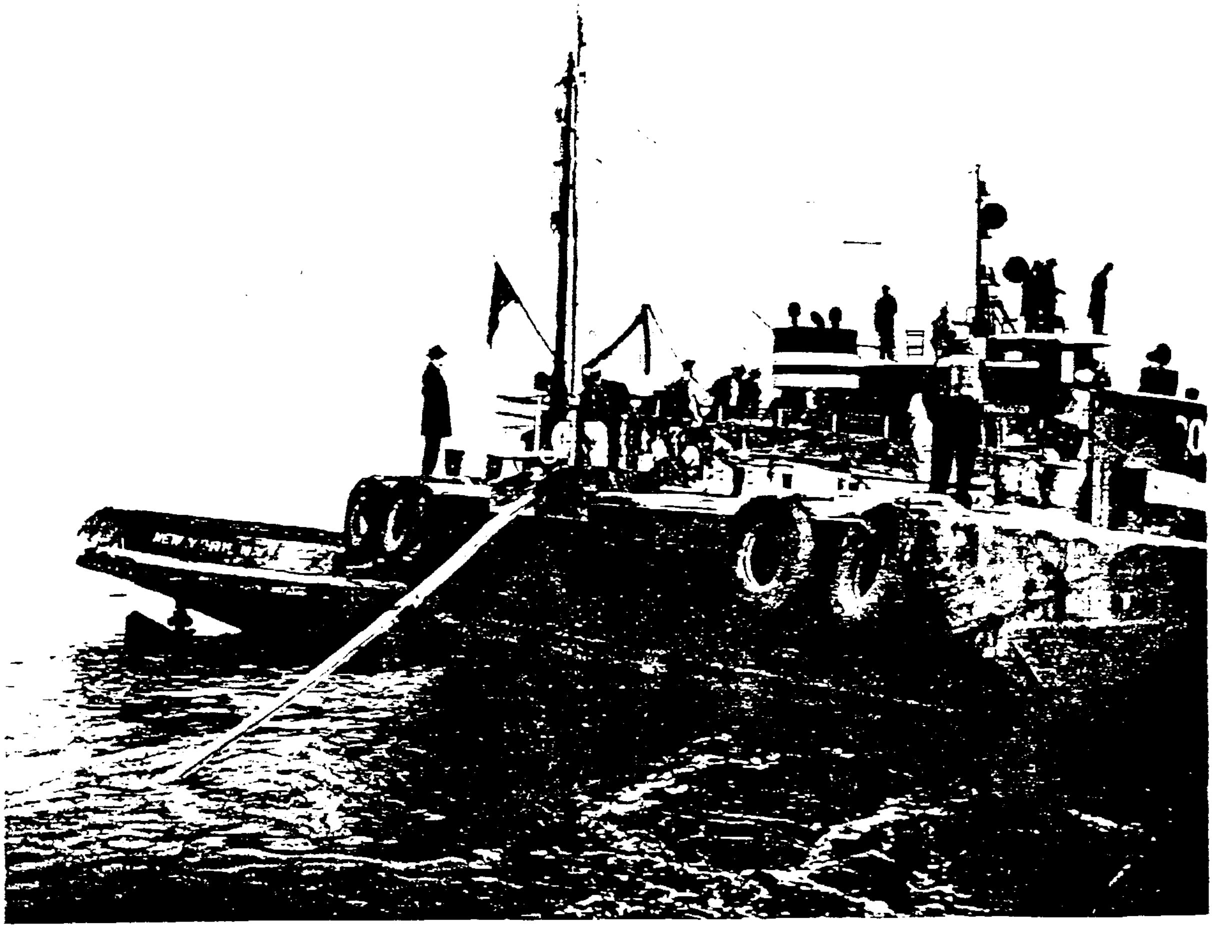
# Lead

VOLUME NINETEEN 1954 NUMBER SIX



*Sheathed in lead, a section of the world's largest submarine cable containing coaxial conductors is payed into the waters of the Hudson River. See story page 2.*

LEAD INDUSTRIES ASSOCIATION

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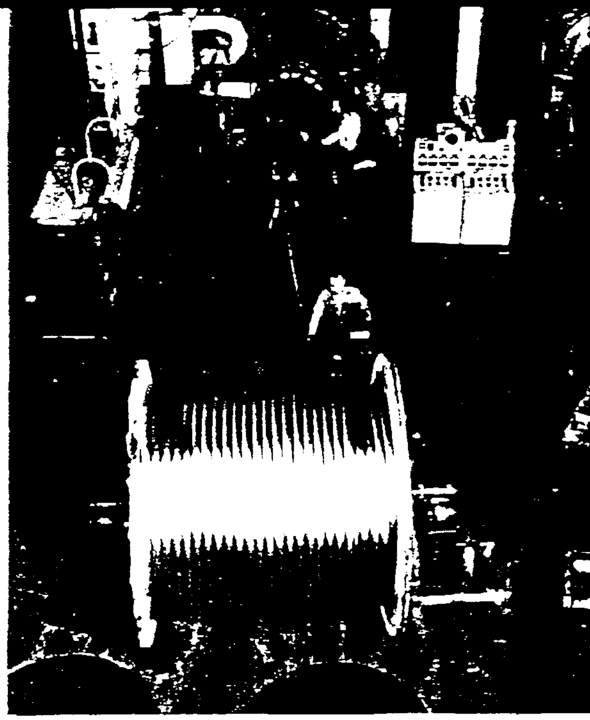


