.

ace and weight requirements of the nuclear power plant, propulsion system and related equipment just about balance those of a conventional power plant, propulsion system, fuel load and ballast. Of course, nuclear power offers the advantage of a far greater cruising radius. And while operation of the Savannah is not expected to be economically competitive with that of conventionally powered ships, it is expected to yield the information which will lead to nuclear fleets superior to today's ships in power, speed, and economy.

High Density, Lead Loaded, Vinyl Coated Fabrics CUT VIBRATION AND NOISE

A new lead-containing material is being used successfully in abating noise in conventional and jet air liners and helicopters. It is a lead powder impregnated vinyl coated cotton duck or woven glass fabric which combines the acoustical properties of lead, high decible (db) lowering per pound, with the strength-flexibility characteristics of vinyl, glass or cotton. Lead's utility hinges on its ability to absorb or damp sound waves of low frequency.

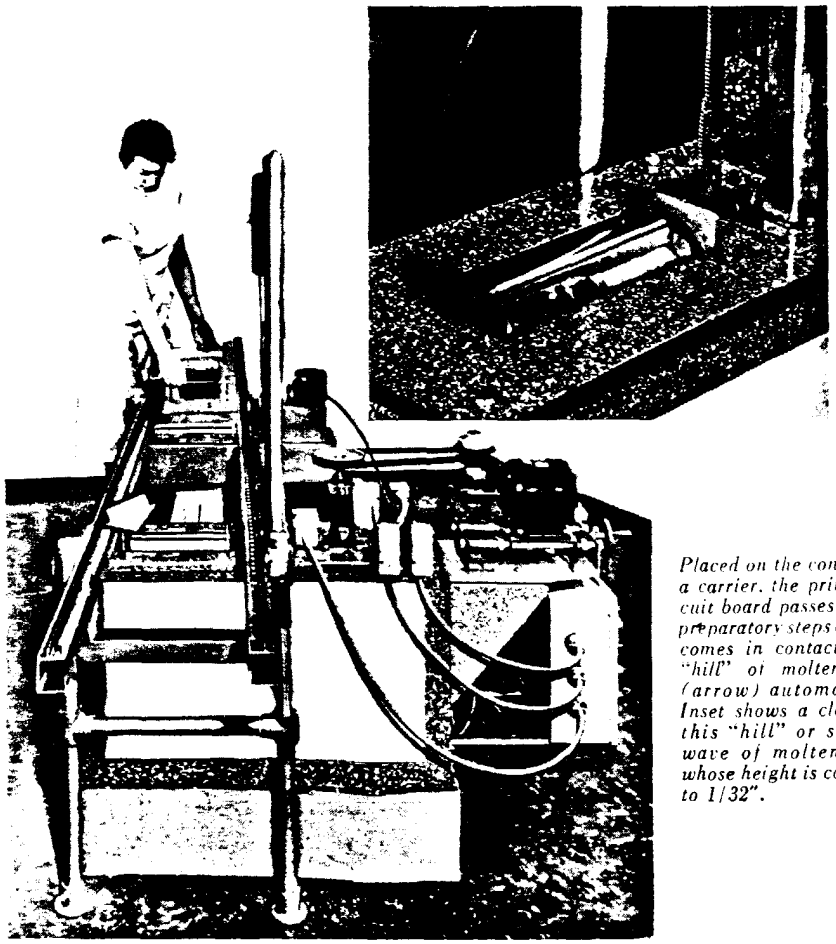
Coustifab, as it is known commercially, is highly successful in knocking the "edge" off sound or vibration energy. Located in ceilings and at the base of rear side panels of jetliners, for example, its high mass serves to dissipate vibrations that ordinary acoustical materials can't handle.

Its lead-dependent properties suggest other uses — in area isolation and source abatement. The latter is exemplified by its use to reduce the noise of the latest electric typewriters. For ease of application in such cases it is now available with a pressure-sensitive adhesive backing. Colored and textural finishes can also be obtained. In addition to its acoustical properties, Coustifab can be employed for aprons or wall covering in X-ray work. Coustifab laminated to foam or glass mat has a very high potential for noise elimination for accordion-type folding doors and the like.

