Lead

VOLUME TWENTY-FOUR 1960 NUMBER FOUR

The HSS-2, the Navy's new all-weather anti-submarine helicopter developed by Sikorsky Aircraft, relies on lead-Teflon powder bearings for dependable low maintenance operation under tough conditions. (See page 4)

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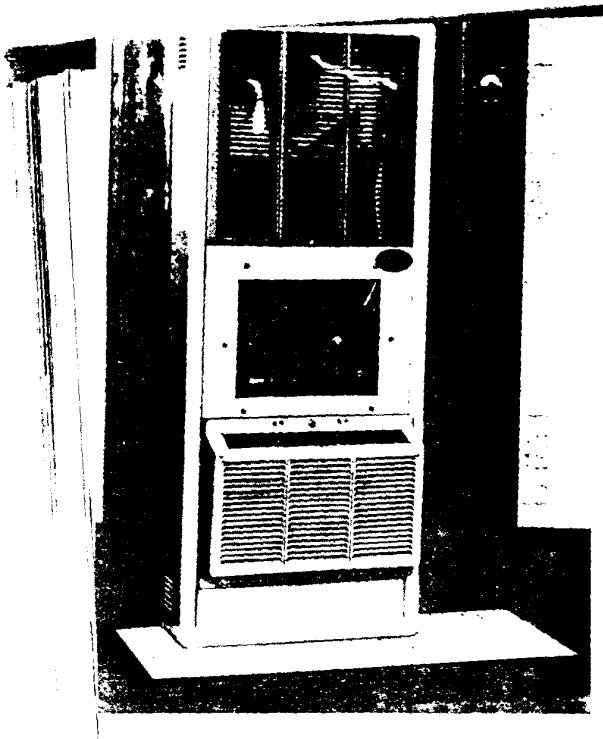
292 MADISON AVENUE, NEW YORK 17, N. Y.



Lead telluride units at center use waste heat to generate the electric power for the fan of this gas-fired space heater.

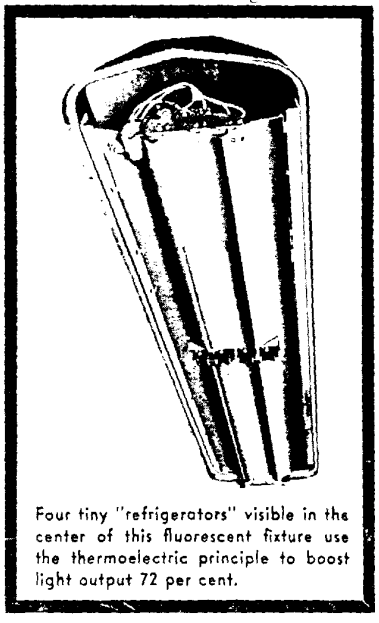
Free THERMOELECTRIC POWER FOR YOUR HOME

If you are impressed by the size of your winter fuel bills for home heating, it may be no consolation to know that about a quarter of the heat you pay for goes up the stack unused. But you should be interested in a new development by Minnesota Mining and Manufacturing Co. Now 3M's is ready to bring out several thermoelectric generators that convert some of this waste heat directly to electrical power.

Key to the new development is the lead telluride semimetal element. This material behaves much like the well known thermocouple. When it is heated while in contact with another metal, a voltage difference is generated between them and current can be made to flow. The two big differences between a lead telluride thermoelectric generator and the thermocouple are that really sizeable currents are now available and conversion efficiencies are twenty times better than thermocouples' — and still going up!

Still experimental, the first complete space heater unit to make use of the free power of waste heat is pictured above. The louvered panel near the bottom conceals an air intake fan. Cool air is drawn in and forced past the lead telluride units visible through the glass at center. In cooling them (the back ends of the units are mounted directly to the wall of the enclosed combustion chamber) the air is heated. Finally, the hot air (130°F) is forced out through the top grill. Power for the fan comes from the thermoelectric units — no line power is required.

In a conventional home heating unit, the elements would be located in the flue and might be used to power a fan or circulating pump. Because the heat transfer from a liquid is always better than that from a gas, lead telluride generators would be even more effective in a hot water heater.