# Nine Miles Of Lead-Sheathed Submarine Cable

*Photos Courtesy Western Electric Co.*

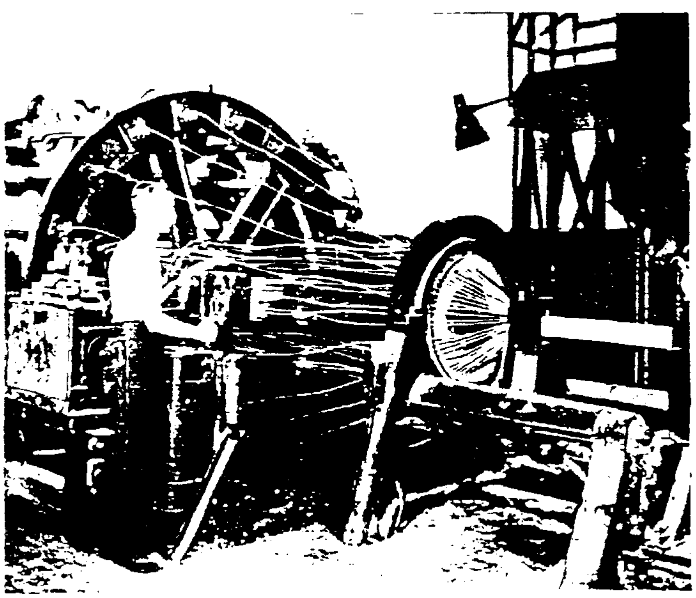
*To provide an impervious membrane for protection of the insulation, a lead sheath is extruded about the Nyack-Tarrytown cable. The cable itself acts as the core in the continuous extrusion by a screw type press.*

UNIQUE in inland submarine cable operations was the completion of a huge cable laying job for the Long Lines Department of the American Telephone & Telegraph Co. Crossing the Hudson River between Tarrytown and Nyack, N. Y., three cables, each of them 3 mi. long, were laid side by side to form a main artery for the telephone company's big new line switching center at White Plains, N. Y. The lead-sheathed cables are the longest and the largest containing coaxial conductors ever made for underwater use.

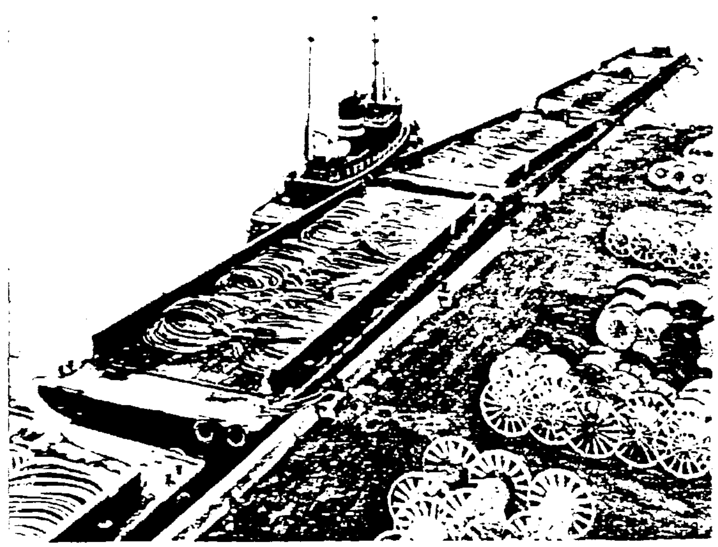
The king size of the cables presented some special problems for the manufacturer. Conventional submarine cable sections containing coaxial units are 1,700 to 1,800 ft. in length, but for the Hudson crossing the three lengths were made up in sections of which most were approximately 3,200 ft. long. Besides this, the coaxial conductors in the cables had to be spliced as they went through the stranding machine—an operation that had never been tried before—and the splice had to be skillfully made so that there would be no bulges in the cable which would interfere with subsequent sheathing and armoring processes.