Coustifab can be obtained in weights varying from 0.25 to as high as 1.75 pounds per sq ft, where a transmission loss from 5 db at 100 cycles to 60 db plus at 13,000 cycles or more can be realized. To provide both low and high frequency sound attenuation, corrugated, compressed glass mat, or urethane, polyether, or fire-resistant vinyl foams can be laminated with any style Coustifab.

Manufactured by Cordo Chemical Corp., Norwalk, Conn., Coustifab (patent pending) is a noteworthy lead product development offering much promise for building trades applications as well as for sound and vibration attenuation in industrial uses.

A "Hill" of Molten Solder Speeds Printed Circuit Work



Placed on the conveyor in a carrier, the printed circuit board passes through preparatory steps and then comes in contact with a "hill" of molten solder (arrow) automatically. Inset shows a closeup of this "hill" or standing wave of molten solder whose height is controlled to 1/32".

IT WOULD be hard to imagine conventional manual soldering as an easy or economical means of completing connections in printed electronic circuits. The radios, amplifiers, tuners, and other electronic units made by this method are so much smaller than their conventional counterparts that hand soldering would require the deftness and delicacy of watch repairing. Yet printed circuits do have to contain "unprintable" components like resistors, capacitors, and coils, and these must be soldered to the printed copper lines which make up the circuit.

Now there is a mechanical soldering device not only deft and delicate enough to complete the connections of a printed circuit, but also far faster than conventional methods. Designed for assembly line work, the automatic device can speed through up to 800 boards an hour and do a perfect job 999 times out of a thousand.

Here's how it works: Boards (up to 9½ in. wide, 24 in. long) with their mounted but unsoldered components are fed to one end of the unit. A conveyor running at ½ to 15 feet per minute carries the boards through a liquid flux applicator. Preheating and excess flux removal follow and the board arrives at the key operation point — the solder wave.

At the soldering station the circuit board goes "over the hill" — or more accurately, through the top of the hill — of molten solder continually pumped up through a submerged nozzle. The "hill" is thus a standing wave or hump of fresh, dross-free solder. The steady flow produces constant soldering temperature and the chord of contact of the circuit board and solder hill, together with the conveyor speed, accurately controls contact time. (Normally, a two-inch strip of the board is in contact with molten solder at this point.)

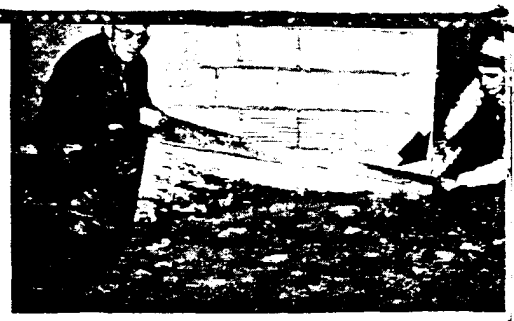
The combination of steady, controlled temperature, washing action, upward movement of solder, and contact angle result in thoroughly wetted, high fillet joints. They have a good appearance and high shear strengths.

While the current uses of this new equipment are largely electronic, it shows promise for many general soldering operations. It can use acid or non-acid flux. It has been operated with high melting solders to temperatures of 750°F. Applications other than circuit boards to date include tinning of switch and switchboard lugs, soldering electric motor windings to commutator bars, and others. The equipment, known as "Flowsolder" is a product of Electrovert, Inc., New York, N. Y.

AWS Soldering Manual Now Available

All aspects of soldering, both theoretical and practical, are discussed in the new 176-page soldering manual of the American Welding Society. Just off the press, this 21 chapter book contains 81 illustrations, 34 tables, and covers everything from basic principles through soldering of aluminum, stainless steels, magnesium alloys, and printed circuitry. Single copies are available at $5.00 from the American Welding Society, Dept. L, 33 W. 39th St., New York 18, N. Y.

