Lead

VOLUME TWENTY-FOUR 1960 NUMBER ONE

Eight shimmering pools will reflect the sleek, graceful lines shown in this aerial view of the new Time and Life building in New York. (story on page 4)

INDUSTRIES ASSOCIATION

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We're moving—
after May 1st
292 Madison Ave
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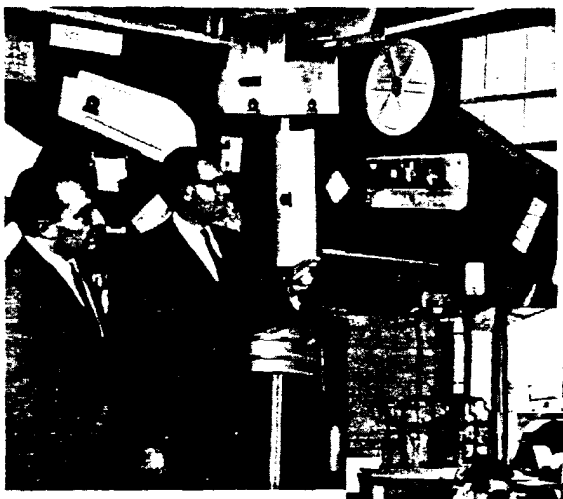
Speed, Ease of Use Make Diverse Friend for

- **it's now used in aircraft antennas**
- **for balancing rotating equipment**
- **in radio-active material handling**
- **and even for do-it-yourself leaded glass windows.**



Operator (below) lowers a masked metal blank into etching solution to start the chemical milling process part. Lead tape protects edges and guards against pinholes in the masked areas. At left, Manuel Sanz, inventor of the process, and S. G. Thornton, President of Turco Products, Inc., inspect some of the parts produced by the company's chemical milling techniques.

First produced back in the 1930's for electroplating, self-adhesive lead tape has graduated into a host of other jobs. It is still used in this original niche where dissolved lead can be tolerated in the electrolyte.

And it fills a similar role, in masking off areas to be protected in the new chemical milling process. Here, the speed with which it can be applied and trimmed to a sharp, clean outline and its resistance to the chemical bath make it a handy adjunct to other masking materials in use. Its principal function in this process is edge masking and pinhole protection.

Because lead tape has the excellent corrosion resistance needed for exposure to powerful chemical etch solutions, it boasts a long service life in outdoor applications.

One example of this is its use for "leaded" glass windows. The quiet elegance of real leaded glass requires hours of skilled work to produce, but today any do-it-yourself enthusiast can achieve the decorative effect of a lozenge pane leaded window in a few minutes. And the only skills he requires are the ability to read a ruler and use a knife or a pair of scissors.

During the Korean war this same weathering resistance was put to good use when lead tape radio antennas were used on rescue helicopters. The austere ration of surface space of a helicopter had designers stumped for an antenna location until they thought of sticking lead tape to any convenient member. A single bolt through the tape and its supporting surface (insulated from any underlying metal) brings pressure to bear on a standard electrical lug to complete the installation.

Since lead is commonly used as a shielding material in working with radioactive materials, its use in packaging of these may seem commonplace. Interestingly, though, lead tape is not usually used for its shielding ability in this application. Its thickness — normally 4 mills, 5 to 20 mills on order — is insufficient to stop "beamed" radiation. The AEC does report its use in three types of application:

- To seal joints in small shipping containers so as to prevent the spread of radioactive contamination in the event of a rupture of the inner container.
- In laboratories as a temporary

The call for help that brought this rescue helicopter to the scene was received on a radio with a lead tape antenna. The technique was used on Bell Helicopters so renowned for their work in Korea.

ndor Lead Tape

Every man a glazier! Converting ordinary windows to leaded glass is a fast, simple job when lead tape is used.

means of sealing joints in exhaust ducts from hoods or glove boxes.

- To seal joints between removable metal clad panels used in the construction of some radioisotope laboratories. This is for decontamination purposes only and not for shielding.

One of the things you notice immediately in working with lead tape is the characteristic "heft" of dense metal. Though the tape is thin, it can add appreciable weight to any area to which it is applied. This has been of help to the Kaman Aircraft Corporation in experimental work to find the balance point of helicopter rotor blades at various pitch angles. Though the tape is replaced by metal structural members before any aircraft is used or sold, this method is a time-saver in making quick weight changes in the exact increments required.