It was after the stranding operation that lead sheathing came into the picture. The conductors in the cable are wrapped in paper insulation. To protect this insulation from moisture an impervious membrane

*Already sheathed with lead, the cable is shown here being wrapped with wire for armoring. Asphalt, jute and marble dust follow before the cable is ready for shipment.*



*Lead sheathing is flexible enough to permit the cable to be figure-eighted on barges, ready to be moved to the Nyack-Tarrytown crossing.*





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surrounding the cable is necessary. Lead is chosen because of its comparative chemical inertness which results in high resistance to corrosion and consequent long life. This is of particular importance in submarine cables where lifting a cable for repair can be a tremendous undertaking. In addition to performing its primary function of blocking moisture, lead also provides good protection from mechanical injury to the insulation. Finally, lead is flexible enough to facilitate reeling and paying out of the cable. The actual operation of sheathing a cable with lead is a unique process where the cable itself acts as the core around which lead or lead alloy, in the case of the Hudson cables a lead-silver alloy, is continuously extruded by a screw type press to form the sheath. Over 300,000 lb. of lead were used in manufacturing the three Hudson cables.

Following the lead sheathing the cable is armored with wire. Layers of asphalt and jute are also applied as bedding and outer covering and after a powdering of marble dust to prevent stickiness, the cable is ready for laying. Because of the size of the Nyack to Tarrytown cable—it is 4⅜ in. thick and weighs 26½ lb. per ft. —it was necessary to provide reels with head diameters 8 in. greater than the largest cable reels commonly used in the cable shop.

The monster manufacturing job done, the cable was figure eighted onto barges and floated to the Hudson River site. There the cables were payed from the barge sterns into a specially prepared trench at the bottom of the river to await connecting into service.

# World's Heaviest Window Is Heavily Leaded For Atomic Airplane Research

THE heaviest glass windows in the world, made that way with lead, the heaviest of common materials, recently were successfully cast and assembled at the Harrodsburg, Ky., plant of the Corning Glass Works. The windows, some of which have a rectangular dimension of 6x8 ft., are 6 ft. thick and weigh as much as 12 tons, will be used to protect from radiation employees working on experiments in the research and development program for an atomic powered airplane.

*The heaviest picture window of them all. Almost as dense as steel, this heavily leaded window will permit observation while providing radiation shielding at the A.E.C.'s engine test facility at Idaho Falls, Idaho.*

Corning Glass Works

High quality glass of three different densities is used in these atomic radiation shielding windows which are made by stacking a number of pieces of glass and assembling them in a steel frame. In order to construct these windows, Corning's research laboratory developed, at the suggestion of Argonne National Laboratory, a glass with a density of 3.3, which has very high light transmission properties, and, when exposed to gamma rays, is non-browning. Corning also developed a glass for the windows with a density of 6.2, one of the densest glasses ever melted. It is six times as heavy as a comparable volume of water, or almost as dense as steel. The shielding windows also contain glass with a density of 2.7.

To attain these densities large amounts of lead, in the form of litharge, are added to the glass batches. This use of lead, to increase the density of glass, has become more and more important in the atomic field where visual observation is desired while proper shielding is maintained. For many years high density leaded glass has been used similarly to observe and operate X-ray equipment from a shielded position. Long prior to these applications, of course, lead had been used, as it continues to be, to obtain resonance and brilliance in fine glassware.

Corning is manufacturing a number of these windows for the Atomic Energy Commission's engine test facility at the National Reactor Testing Station west of Idaho Falls, Idaho. The company is furnishing all parts for the windows under a contract which Utah Construction Co. of Salt Lake City has for the initial portion of the Aircraft Nuclear Propulsion facility.

After their initial demonstration at Harrodsburg the windows were taken apart and shipped to the National Reactor Testing Station. There they were reassembled and placed in the walls of two different rooms. The employees, by using manipulators, will thus be able to perform their experiments by looking through the huge windows without fear of radiation injury.



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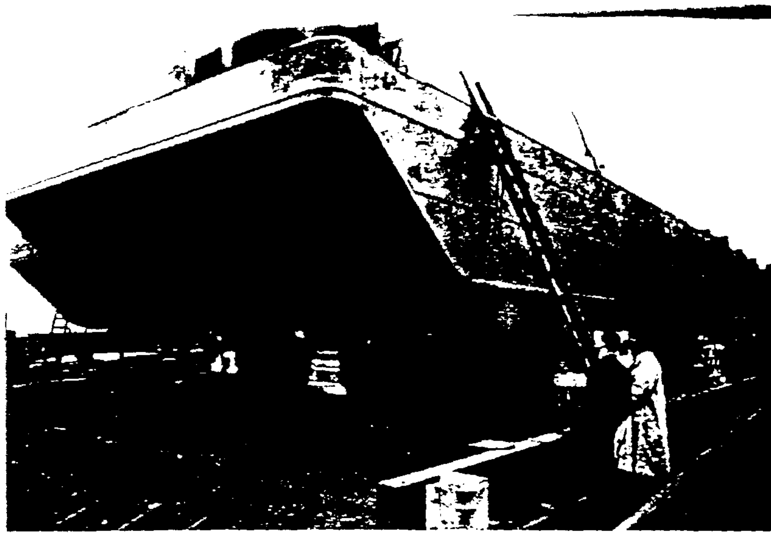


*Fully primed with a red lead paint, this New York Central freight barge is almost ready for launching.*

# Railroad Barges Primed With Red Lead

TWICE a week for the last two years the Bethlehem Steel Co. has been splashing an all welded barge or scow into the waters of its Staten Island shipyard. Built for various railroads and destined for freight carrying service, the vessels are, in absolute literalness, spilled off an assembly line. The barges shown on these pages were part of more than 100 built for the New York Central Railroad. In accordance with that railroad's specifications, the steel surfaces of the vessels are primed with red lead.