Built to Last, Des Moines YMCA Uses Lead Pans, Pipe



A

INSTALLATION OF A SHOWER SAFE PAN begins with a coating of asphaltum over the concrete floor. Tarred building felt is placed over this and (A) 4 lb sheet lead is laid and cut to fit drains and walls. Note (arrow) fitting of corner and the forming of a 4" upstand so that the lead pan will rise 2" above the finished

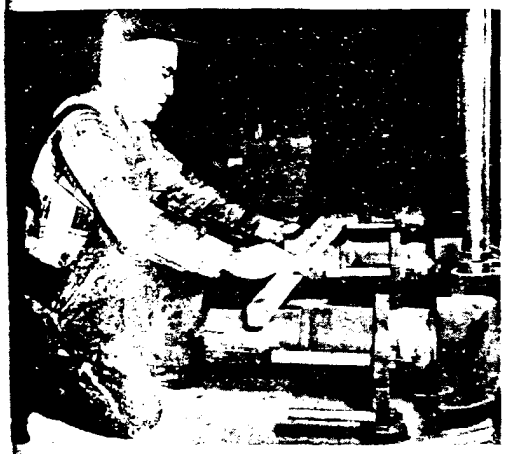
B

floor line. Subsequent sheets are lapped (B) over those already laid to form lap joints 1 to 1½" wide and dressed smooth. When the pan is complete (C), the lead sheet is soiled along the seams, the width of the joint marked and shaved, then rubbed with a plumber's candle to flux the solder. Seams in the shower pans for

C

the Des Moines YMCA were soldered (D) with wire solder and an iron. Note the drains (double drainage shower traps) in place with clamping rings set and tightened to the drain apron. This holds the lead pan tight to the drain. The weep holes in the drains are protected from stoppage with packing grommets.

D



Harry Westover, Journeyman plumber, levels three 4" lead stubs for water closet waste connections.

A spanking new YMCA is nearing completion in Des Moines, Iowa. When complete, the eight-story building will include 198 residential rooms, two gyms, four handball courts, two squash courts, a dozen shower rooms, a coffee shop, and three dining rooms.

Wetherell and Harrison, architects for the new Y, specified lead for the four-inch stubs connecting 64 water closets to the waste lines, and for shower pans, roof drains, and vent pipe flashings. The shower pans alone make use of 5,883 square feet of 4 lb sheet lead. Step-by-step photos show plumbers of the A. J. Allen Plumbing and Heating Co., plumbing contractor for the building, at work installing one of these safe pans.

The 64 water closets, all using 4 inch lead stubs, include 62 wall hung fixtures. Sixteen vent pipe flashings (2½ to 8 inch dia.) and 26 roof drain pans of 3 square feet of 4 lb lead were also used.

Intentional imperfections add beauty to these bricks.

THREE MILLION PIECES OF FINE POTTERY

The brilliantly colored durable lead glazed bricks that are adorning the new Washington Square Village apartment buildings in New York City are, in the words of builder Paul Tishman, ". . . three million pieces of fine pottery." These bricks, which were supplied by the Binghamton Brick Company of Binghamton, N. Y., are vivid yellow, red, and blue, of such brilliant hue that they can be achieved only in low-temperature lead based glazes. The brick maker produces "perfect" bricks with sharp clean edges and flat surfaces in large volume. But this type of brick didn't suit Mr. Tishman, who wanted "imperfect" bricks with ". . . ragged edges, spots under the glaze and chipped corners — just what we need to provide softness along with color to contrast with perfect off-white bricks."

Always happy to comply with a customer's wishes, Binghamton Brick shipped "imperfect" sand moulded brick packed like eggs, with six to a carton, to protect the fine glaze finish.