Depending on the application, most of these users choose tape of ½, 1, or 2 inch width. It can be supplied, however, in widths up to 18 inches in any thickness up to 20 mils. Principal manufacturers include Permacel Division of Johnson and Johnson, and Minnesota Mining & Manufacturing Company.

D-ORGANIC MIXTURES

IMPROVE REACTOR DESIGN

Where it is desirable to have a hydrogenous material for neutron attenuation and a heavy material with a high neutron inelastic cross section but low gamma ray production efficiency as the gamma attenuator, organic-lead mixtures are advantageous. The L-77 solution type reactor uses this concept in its multi-region primary, an improved version of L-47, the first nuclear reactor employing lead as the only reflector material (LEAD, Vol. 22, No. 1).

Built by Atomics International, a division of North American Aviation, Inc., for educational and industrial applications, the laboratory reactor is only 8 ft. in diameter and 8 ft. high, and can be installed without adding special facilities.

Unique in its field, its primary shield comprises three concentric regions separated by aluminum and makes extensive use of lead pellets. The innermost region, composed of a mixture of lead pellets and diphenyl, surrounds a stainless steel sphere containing 20 per cent enriched uranyl sulphate. It acts primarily to attenuate gamma radiation, reduce neutron leakage, making use of lead's reflector characteristics, and moderate escaping neutrons.

The central region is composed of borated paraffin which further moderates, capturing a significant portion of thermalized nuetrons. The third region features a mixture of lead pellets and paraffin and functions as a neutron-gamma shield.

To compensate for a relatively high radiation absorption in organics and to improve neutron economy, mixing with a good reflector-shield is desirable. The rate of radiation damage would be reduced since it is proportional to the energy absorption in the organic and dilution by other materials. Decomposition, primarily due to

(continued on next page)

REACTOR ASSEMBLY LINE — Atomics International's L-77 Laboratory Reactors are manufactured at this assembly line. Technicians lower top on an L-77 tank while others (background) prepare core vessels for insertion into core shield amplifiers.

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REACTOR

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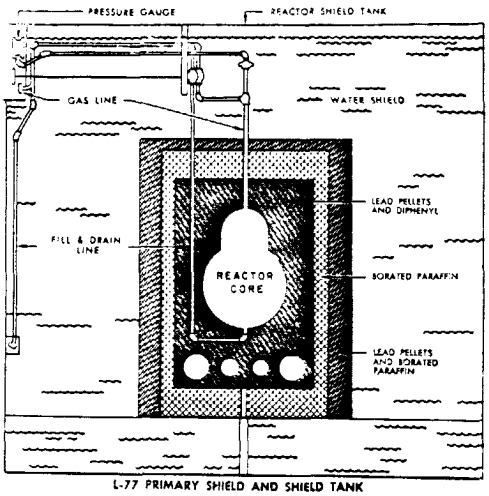
gamma rays and epithermal neutrons. would be reduced by fractional absorption in lead. Also since carbon is a good source of hard gammas when bombarded by high energy neutrons. distribution of lead throughout the