Actually, there are two assembly lines standing side by side at the Staten Island yard. The procedure is made possible by the fact that the barges are built to a type adopted as standard by the railroads and the demand is heavy enough to warrant mass production. At one end of each line the component sections are set in place by cranes on a railroad track arrangement. Step by step the sections are joined and moved along to the next position for specific operations. In a week a vessel has reached the final position and is ready for launching. As the completed barge is poised for its first taste of water, it measures 90 ft. long, 30 ft. wide and has a depth of 9 ft., 3 in.

The steel bottom and side shell of the barges are pickled steel. This is wire brushed before the first coat of primer is applied. For these vessels the most obvious requirement for the primer is protection against the severe condition of a marine environment. Red lead has successfully demonstrated its ability to inhibit corrosion under these conditions. A further requirement imposed by the assembly-line construction was quick-drying. Again, the red lead formulation meets this. Red lead formulations are available to meet all kinds of requirements for drying time, weight, low cost, type of exposure, and other conditions specified by the user.

The red lead primer for the New York Central barges was spray applied in two coats. Above the light load line a black finish coat was applied. Then, with the addition of the railroad's insignia, the barges were ready for busy service carrying everything from crated automobiles to cases of pomegranates around New York and other harbors served by the New York Central.

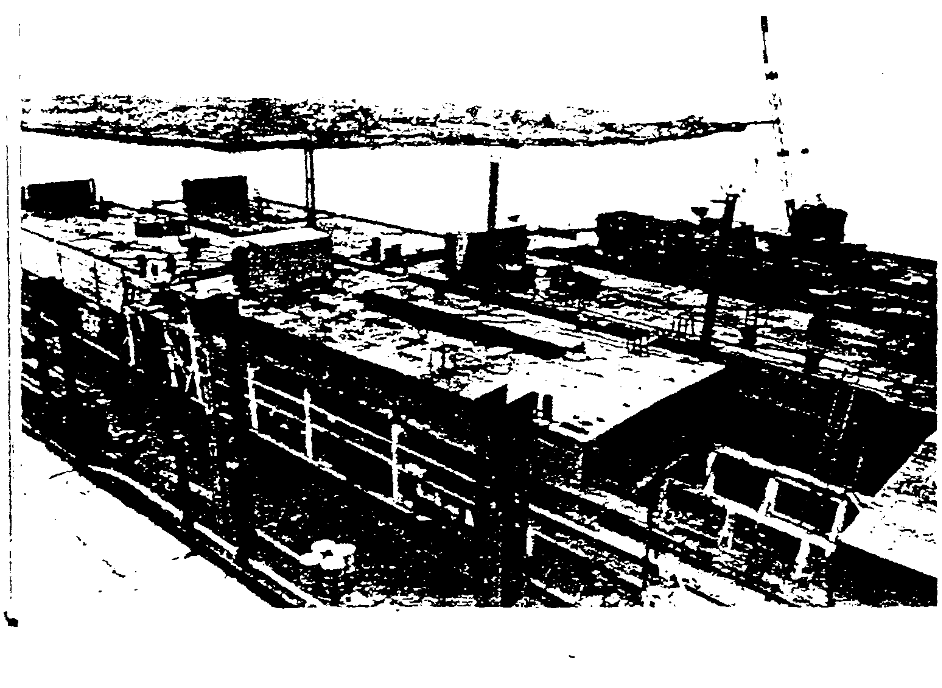
A number of manufacturers supplied the red lead paints for the barges and scows. A representative formulation of the paints employed is as follows:

**MARINE RED LEAD PRIMER**

| | | Percent |
|---|---|---|
| PIGMENT: | Red Lead | 56.0 |
| | Zinc Oxide | 8.0 |
| | Silicate and Sulfate | 36.0 |
| | | 100.0 |
| VEHICLE: | Phenolic Varnish | 16.0 |
| | Linseed Oil | 38.0 |
| | Thinners and Driers | 46.0 |
| | | 100.0 |

Pigment = 79%
Vehicle = 21%
Wt./Gal. = 22.1 lbs.