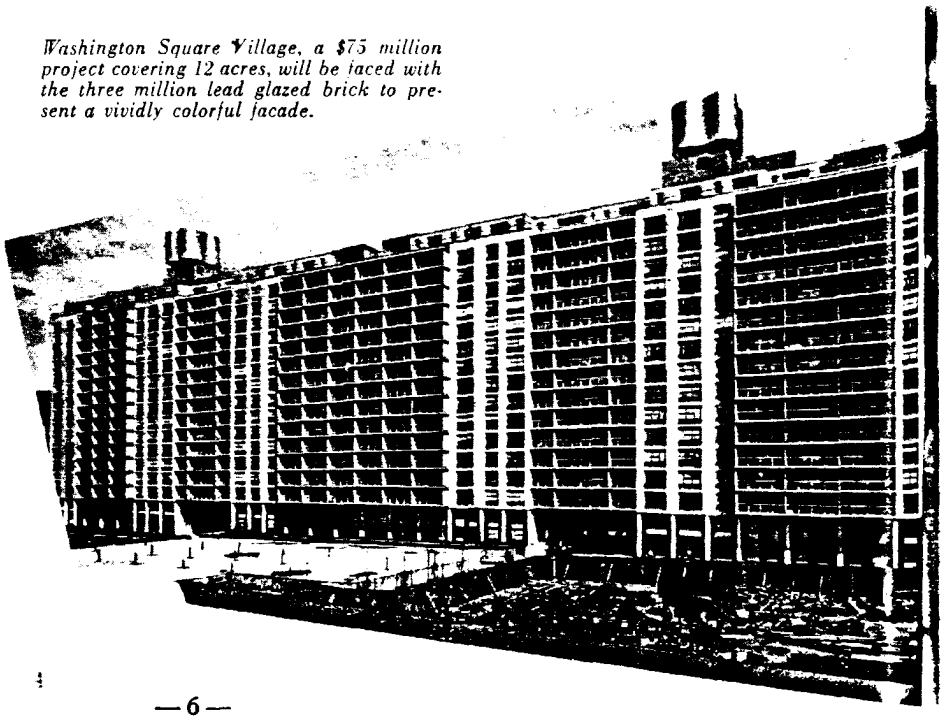
Washington Square Village, a $75,000,000 project, is called a slum-clearance middle-income project with apartments ranging from $133 to $398 a month. Spread over an area of twelve acres, it will have three main buildings with 2,004 apartment units with plenty of room remaining for large landscaped areas. This project is situated just south of Washington Square Park sharing this historic and lovely park with the New York University downtown colleges.

The term "imperfect" brick, of course, doesn't imply that rejects — or in the words of the brick maker, culls — were used. Rather, "imperfect" refers to a type of brick made purposely rough the old-fashioned way, by hand moulding. This brick is called a "sand moulded" or "soft mud" brick and the character and charm of a wall built with these bricks contrasts with the austere precision of the extruded "stiff mud" brick.

The glass can be fused to the brick, in certain cases, at the same time as the brick is fired. This is called single-fire glazed brick. On the other hand, "double-fire" brick requires a separate glazing operation. Both "single-fire" and "double-fire" glazed brick are produced by Binghamton Brick Co.

Binghamton shale matures at about 1950° F. (cone 06 in the jargon of the ceramist) and a wide range of colors is produced in single-fire brick. Substantial amounts of lead are used in many of these glazes depending upon the color, with those containing lead being generally of higher gloss. However, the really vivid colors such as the cadmium-selenium reds, oranges, and bright yellows and other special shades must be fired at lower temperatures. These double-fire bricks are glazed in the 1600° to 1700° F. range; all are high lead glazes and have substantially higher gloss than the single-fire glazes. The Washington Square Village bricks fall into this category.

Washington Square Village, a $75 million project covering 12 acres, will be faced with the three million lead glazed brick to present a vividly colorful facade.



The 180,000 gallon wrought iron tank is located on a hilltop just north of the Wrentham State School of Massachusetts.

ne Years Under Water, ed Lead Tank Coating in Excellent Shape

Nine years ago the 180,000 gallon standpipe of the Wrentham State School at Wrentham, Mass. was painted inside with type IV red lead (TT-P-86a-IV.) This June the tank was drained, inspected and repainted. The coating was found to be in excellent condition despite the fact that it had had no care or even inspection in the intervening years. Well over 95 per cent of the coating was still intact and where it had been penetrated, only small pits were evident under the rust tubercules which formed.

The tank itself is one of the two standpipes situated on the knob of a hill overlooking the dairy, farm, and buildings of the Massachusetts school. Built in 1909, the riveted, wrought iron tank is 22 feet in diameter and 65 feet high with a low conical roof. pH of the water has been in the range of 6.0 to 6.4.