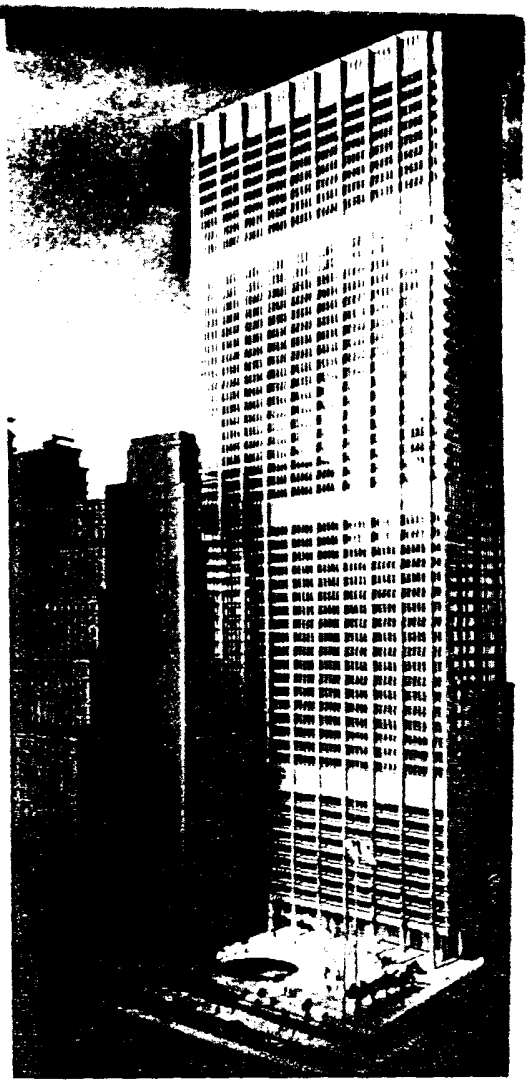
Four tiny "refrigerators" visible in the center of this fluorescent fixture use the thermoelectric principle to boost light output 72 per cent.

While domestic heating appears to be a huge field for the new devices, there are plenty of other applications being tried. The SNAP III satellite power unit is of this type. The military is interested in more prosaic jobs, too. Harbor buoys and shore lights for navigation are to make use of it.

One gas company in northern Illinois is tapping off a small flow of gas from the main to power a thermoelectric generator which, in turn, powers a cathodic protection system to prevent corrosion of the main. Part of the economic attractiveness of this arrangement is that power is available anywhere the gas main goes without stringing electric lines to it. Thermoelectric units of this type are about the same in cost as rectifying equipment needed for impressed current power.

One other filip performed deftly by the lead telluride units: if an electric current is fed to the thermoelectric unit in the right direction, the unit can become a miniature refrigerator. A current application of this cooling magic is in keeping mercury vapor pressure from climbing inside fluorescent lighting tubes as they heat in service. Light output is increased as much as 72 per cent.

A NEW APPROACH—
With Porcelain Enameled Aluminum



America's financial community is witnessing a change from the traditional canyonesque architecture of lower Manhattan. The Chase Manhattan Bank Building, one of the major new architectural landmarks in New York City, in a new departure from the crowded buildings of the area has had open space designed into its structure. In line with this break with an old tradition, porcelain enameled aluminum, one of the newer traditions of architecture, has been specified for the spandrel areas of the outer skin.

The plaza is scheduled for completion in 1963. Customers using the public banking floor located immediately below the plaza will have a refreshing view of the sunken pool and a garden while conducting their business.

The building's outer skin consists largely of glass — 7-ft. high windows were used — with porcelain enameled aluminum spandrel panels and narrow vertical strips (mullions) of natural finished aluminum anodized for protection against the weather. "Tin canning," a defect of some of the early curtain wall buildings is avoided here by the use of a matte black lead-bearing porcelain enamel (35 to 50 percent gloss). "Tin canning" is the architect's term describing the reflection of the surrounding buildings off glossy walls.