*Two assembly lines, side by side at the Staten Island Shipyard of the Bethlehem Steel Co., have been turning out a railroad barge or scow twice a week for the past two years.*



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# Lead Fittings In Hotel And Apartment House Construction

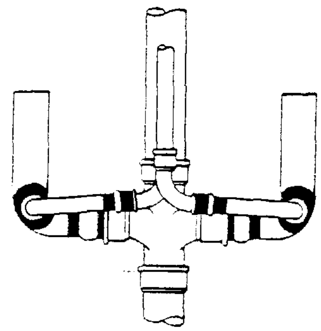
THE use of lead fittings in the recent construction of the Hotel Galvez Annex in Galveston, Tex., effectively illustrates all the most important advantages of lead. The number of bathrooms, 100, called for a material fitted to prefabrication for maximum installation efficiency; the wide dispersion of bathrooms, characteristic of hotels, made demands for a material that would be trouble free and adaptable to a complicated waste disposal system; and, finally, the extra long-life expected from a hotel required that the material have outstanding durability.

Lead fittings answered all three requirements. Each of the hotel's 100 bathrooms was fitted with a lead bend, lead wastes and lead drum trap. The bends were revented with 2-in. lead pipe. All of the lead work was prefabricated in the shop of plumbing contractor R. T. Short and was fed onto the job at the exact time needed. The free flowing lead fittings assured a clog free waste system and the flexibility of these lead fittings made certain that they could be fitted to rigid connections even if there were variations in structure. For the extra long-life the hotel had only to look to lead's past record where it has been in service in some instances for fifty, sixty, even a hundred years without failure.

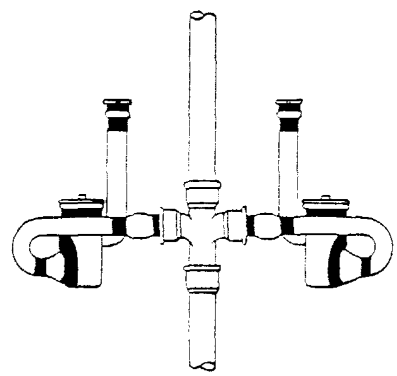
Very similar to the requirements of hotel construction are those for apartment buildings. The Graham Terrace Apartments in Greenwich, Conn., are 4-story garden apartments. Wiped in advance, lead bends were used for water closet waste connections in all the buildings' 159 bathrooms and lead shower pans are being installed in the 48 second bathrooms. The value of lead's flexibility was accented here in the back to back installation of bathrooms where connections had to be made to a single rigid stack from rigid, brittle fixtures in two separate rooms. A double source of potential stress was then set up, but the lead bends will have enough give to protect the fixtures if such stresses do materialize as a result of settling.

In apartment houses water seepage can be a worse immediate headache than in many private dwellings. In either case seepage has to be prevented, but it may be easier to put up with dripping into your own cellar, as might be the case, than with the irate downstairs neighbor who has had water dripping on him as he brushed his teeth or, worse, whose expensive oriental rug has been spotted. In the Graham Terrace Apartments the architect, Frank S. Massai of Stamford, Conn., followed wide practice in specifying the protection of shower pans of 4-lb. sheet lead. The proven impervious membrane that a lead pan provides under the shower floor insures that there will be no damage to finished ceilings, walls or milady's wardrobe. One point is to be remembered in the installation of lead safe pans. The surface of the lead must be coated with asphaltum before pouring on cement, mortar or concrete. This is to protect the lead during the curing period, after which there is no longer danger of corrosion from free lime in the cement.

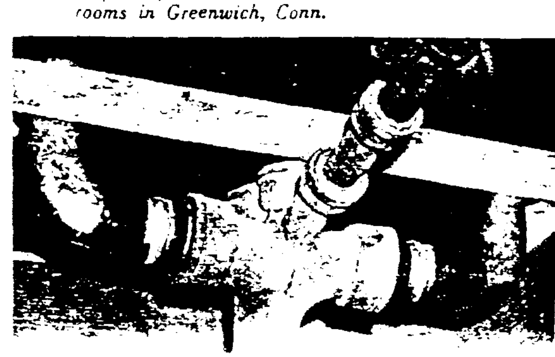

*One of lead's greatest advantages is its adaptability to shop prefabrication. These men prepared in advance the lead work shown with them for the 100-bathroom Hotel Galvez Annex.*



*The drawings of revented lead bends, above, and of lead drum traps and wastes for the bath, below, the essentials of the Hotel Galvez Annex plumbing, illustrate the suitability of lead in a complicated installation.*



*Lead bends, easily adjustable to construction variations, are shown below in place for back to back bathrooms in Greenwich, Conn.*



**"SUGGESTED SPECIFICATIONS FOR CHEMICAL LABORATORY DRAINAGE SYSTEM" NOW AVAILABLE**

**To provide a complete guide to the selection and installation of drainage systems in chemical laboratories, the Lead Industries Association has prepared a 5-page suggested specification titled as above. Included are specifications for materials, joints and connections, hangers and supports. Specifically treated are laboratory waste and vent piping, traps, sinks, acid trays, troughs, safe pans and neutralizing basins. Additional references are to table top coverings, fume ducts and hoods.**