The tank was sandblasted to white metal and given three coats of Type IV (phenol-formaldehyde) red lead in early July, 1950.

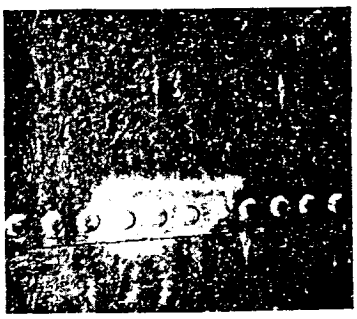
When it was opened for inspection, the coating was found to be hard, continuous, and tightly adherent to the metal surface. Where rust tubercules had formed — a typical large tubercule might measure ½" x 1½" — it was found that most of the paint film under the tubercule was still protecting the metal. No pits in the metal were found to exceed about ⅛" x ⅛" by a few thousandths deep.

Formulation of Type IV Red Lead Primer

(Fed. Spec. TT-P-86a, Type IV)

	Percent	Pounds	Gallons
PIGMENT:			
Red Lead (97% Grade)	85.0	950.0	12.85
Diatomaceous Silica	8.0	89.6	5.36
Magnesium Silicate	6.6	74.0	3.10
Aluminum Stearate	0.40	4.4	0.53
	100.00		
VEHICLE:			
Phenolic Varnish	74.0	432.0	57.70
Aromatic Petroleum Spirits	22.4	129.7	17.70
Dipentine	2.75	16.0	2.26
Antioxidants	0.5	2.2	0.27
Lead Naphthenate (24% Pb)	0.23	1.4	0.15
Cobalt Naphthenate (6% Co)	0.06	0.3	0.04
Manganese Naphthenate (6% Mn)	0.06	0.3	0.04
	100.00	1699.9	100.00

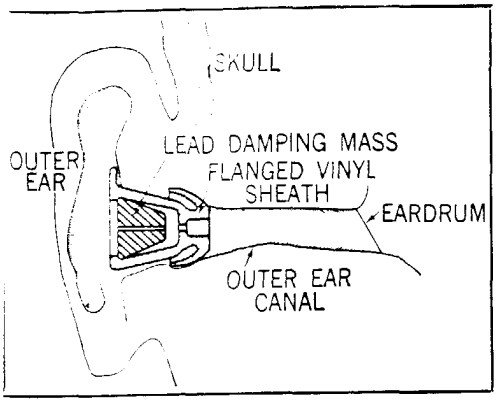
Pigment: 65.9%
Vehicle: 34.1%
Wt./Gal.: 17 lbs.
PV: 41%



A closeup of the tank interior. Spot sandblasting has removed the paint in the patch at center. Note the continuous paint film and absence of pitting or other corrosive attack. Scale of the picture can be judged by the 1¼-inch rivet heads.

Here's Lead in Your Ear . . .

Lead-and-Plastic Earplugs Prevent Deafness



BACK in 1943, ear specialist John S. Knight and inventor James Dunbar developed a better earplug for the Navy. Designed to prevent ear damage and concussion when big guns were fired, the plug was so successful that it is still being used by the Navy. Thousands of pairs have been purchased to tame the noisy environment of boiler shops, aircraft work, shipyards, etc.

The plug uses a shaped lead pellet (see cutaway drawing) weighing about $\frac{1}{8}$ ounce as a damping mass. Soft vinyl plastic in a flanged sheath permits the plug to be firmly seated in the ear without causing discomfort.

When a shock wave of sound hits the plug, its lead mass keeps it from moving. The restricted opening through the lead core allows pressure in the outer ear canal to slowly rise to balance outside pressure — though the rise is so slow that the shock wave passes before pressure inside the ear can become dangerous. The tiny perforation also permits the wearer to hear a normal speaking voice in a quiet environment.

These patented plugs are made by the Dunbar-Knight Company of 305 West 43rd St., Kansas City 11, Mo.

THE *Lead* LIBRARY
of Technical Information

The following articles and reprints contain information, drawings and specifications on the use of lead products helpful to architects, engineers and others interested. They are available free of charge except where otherwise indicated, upon request to the LEAD INDUSTRIES ASSOCIATION, 60 East 42nd STREET, NEW YORK 17, N. Y.