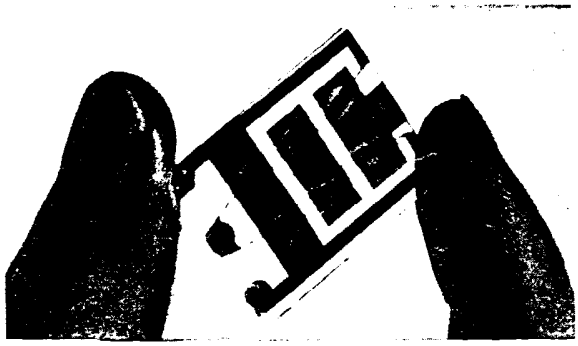
Skidmore, Owings & Merrill, the building's architects, ascribe several advantages to the use of porcelain enameled aluminum. The lead bearing finish has great durability to weather. Harsh New York winters, hot summer sun and corrosive atmospheres will not fade or damage the finish even after many years of service. Every rain is a bath for the building too because dirt won't adhere to the glass windows or to the glass-like porcelain enamel surface.

The high corrosion resistance of the aluminum itself adds to its durability. Even if there are slight imperfections in the porcelain enamel coating, no rust or unslightly streaking will develop. The lead bearing porcelain enamels are fired at low temperatures so there is no danger of warping of the panels either.

The Chase Manhattan Building extends downward as well as towards the sky. Five levels reaching to 90 feet below the surface have been built. The largest bank vault in the world, encased in thirty inch walls of heavily reinforced concrete, occupies the lowest level.

COMPUTER'S BRAIN CELL

A six-cryotron circuit of tin and lead vaporized and deposited as thin films on glass has been developed as a miniaturized electronic switch by scientists at Arthur D. Little, Inc., Cambridge, Mass. Using superconductivity, these devices are expected to make possible drastic reductions in computer construction costs.



Navy's all-weather helicopter, powered by twin gas-turbine engines is built by Sikorsky. Flying boat hull enables it to operate from water, land or almost any other surface.

OILLESS BEARINGS

cut helicopter maintenance

Maintenance free bearings—always an objective of engineers — have been designed into the Navy's super twin-turbine HSS-2 helicopter built by Sikorsky Aircraft. A new member of the illustrious family of lead bearings is doing the trick here.

Called DU*, these bearings can withstand a wide range of tough operating conditions and they need *no* lubrication. Developed in Great Britain by Glacier Metal Co., they consist of lead and T.F.E. fluorocarbon (Teflon) powders impregnated into a sintered bronze matrix. A steel backing provides strength. DU bearings are exclusively marketed in the USA by the Special Products Department of Garlock Inc., Camden, N. J.

The HSS-2 helicopter is designed for anti-submarine service — a tough job demanding a high performance aircraft that requires minimum maintenance. In the helicopter's rotor hub, the critical damper assemblies damp any blade motion about the lag hinges avoiding damaging vibration levels. Bearings in this assembly are subject to heavy loads, shock, vibration, intermittent motion and a corrosive environment.

Historically, bronze or anti-friction bearings were used. By replacing these with DU, Sikorsky eliminated 10 grease fittings which would have required daily lubrication. The DU bearings will require no lubrication during the service life of the rotor hub. Although relatively new to this country, DU bearings have been used in Europe for several years. Quality cars like the British Humber Hawk, Aston Martin and Jaguar have specified DU in a number of applications.

Manufacturers of trucks and other commercial vehicles -- where maintenance costs are important and time lost in the repair shop is money not earned -- have made good use of reliable DU bearings. Sweden's Scania Vabis is one of the major users of DU in this field. Low maintenance, long service life and excellent performance over a wide range of operating conditions are the reasons.

The coefficient of friction range is similar to what would be expected from conventional oil lubricated bearings. It varies from 0.04 at high loads and low speeds to around 0.16 at fractional loads and high speeds. Design parameters have been established relating bearing pressure and sliding velocity for long term operation. Load-velocity constants (k) are given in the table for 1,000 and 10,000 hours service life for:

- Thrust bearings
- Slides and general bearings
- With unidirectional loads (load fixed relative to bushing)
- With rotating load (load rotating relative to the bushing)
- With fixed load and oscillating shaft

DU bearings have operated successfully over the temperature range -450°F. to 536°F. Even rapid, wide temperature changes do not reduce performance. Jet engine and furnace manufacturers have made good use of this characteristic.