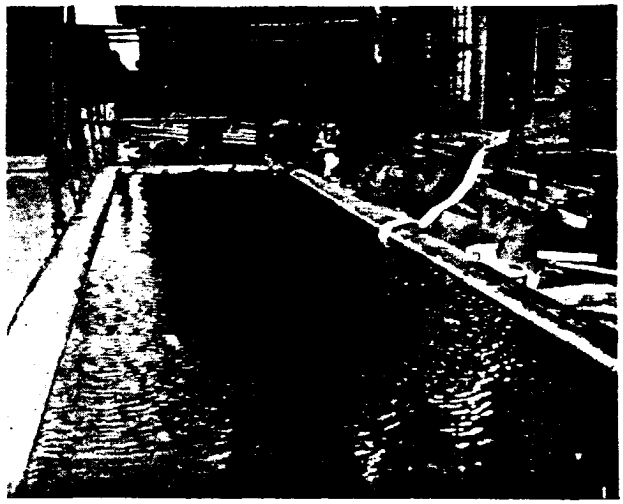


L-77 PRIMARY SHIELD AND SHIELD TANK

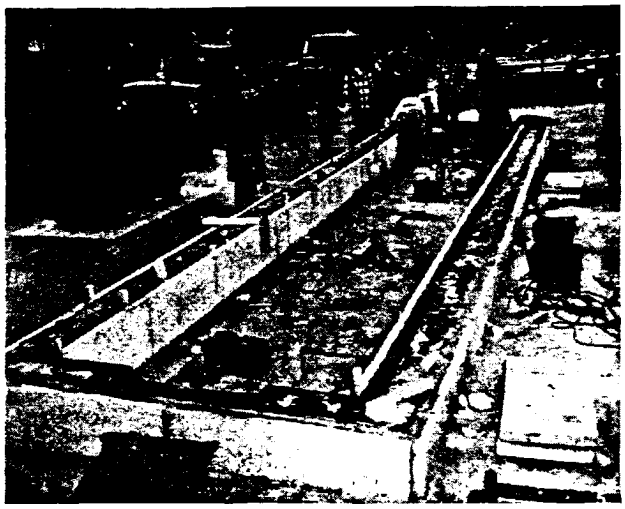
shield volume makes mixing even more desirable.

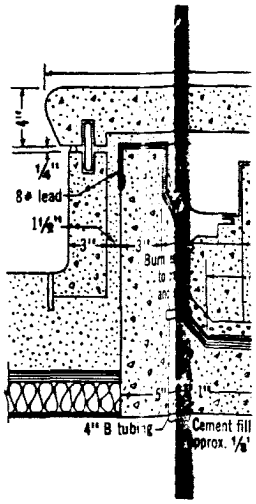
Laminated layers of lead and paraffin are difficult to work with from a construction viewpoint and also not as effective as the homogenous mixture easily cast into shapes. In addition. by intimately mixing, the thermal conductivity and specific heat are increased thus allowing for higher temperature operation, elimination of hot spots. etc. And by combining lead's reflector function with its use as a gamma shield, important savings in weight and costs are achieved.

The L-77 carries dual or multi-function concepts further than the L-47 by utilizing intimate mixing of lead and diphenyl in the innermost region of the three-region primary, effecting neutron shielding or moderation in combination with gamma shielding or reflection; and as indicated, by increasing resistance to radiation damage or degradation in the case of the organics and in heat tolerance and elimination properties in the composites.



Completed 8-lb. sheet lead pool lining (above) is tested by filling it with water. When this test shows absolute water tightness, the pool is drained, and after drying is swabbed with asphaltum (right). After this coating has been applied — it protects the lead from free lime present in cement or mortar until curing is complete — the stone work trim of the pool is set in place (bottom). Detail drawing (lower right) shows the method used in installing the lead membrane in all of the seven ground level pools. Also shown is the method used to flash all piping protruding through the lead pan.





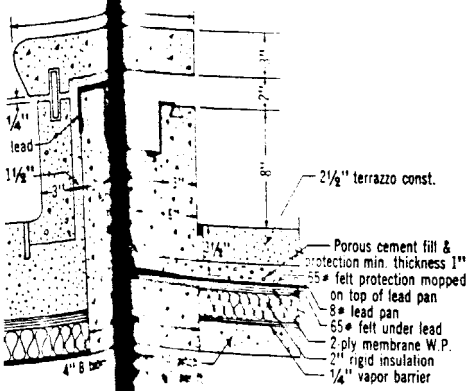
Eight Shimmering Pools Accent Straight Line Design

Eight lead-lined pools, reflecting the lean, graceful beauty of the newest of New York's Rockefeller Center skyscrapers, the Time & Life Building, are a major design feature of this most recent addition to the imposing array of structures that make up the "Center."

As designed by Harrison & Abramovitz & Harris, the Time & Life Building is a 48-story, free standing tower without setbacks. Abutting on the north and west of the rectangular tower is an L-shaped base of seven stories on top of which there is an auditorium and terraced roof designed by the Italian architect-designer, Gio Ponti. The terrace roof has been landscaped at its borders and punctuated with a 20 ft. by 40 ft. lead-lined reflecting pool, sculptured standards and varicolored triangles formed in the paving.

The plaza on the east side of the tower, an overall area of 170 ft. by 33 ft., will have another of the lead-lined pools, 110 ft. long by 30 ft. wide by 3 in. deep, one of the largest of its kind in New York.

The remaining six lead-lined pools, each measuring 37 ft. long by 9 ft. 4 in. wide by 18 in. deep, will grace the 380 ft. long by 42 ft. wide promenade located on the south side of the tower. Because all of the pools are located over income producing areas or underground passageways, the selection of a permanent waterproofing material, such as sheet lead, was of paramount importance.