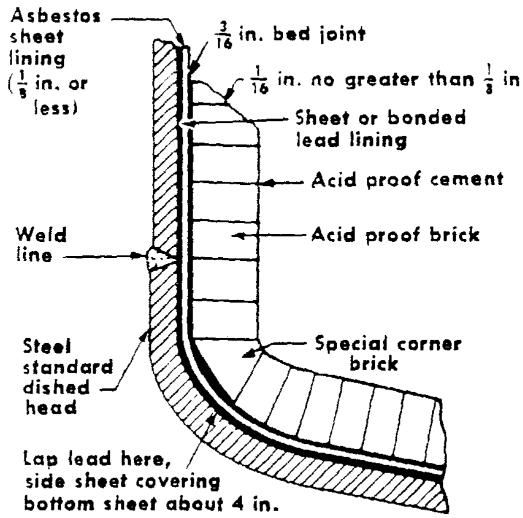
**Copies may be secured, free of charge, by writing to Lead Industries Association, 420 Lexington Ave., New York 17, N. Y.**



LIA26047

# Brick And Lead Linings In High Temperature Chemical Applications

AS a material of chemical construction, sheet lead has many advantages, not the least of which is its excellent corrosion resistance and ease of installation. However, lead's inherent physical characteristics impose temperature limitations when it is used in sheet form alone or when improperly supported. This limitation has in large measure been overcome by bonding the lead directly to steel or copper to form a lead cladding and in this way combine the structural strength of steel or high heat transfer of copper with the superior corrosion resistance of lead. But there is still another means of using lead where high temperature is a problem: acid-proof brick and lead lining in combination. This approach is being used effectively at temperatures averaging 450 deg. F. and, in fact, has on occasion been used with temperatures approaching the melting point of lead, 620 deg. F. Brick lining with a lead inner liner or membrane separating the brick from the steel of the vessel provides a temperature gradient to insulate the lead from the high temperature within the vessel. Corrosives seeping through the brick (no brick lining can be completely impervious) is stopped by the lead and prevented from attacking and weakening the steel supporting structure.




*Detail of lead and brick lining that has been the answer to many problems in chemical construction where both corrosion and high temperature are encountered.*

*Sulphuric and hydrochloric acids and chlorinated organics are handled in this brick and lead lined vessel of the Pennsylvania Salt Manufacturing Co., in successful service now for 6 years.*

The accompanying illustration shows a 6-year old brick and lead lined steel vessel operated by the Pennsylvania Salt Manufacturing Co. handling sulphuric acid, chlorinated organics and some hydrochloric acid at 400 deg. F. There are two such installations: one incorporating a $\frac{1}{8}$-in. lead cladding and the other 12-lb. chemical sheet lead without straps. Both have been in service for about 6 years. Despite the fact that the tanks are protected by two 4-in. courses of acid-resistant brick bonded with Penchlor Acid-Proof Cement, some corrosives do manage to penetrate the brick work to the lead, forming insoluble salts on the lead surface. Once formed these salts prevent further corrosion and protect the steel supporting vessel from dangerous, weakening effects of corrosion.

In another vessel in one Pennsylvania Salt's plant 35 percent sulphuric acid being processed with co. tars at 120 deg. F. The steel vessel originally was lined with 16-lb. lead on the wall and 20-lb. lead on the floor. The tank floor was protected by a 4½-in. course of a hard burned high silica acid-resisting brick, bonded on the sides and back with Penchlor Acid-Proof Cement. The lead on the walls was not protected in this manner. During the life of this structure extending over a 13-year period, the lead on the walls was renewed three times. No repairs were made to the lead on the bottom of the tank. Repairs on the side walls during this period were necessary because of the peculiar corrosive action of the combination of sulfuric acid with organic chemicals. At the end of the 13 years, it was decided to tear the tank down and build a new one, whereupon it was found that the original 20-lb. lead under the brick work on the bottom was in perfect condition and in fact reusable.

It was proven in this instance that although lead alone is not recommended for the particular type of service involved, lead and brick together would give almost indefinite life. On the strength of past performance the decision was made to brick and lead line the entire replacement tank.

Brick and lead linings, then, — a steel shell lined first with lead and then a layer or two of acid-proof brick set in suitable cement — provide another approach to corrosion problems in chemical construction. Where high temperatures, temperature changes and fluctuation, unusual corrosive conditions, or high abrasion are involved, brick and lead complement each other and go hand in hand providing a long and trouble-free life of service.



LIA26048

# Adhesive Lead Tape Improves Masking For Plating Operations

THE addition of a pressure-sensitive adhesive has created new uses for lead foil and considerably improved and expanded an important existing use. Developed and marketed by the Minnesota Mining and Manufacturing Co. as another in their line of "Scotch" brand tapes, the new lead tape has provided the solution to a number of touchy problems in the plating of hard chronium and other metals.