Operation in dust or dirt laden atmospheres has generally posed no problem either. Dirt is not desirable, of course, but except in the odd occasions where bearing clearances were completely blocked, presence of free floating dirt particles in the bearing has had no detectable effect on performance. DU bearings are in trouble free service exposed to abrasive cement, concrete mix and other dirt laden atmospheres.

LOAD VELOCITY CONSTANTS =

	Mild Steel etc.*		
	1,000 hours	10,000 hours	
Thrust bearings,	25,000	12,000	30
Slides	12,000	6,000	1
(a) With unidirectional loads (load fixed relative to bushing)	16,000	12,000	2
(b) With rotating loads (load rotating relative to bush)	25,000	19,000	3
(c) With fixed load and oscillating shaft	30,000	23,000	

*These figures apply also to cast iron, austenitic s[tainless s]teel, aluminum and to mild steel electroplated with [chro]mium, with nickel.

*Engineeringese contraction of the more jocular "damned ultimate."

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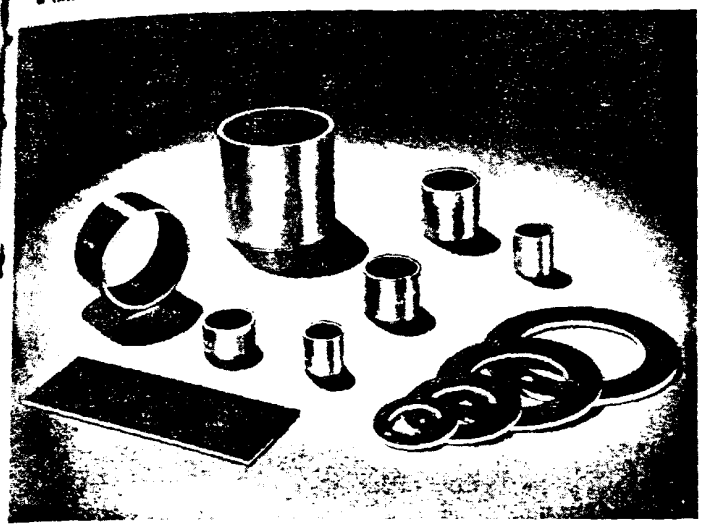
DU bushings, thrust washers and strip. A thin surface layer (0.0008 in.) of the lead-teflon powder is left on the sintered bronze surface for the "bedding-in" process. During "bedding-in," the mating surface is covered with a thin film of lead-teflon.

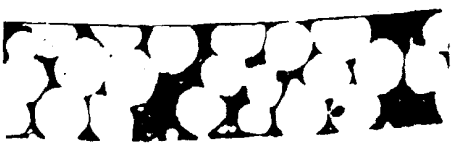


ANTS = K

	Hard Steel 540 Brinell
	1,000 hours	10,000 hours
	30,000	15,000
	13,000	7,000
	25,000	19,000
	30,000	24,000
	33,000	24,000

...inless steel, anodised ...id, with cadmium or

Photomicrographs of DU before (above) and after "bedding in."



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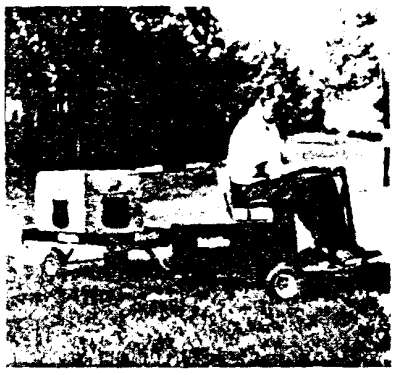
Now you can . . .

Drive

~~WATCH~~ THE BIRDIE!

Designed as a one-man golf cart, the Birdie is finding increasing use in and around industrial plants. It carries a man and his tools economically at speeds of five or six miles an hour. It takes 30° grades in stride. Best of all, the "fuel" for the Birdie is the standard 110 volt electrical outlet, for it is battery powered and contains its own charger.