THE MATERIALS YOU BUY — LEAD
Descriptive information about lead from mine to finished products. Reprinted from "New York Purchasing Review," January, 1959.

MATERIALS of CONSTRUCTION REVIEWS
Lead and lead alloys in design and construction research, engineering and technological applications. With bibliography, 1958, 1957 and 1956 reviews (editions are not cumulative) are available. Reprinted from "Industrial and Engineering Chemistry," September, 1958, September, 1957 and September, 1956.

USE LEAD TO CONTROL CORROSION
Latest practices in lead construction for the petroleum refining industry are described. How to avoid the difficulties sometimes experienced with lead-lined equipment. Reprinted from "Petroleum Refiner," April, 1958.

INSPECTING LEAD LININGS
Latest methods of testing and inspecting sheet lead and bonded lead linings used in the chemical process industries are described. Reprinted from "Chemical Engineering," November, 1956.

BEST DESIGNS FOR LEAD INSTALLATIONS
A special report on the applications of lead and lead alloys in the chemical and metallurgical industries. Recommended practice for joining lead sheets, and the construction of wood stave tanks, launders, towers and flues where lead is involved are included. Reprinted from "Chemical Engineering," March, April and May, 1956.

RADIATION PROTECTION
The place of lead in shielding against radiation in X-ray and atomic energy applications. Principles of lead shielding construction. Reprinted from "Lead In Modern Industry."

LEAD WORK FOR MODERN PLUMBING
$1.50 Postpaid. $1.00 per copy in quantities of 10 or more
Profusely illustrated with over 140 photographs and drawings, the textbook presents clearly to the plumbing student the necessary tools, procedures and the methods required for lead work.

LEAD IN MODERN INDUSTRY
$1.00 Postpaid
A fully illustrated 230 page, cloth bound book describing all phases of the production and use of lead, lead alloys and lead compounds.

LEAD BUILDING CONSTRUCTION BULLETIN NO. 1
Specification for Lead Waste Connections for Plumbing Fixtures with Integral Traps (Water Closets — Pedestal Urinals — Service Sinks).

FEDERAL SPECIFICATION WW-P325
For Pipe, Bends and Traps: Lead
Dimensions and weights of lead products used in the plumbing and water works fields are given. Published by the Government Printing Office.

LEAD WELDING
An informative as well as practical guide to lead welding. Reprinted from the "Welding Handbook, Third Edition" published by the American Welding Society.

LEAD FOR MODERN PLUMBING
Preferred installation method for lead pipe and fittings in the plumbing systems of today's industrial and residential structures. Detailed drawings are included. Reprinted from "Sweet's Catalog," 1958.

RED LEAD TECHNICAL LETTERS
No. 12 Seven formulations and schedules for painting highway structural steel.
No. 13 L.I.A. Formula 9-2. A single Red Lead Primer for Rusted, Weathered or New Galvanized Steel.

FEDERAL SPECIFICATION FOR PAINT: RED-LEAD-BASE, READY-MIXED TT-P-86a
Covers four types of red-lead-base paints including two fast drying formulations. Many intended applications listed.

LEAD-ACID BRICK CONSTRUCTION
Reviews use of lead-acid brick for corrosive, abrasive, and hot chemicals. Installation techniques and case histories supplement cost and corrosion data. Reprinted from "Corrosion," Feb. 1959.

N. Y. TRANSIT AUTHORITY PAINTS
Evaluates experiences and best formulations found by the New York Transit Authority for maintaining subways, elevateds. Reprinted from "Mass Transportation," March 1959.

LEAD GUTTERS RUN WATER OFF DUKE'S BACK
A description of the installation of hard lead gutters on a new dormitory at Duke University. Reprinted from "American Artisan," October, 1958.

FLASHING WITH HARD LEAD
A complete "How-to-do-it" article on the use of hard lead in roofing and flashing. Reprinted from American Roofer & Siding Contractor," December, 1958.

NEW LITERATURE

RED LEAD TECHNICAL LETTER NO. 14
Describes the formulation of red lead-coumarone primer for seawater immersion — ship hulls, fixed marine installations.

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