Pioneer work with the pressure-sensitive lead tape in plating was done by Pratt & Whitney Aircraft, many of whose manufactured parts require plating of critical areas. Previously, aluminum and lead foil had been used for masking in plating operations because of their effective thieving action whereby high current densities at sharp corners are prevented from causing excessive buildup of plated deposit which require considerable hand operations for removal. Unfortunately, however, the non-adhering foils did not always give the tight seal required of a masking material. Besides this the foil had to be secured on exterior surfaces with wire wrapping, which, in addition to the expense of time and labor, was often unsatisfactory. And one other undesirable factor was the possibility of etching due to the juxtaposition of two metals and the resulting galvanic action.

The success Pratt & Whitney experienced with pressure-sensitive lead tape masking in thoroughly satisfactory thieving action, in a tight seal, in very substantial savings of time and labor in masking application and in successful prevention of etching, led to their entire elimination of other type masking in chromium plating operations. The lead tape has also been used effectively by Pratt & Whitney in plating nickel, tin, copper, cadmium, silver and lead. And, of course, after Pratt & Whitney's demonstration of the tape's advantages other platers were quick to follow suit.

The lead tape can be applied to any surface quickly and easily with no risk of its slipping out of position or working loose. Parts now can be masked in five minutes which formerly required as long as half an hour. The tape can be used on interior surfaces as well as exterior and on parts that could not be properly masked easily by any other method.

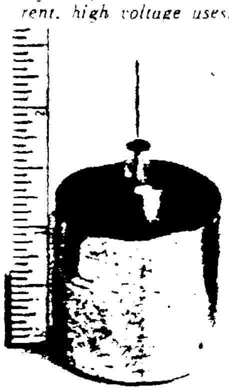
Outside the plating field the lead backed tape has found an interesting end application as the radio antenna in Bell Aircraft helicopters. Bell engineers were looking for a dependable antenna that was light weight and low in cost. The antenna, of course, had to be an electrical conductor. The Bell people themselves conceived of the tape idea and came to Minnesota Mining and Manufacturing who gave them the lead backed tape, fulfilling all their requirements. The tape is applied quickly, easily and permanently around the inside of the bulging plexiglas windshield of the helicopter.

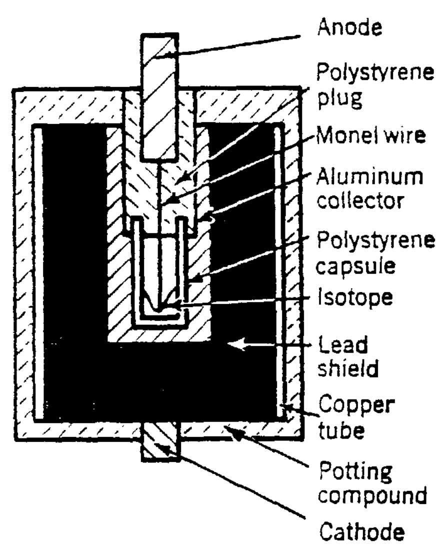
*Quickness, tight seal, and no excessive buildup of plated deposit, are the reasons why pressure-sensitive lead tape is used in masking this rear crankshaft section.*

# Nuclear Battery Enclosed in Lead

CONTRARY to impressions that might be gained from recent publicity, present nuclear batteries neither are, nor are intended as, substitutes for the conventional lead-acid storage battery whose most familiar use is in the automobile. Appropriately enough, however, lead, the largest single use of which is in storage batteries, finds an important role in the newest of storage batteries where it functions not in its usual role as electrode but in another increasingly important capacity, that of radiation shielding. The nuclear battery is a lead shielded nuclear activated storage battery delivering a high potential at low current. This is just the reverse of the customary storage bat-

*Right, drawing, and, below: a photograph of the tiny nuclear battery which is shielded with lead. Unlike conventional storage batteries, it is designed for very low current, high voltage uses.*





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tery which can deliver very high currents at usually low voltages, most commonly 6 and 12 v. The nuclear battery measures voltage in the thousands and current in micromicroamps. Its applications are such as the charging of dosimeters, the devices that measure radiation exposure, calibration of electrometers and high-meg resistors and condensers, testing of insulation, and similar specialized electrical and electronic uses where small currents are required.

It has long been theorized that radioactive energy offered a potential source of electrical energy. Utilizing radioactive energy in a battery, for example, should theoretically give operating life equal to that of the half-life of whatever source of radiation was used. Conceivably then it would be possible to construct a storage battery that would never need recharging and would function for as long as, say, 1100 years, the half-life of radium.

Appreciating the intriguing challenge to develop such a battery as well as being aware of its more practical aspects, the Radiation Research Corporation under the sponsorship of the Power Sources Branch of the Signal Corps Engineering Laboratories succeeded in producing what they term a "nuclear battery." Using beta radiation furnished by radioisotope strontium 90, they were able to make a battery which would supply current up to 1000 micromicroamps with voltages in the order of several thousand for a half-life period of 25 years.