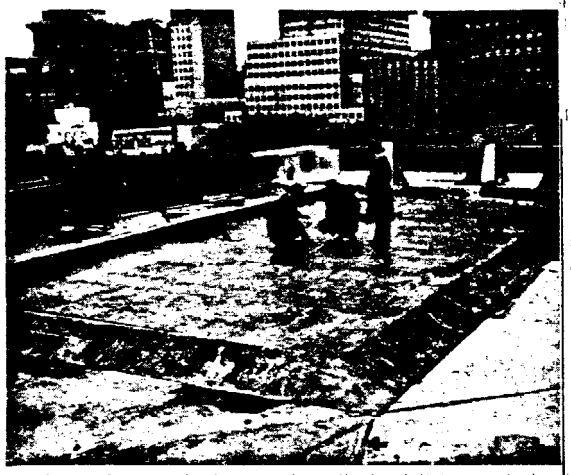


The accompanying drawing illustrates the construction details followed in preparing the pools and the method used in installing the 8-lb. sheet lead membrane. Joints in the lead were kept to a minimum and where it was necessary to make them, they were made by lead burning.

As can also be noted in the drawing, the sheet lead was placed over 65 lb. felt paper and covered with the same material mopped on top of the lead pan. This asphaltum coating is necessary to protect the lead during the curing stage of the cement. After the free lime in the cement has completely carbonated, the interim protection provided by the asphaltum is no longer important.

Contractor for the sheet lead pool linings was C. H. Cronin, Inc., plumbing contractors of New York and Boston and these were installed by the John F. Abernethy Co., Brooklyn, N. Y., under a subcontract. The extensive and complex plumbing system required by a building of this magnitude was also installed by the Cronin organization. Lead had a part in this phase of the project with flexible lead stubs used to connect the water closets to the waste piping.

General contractor for the Time & Life Building was a joint venture of the George A. Fuller Company, and John Lowry, Incorporated, both of New York.



The rooftop pool, showing the 8-lb. lead lining and the lead apron extending around it.

Lead burner forming a corner seam near a drain in the Plaza pool, the largest of its kind in New York. The area is covered by a temporary roof.

Permanent COLOR for Lightweight Building Block

Glaze Formulations for Clay-bonded Vermiculite Block

	Pink lb.	Blue lb.	Tan lb.	Red-Brown lb.
Frit A	0.40	0.40	0.40	1.00
Frit B	1.40	1.40	1.40	0.79
Frit C	0.70	0.53	0.35	—
Lunday	0.53	0.53	0.53	0.53
Whiting	0.17	0.17	0.17	0.17
Superpax	0.80	0.80	0.80	0.80
Flint	—	0.18	0.35	0.70
Stain	0.30	0.30	0.15	0.20
Water	908cc	908cc	908cc	800cc
CMC Low Vis.	5.5 g.	5.5 g.	5.5 g.	5.5 g.

Frit A		Frit B		Frit C	
K_2O	0.3%	PbO	61%	CaO	3.3%
Na_2O	8.5%	Al_2O_3	7%	MgO	16.1%
CaO	17.0%	SiO_2	32%	Al_2O_3	19.6%
Al_2O_3	5.0%			SiO_2	61.0%
B_2O_3	18.7%				
SiO_2	50.5%				

Lightweight structural blocks with permanent weatherproof color are now a reality and will soon be an important new product in the architect's bag of tricks. Developed by the Zonolite Company, blocks are made light by the inclusion of up to 12 per cent of expanded vermiculite in a clay matrix. The product is now in pilot plant production. Successful pilot production runs have been completed using concrete block machines and "soft mud" brick molding machines.

Lightweight blocks will offer a number of economies which can materially reduce the cost of constructing a building.

Delivered costs of the blocks are anticipated to be competitive with concrete block because of significant savings in shipping and handling. The reduced dead weight means that structural supporting requirements, particularly for multistory buildings, would be considerably lower. Labor costs on site are also expected to be lower. An additional advantage is the extremely high insulating quality of these blocks — with a U-factor* of one half that of the dense blocks — which means lower heat losses from the building.

The architectural design potential of these blocks has been enormously increased by the development of colorful, permanent glazes. An exhaustive development program was carried out by Zonolite to find glaze formulations that would yield glazes with the desired textures and colors. Of all the compositions that were tested, only the lead glazes gave consistently good results.

The ability of lead to promote glaze-body reactions, coupled with a controllable viscosity and low surface tension made it possible to formulate glazes with varying textures — from a rough to a smooth, high gloss texture — despite the relatively rough texture of the fired block.