The lead-acid batteries that power the vehicle are intermediate between standard automotive types and the larger industrial units. They will furnish 100 amperes, at 12 volts, over an eight-hour shift, according to the manufacturer. This means that the Birdie can be used to carry



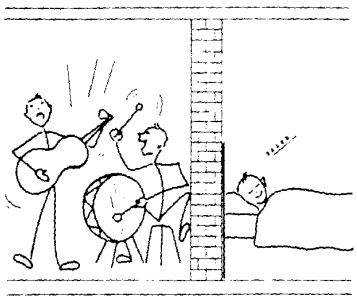
a heavy driver and about 100 pounds of additional load for all the travel he normally encounters in eight hours.

Since the charger is built in, it is a simple matter to plug the car in at the end of a shift. The 6 amp charger has it ready to go overnight. For round the clock operation, batteries can be changed — they are mounted with wing nuts.

Current industrial users include plant maintenance men, superintendents, and executives. In one large plant the mail boys drive these vehicles and average about 14 miles a day.

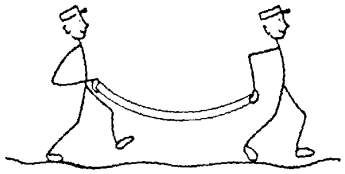
A new model of the Birdie, soon to be in production, has a rear-mounted bin — like a pick-up truck. Like the present model it can be equipped with a trailer. Price on the new model has not been announced but the present car costs less than $400 f.o.b. the Birdie Company plant in Summit, N. J.

USE LEAD TO STOP NOISE

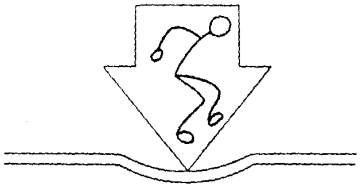


WEIGHT BLOCKS SOUND

Copies of "Improved Sound Barriers Employing Lead" are available. The 12-page report furnishes detailed information about the ideas presented here and also provides data and calculation methods for estimating sound isolating performance of many common materials.



LIMPNESS BLOCKS SOUND



Silence may be golden, but lead looks like the best practical material to confine noises. Because it is heavy and limp, it shows the highest "quieting" performance of any common building material. Mass and limpness are the two key criteria for a sound barrier. Lead approaches the ideal in combining these.

According to the recently published engineering report, "Improved Sound Barriers Employing Lead," based on studies by the well-known acoustical consulting firm of Bolt, Beranek and Newman, a sheet of lead foil about 0.008 in. thick is as effective as ¾ in. of plywood in stopping sound transmission. Lead ¼ in. thick is as effective as a two-course brick wall 8 in. thick.

In many cases the reduction of wall thickness and weight which can be achieved by using lead in place of conventional materials will easily pay for the added cost of the lead.

For example, if a brick wall 8 in. thick is replaced by a wall 2 in. thick (¼ in. of lead plus framing) the 6 inches of saved wall thickness are worth about $7.50 per linear foot of wall, based on today's average building costs of about $15 per square foot. And the weight reduction — the brick wall weighs about 104 lb/sq ft, the lead wall about 16 — of nearly 90 lb/sq ft, amounts to about 900 lb. per running foot in a wall 10 ft. high. This means that lighter framing and foundations can be used and that longer spans between bearing walls are possible.

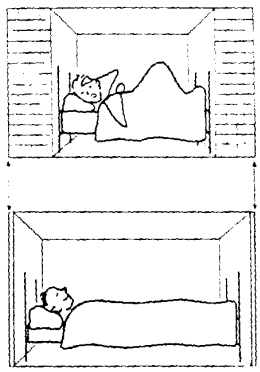
The technique of using lead for such soundproofing is quite simple. It can be cut with a saw, shears, or a knife, bent to fit contours, and painted with conventional oil paints.

The report suggests several interesting specific uses.

Lead "wallpaper" is one of these. As little as ⅛ in. of lead (or leaded cloth or plastic) surfacing on each side of acoustically substandard walls will provide a significant increase in sound isolation. *Door facings* of sheet lead over wooden panel doors in old buildings not only achieve the modern flush door look but can assure privacy in professional offices of doctors, lawyers, and others.