Besides the advantage of long service life, the construction of a nuclear battery is uncomplicated by liquid electrolytes and its power is packed in a small unit. Batteries constructed to date average no more than 1 cu. in. in size; about 1 in. in diameter and 1 in. high. The typical nuclear battery consists of a radioactive source whose emitted beta electrons are collected by an aluminum cup as electric current after passing through a polystyrene insulator. Others are investigating the use of gamma radiation as a power source in which case lead would similarly be required.

About 5 oz. of lead shielding are used around the aluminum collector to reduce the external radiation below tolerance rate. Lead was naturally selected for this purpose because it is commonly available, it has the highest density of all common materials, and perhaps more significant, lead itself does not become radioactive after exposure to virtually any amount of radiation. Here the obvious advantage is that no hazard due to external radiation would ever be experienced with a nuclear battery — even after years of service.


# 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, 420 LEXINGTON AVENUE, NEW YORK 17, N. Y.**

**1954 MATERIALS OF CHEMICAL CONSTRUCTION ANNUAL REVIEW — LEAD AND LEAD ALLOYS**
An up-to-date report on new developments in the uses of lead and lead alloys in chemical construction, including research progress, engineering applications, and technological advancements, such as methods of testing linings, automatic lead welding, and air pollution control. Reprinted from "Industrial and Engineering Chemistry," October, 1954. Bibliography.

**LEAD AND LEAD ALLOYS**
The corrosion resistance of lead and its alloys as materials of construction in the chemical process industries is shown for more than 188 industrial chemicals, citing the effects of concentration and temperature. The illustrated article also describes the forms of lead available for chemical construction and gives recommended practices for fabrication as well as applications. Reprinted from "Chemical Engineering," February, 1953.

**MATERIALS OF CONSTRUCTION — LEAD**
A brief survey of the uses of lead in chemical construction reprinted from the materials review published in "Chemical Engineering," Nov. 1954.

**LEAD LININGS— FASTER, CHEAPER, BETTER**
A report on a new method of fastening strapped lead linings by the use of a cartridge powered stud driver. Reprinted from "Chemical Engineering," February, 1954.

**LEAD IN MODERN CHEMICAL CONSTRUCTION**
What you should know about the various types of lead construction in the chemical field. Reprinted from "Chemical Engineering," Jan. 1952.

**CONTROLLING CORROSIVE AIR POLLUTANTS**
A discussion of the various methods in use today to control corrosive air pollutants. Reprinted from "Air Repair," May, 1952.

**LEAD IN MODERN INDUSTRY**
**$1.50 Postpaid**
A Fully illustrated, 220 page, cloth bound book describing all phases of the production and use of lead, lead alloys and lead compounds. Discussion of the physical and chemical properties of lead and its compounds is included. Sufficiently technical to be of practical value to the engineer in industry, yet broad enough for those with a more casual interest.

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**LEAD IN MODERN PLUMBING— WHY, WHERE, HOW IT IS USED**
A 24 page booklet containing descriptive information as well as four pages of detailed drawings for plumbing installations in various type houses.

**FEDERAL SPECIFICATION, WW-P-325**
**For Pipe, Bends and Traps, LEAD**
Part 5 of Section IV of the Federal Standards Stock Catalog, published by the Government Printing Office.

**CALKING LEAD**
**Commercial Standard CS94-41**
Promulgated by the National Bureau of Standards.

**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.

**RED LEAD TECHNICAL LETTERS**
A series of technical letters containing red lead paint formulations issued by the Red Lead Division, Lead Industries Association. Available separately.

- **Technical Letter No. 3—Red Lead Primers for Atmospheric Exposure**
- **Technical Letter No. 5 — Red Lead-Vinyl and Coumarone Type Paints**
- **Technical Letter No. 6 — Red Lead Paint Formulations**
- **Technical Letter No. 7—Paint Systems for Hydraulic Structures**
- **Technical Letter No. 8—Primers for Railroad Structures and Rolling Stock**
- **Technical Letter No. 9—Red Lead Paints for Galvanized Steel, Rusted, Weathered or Treated New**

**FEDERAL SPECIFICATION TT-P-86a**
**Paint: Red-Lead-Base, Ready-Mixed**
Covers four types of red-lead-base paints including two fast drying formulations. Many intended applications listed.

**METAL PROTECTIVE RED LEAD PAINTS**
The versatility of red lead in protective primers to meet a wide range of surface conditions, drying schedules and economic demands is described. Reprinted from "Paint and Varnish Production," January, 1951.

**AN INVESTIGATION OF PRIMERS FOR MARINE ATMOSPHERIC ENVIRONMENTS**
Results of an investigation of synthetic vehicles and red lead mixed pigment primers over an exposure period of three and one-half years in a rigorous marine atmosphere. Reprinted from "Official Digest" published by The Federation of Paint and Varnish Production Clubs.

**THE USE OF LEAD IN THE PULP AND PAPER INDUSTRY**
Reprinted from "Paper Trade Journal," Oct. 26, 1950.

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