Glazing can be accomplished during the firing of the block—called "single fire" glazing in the structural clay industry. Or, the fired blocks can be ground to precision dimensions — the block grinds easily — and "double fire" glazed at a lower temperature.

Three general grades of lightweight block can be produced—10-lb., 20-lb., and 30-lb. — depending on the percentage of vermiculite included in the mixture. Standard concrete blocks, on the other hand, with a nominal block size of 8 x 8 x 16 in. weigh about 40 to 45 lb. The 20 and 30-lb. block types have high strength and, in this regard, meet the A.S.T.M. specifications for class A concrete block (A.S.T.M. C90-52 — 1000 psi compression strength over gross area).

The 10-lb. block is lower in strength and is not designed for structural applications. It will be ideal for unloaded interior walls, in hospitals, schools, industrial plants, etc., where its permanent ceramic color will provide an easily cleaned, colorful finished interior surface without the necessity of an additional finishing operation.

Vermiculite is a lightweight aggregate material weighing only 7-lb. per cu. ft. after being expanded. It is compatible with clay materials and can withstand firing temperatures up to 2100 deg. F. Above this temperature, the vermiculite begins to melt. The block manufacturer will be able to expand this material himself and the clay matrix can be any raw material that is suitable for structural clay products.

*U is the overall heat transfer coefficient (Btu/hr./sq. ft./°F)

PLASTIC LEAD

Cast it without heat

Mixing with accelerator readies lead-plastic for use

A lead and plastic putty-like material called Devcon L has been put on the market recently by the Devcon Corp., of Danvers, Mass. Consisting of 94 percent lead powder and 6 percent special epoxy resins, Devcon L can be easily formed to any shape before curing. Three hours after the addition of a "catalyst" or hardening agent, the mixture becomes a rigid, tough, strong mass. No heat, pressure or flame are required.

The Devcon Corp. reports that it has good adherence to lead, steel, aluminum, bronze, brass, wood, cast iron, porcelain, concrete, and can therefore be used to bond lead to a variety of materials, standing up to temperatures in the range of 250° F.

Once hardened, Devcon L can be sawed, drilled or machined with regular tools. It can be pounded or shaped with a hammer and has a malleability almost identical to lead's. The shrinkage during hardening is approximately 0.0005 in. per in. It can be stored almost indefinitely, will not become embrittled on aging and does not contain any flammable or volatile solvents.

By using a special curing agent called Devcon Flex in place of the regular hardening agent, a flexible material is produced. One part of Flex, for example, to five parts of Devcon L by weight will yield a material with a flexibility similar to an automobile tire. Any form or final casting can therefore be shaped or bent by hand to the exact contour required.

Devcon has run a test program to determine the corrosion resistance of Devcon L. The results so far are favorable showing good resistance against acids and alkalis as well as organic solvents. The attached table gives the results of this program by comparing weight change of specimens exposed to a variety of chemicals for 14 days and for two months.

A number of companies have already found uses for this material. Several companies, including the Carr Leather Company of Peabody, Mass., producers of high quality suede, calf skin, and side leather, have constructed processing tanks of sheet lead bonded to wood with Devcon L. Another company has used Devcon L to bond lead sheet to the inside of a cast iron and steel cylinder. This company also made a useful corrosion resistant tank by simply trowelling the putty onto the inside surfaces.

The Lynn Gas & Electric Company has used this putty for sealing new connections on lead cable as well as for making repairs on damaged cable. The Marriner Combing Co., of Lawrence, Mass., accomplished the repair of a large lead lined cast iron scouring tank, damaged by its agitator, by simply trowelling the lead-plastic putty over the damaged areas.

Other applications suggested by the manufacturer include building up lead castings or shapes to desired dimensions, lining sinks, weighting wheels that are off balance, and sealing underground boxes. And to finish up with a note from the atomic age, lead plastic mixes haxe proved of value for shielding against radioactive materials. Several companies report that it is highly effective, is easy to use, and can be shaped to the exact form required.

Corrosion Resistance of Lead-Plastic Putty

(Data from Devcon Corp.)