Lead laminated to sheet metal or other materials is an obvious choice for *machinery enclosures*. Lead tape and leaded plastic sheet can be used to improve existing enclosures for noisy machines. For extreme cases, a *high transmission loss panel* made up of vinyl film, ⅛ in. sheet lead, 3 in. of low density Fiberglass, another lead sheet and a final vinyl film has such excellent predicted performance that it is recommended for jet engine test cells.

Lead backing for acoustical tile appears to be a practical way of preventing noise from penetrating the tile to "bounce" off high ceilings into adjacent rooms where false ceilings of tile are used.



LIMP WEIGHT SAVES SPACE

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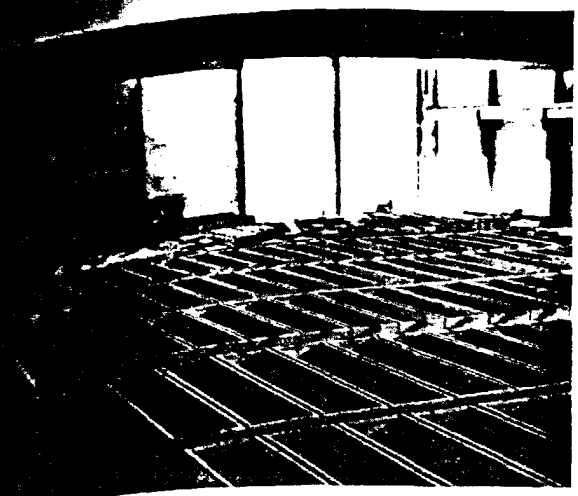


View of one tank bay at the new Kennecott copper refinery.

NEW TANK LINING METHODS BOON TO COPPER REFINERY

The new 16,500 ton per month copper refinery built for Kennecott Refining Corporation in Anne Arundel County, Md., by the M. W. Kellogg Company is, in itself, a model of operating efficiency and modern practice. It's not surprising, therefore, that new, specialized techniques were used in building and lining with lead the 1,172 concrete electrolytic tanks that form the heart of the purity-refining operation.

Two departures from normal practice paid handsomely in time saved and in paring construction costs. One of these was pre-casting the concrete tanks at the rate of 20 per day and moving them into the plant with a straddle carrier. The other was division of the lead lining work into three areas of specialization so that linings, too, could be turned out on a mass production basis.

Usually, lead lining work is done by an experienced crew which does the layout, forming, cutting, and lead burning on each tank. The novel approach used by Knapp Mills, Incorporated of Long Island City, N. Y., subcontractors on the Kennecott job, employed three crews —

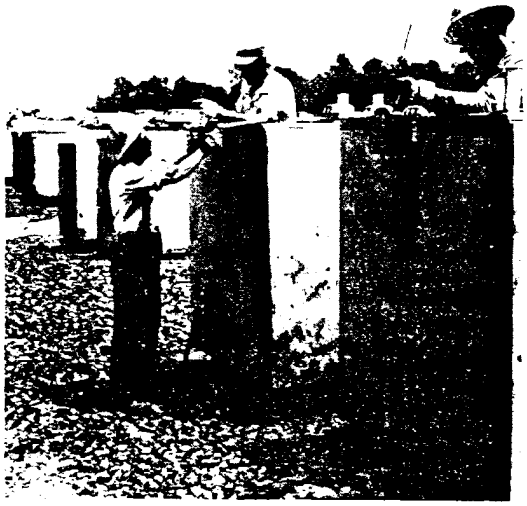
- A layout crew who measured and cut all the sheet lead for all tanks
- A brake crew who, right on the site, turned out thousands of "interchangeable parts" of the tank linings
- And finally a crew of lead burners who installed, fashioned and welded the lead linings in place.

Normally, a lead lining job of this size could be expected to take 217 working days. The streamlined operation used at Kennecott accomplished it in exactly 127 working days.

Contrast the contruction methods shown in the drawings. Note that the new method makes use of pieces of formed sheet lead which have all bends parallel to one another. These are easily made on a brake. Also note that the new method enables linings to be installed with no hand fitting to the tank.