Immersion in	1" Cube 14 days		1" Cube 60 days	
	% wt. change	Rating	% wt. change	Rating
50% sulphuric acid	0.41	E.	0.36	E.
5% sulphuric acid	2	E.	1.8	E.
50% nitric acid	1.2	G.	3.6	F.
5% nitric acid	2	G.	2.1	G.
50% hydrochloric acid	0.55	E.	0.63	E.
5% hydrochloric acid	2	G.	1.4	G.
Saturated sodium hydroxide	0.7	E.	0.68	E.
10% sodium hydroxide	0.12	E.	0.09	E.
Ammonium hydroxide	0.09	E.	0.10	E.
Water	0.3	E.	0.32	E.
Gasoline	0.005	E.	0.009	E.
Toluol	0.89	E.	0.75	E.
Textile spirits	0.003	E.	0.002	E.
Mineral spirits	0.002	E.	0.002	E.
Isopropyl alcohol	0.010	E.	0.011	E.
Denatured alcohol	1.9	G.	1.75	G.
Ethylene dichloride	3.0	G.	2.9	G.
Carbon tetrachloride	1.1	G.	1.3	G.

NOTE: Corrosion Rating E = excellent, G = good, F = fair.
Ratings given are based on weight change plus analysis of any dimensional changes as well as the presence of obvious corrosion products.

Ten Silent Miles a Day

At secluded Ocean Reef at North Key Largo, Fla., lead-acid battery powered carts help the staff to provide the quick, courteous and quiet service expected by the discriminating clientele. Ocean Reef, with its cottages, hotel, club house, yacht basin and golf course, covers hundreds of acres. The dock master, chamber maids, maintenance men and maitre d'hotel could not possibly perform their duties satisfactorily on foot.

Three service carts are used constantly, traveling an average of some 10 miles a day each. Manufactured by Cushman Motor Works, Inc., of Lincoln, Neb., each is powered by four 6-volt lead acid batteries which maintain full speed and power for the whole day. The batteries are placed on charge each night.

The maitre d'hotel travels in one from cottage to cottage and yacht to yacht to take dinner orders. Maids use them to carry their linen and other supplies from cottage to cottage. The dock master employs one in his busy travels to and from the yachts — as many as a hundred at busy times — tied up in the yacht basin. Beds, furniture and baggage are often delivered in them.

Using no fuel and economical to operate despite frequent stops, these carts serve in silence that offers no annoyance to the guests, yet they enable the staff to cover a large area quickly and efficiently.

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., until May 1, 292 MADISON AVENUE, NEW YORK 17, N. Y. thereafter.

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

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.

MATERIALS of CONSTRUCTION REVIEWS
Lead and lead alloys in design and construction research, engineering and technological applications. With bibliography, 1959, 1958, 1957 and 1956 reviews (editions are not cumulative) are available. Reprinted from "Industrial and Engineering Chemistry," September, 1959, 1958, 1957 and 1956.

CORROSION DATA — LEAD & ALLOYS
Chart form presentation of the corrosion resistance of lead and its alloys to 188 common chemical materials over the normal temperature range. Reprinted from "Chemical Engineering," February 1953.

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.

BETTER LEAD TANK LININGS
Sketch and description of an improved method for lining wooden tanks with sheet lead. Reprinted from "Chemical Engineering," September 1959.

LEAD-ASBESTOS PAD FOR VIBRATION
Gives specification, drawings, and reviews recent applications of lead-asbestos anti-vibration pads for buildings.

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.

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.

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.
No. 14 Describes the formulation of red lead-coumarone primer for seawater immersion — ship hulls, fixed marine installations.

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.

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.

RADIOISOTOPE CONTAINERS
Twelve-page booklet illustrates and describes eight shipping containers evolved at Oak Ridge for small quantities of radioisotopes.

NEW LITERATURE

LEAD DOME'S SILVER ANNIVERSARY
The excellent maintenance and service records of the lead dome at New Jersey's penitentiary in Rahway are reviewed after 25 years. Shows construction method. Reprinted from "Heating & Air Conditioning Contractor," January 1960.

TRUCK COSTS IN A JIFFY
Three nomographs permit estimation of costs for gas or battery powered industrial trucks in two or three minutes. Depreciation, operating costs, and maintenance are appraised separately for all unusual types of operation.

ULTRA LOW LOSS CERAMICS
Technical discussion of new formulations for ultra low loss ceramics together with possible mechanisms of behavior. Reprinted from "Jour. Amer. Ceramic Soc.," September 1959.

ANODES FOR SHIP PROTECTION
Results of a detailed examination of lead-silver anodes for corrosion protection of ships. Operating efficiency and behavior are given. Other anodes are compared. Reprinted from "Corrosion," November 1959.

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