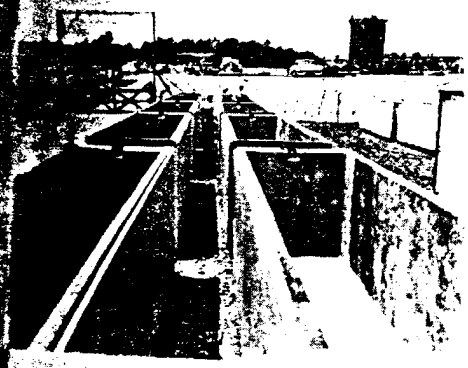
Still another advantage of the new design is the fact that it produces a smooth end wall for the tank. Tanks lined by the older method inevitably had some roughness and irregularity in the end surface.

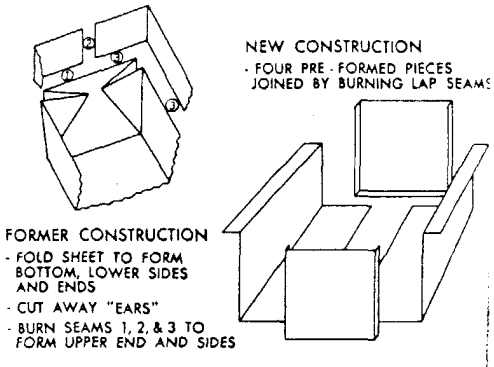
This improved lining method was so easy to carry out that a crew of 30 men was able to install 18 tons of lead in one day. As the lined tanks, 17'7" x 3'7" x 4'0" complete with drain and filling connections, were completed, a 34,000 lb. straddle carrier took them into the plant and positioned them for piping up. In all, 1173 tons of lead were employed in the lining.



Here, lead burners install overflow drains.

A few of the tanks awaiting drain connections. Note the smooth end surfaces.

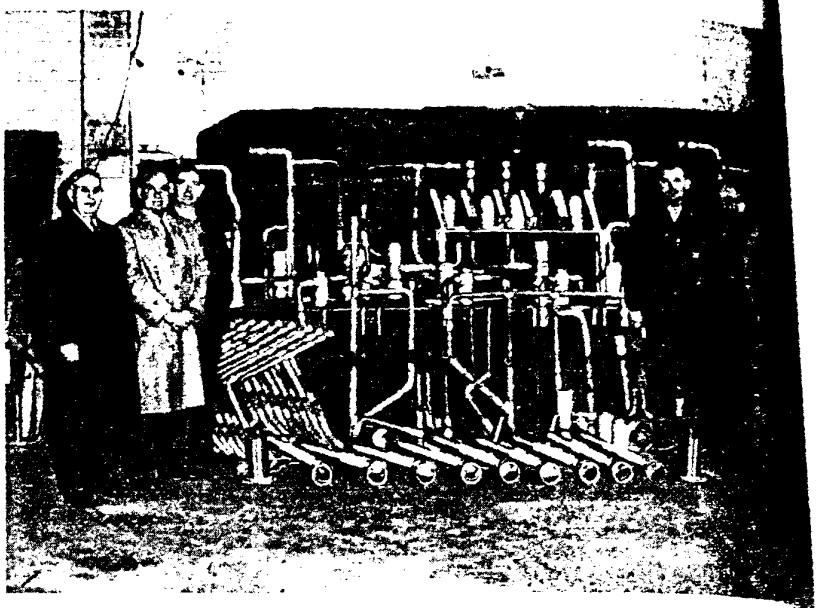




The first 500

. . . homes of the St. Louis Gardens development have been completed and more are being built. Plumbing contractor Alvin G. Fields, business agent Arthur Fischer and four journeymen plumbers are shown here with a small number of the lead drum traps, vent and waste lines fabricated for the project. Site of the development is just south of East St. Louis, Illinois. The builder is Oliver Parks.

The display illustrates quite graphically one of the uses of lead in plumbing. No matter how intricate the roughing is, it can be prefabricated economically in the shop and installed in a minimum amount of time. And if, upon installation, the measurements are slightly inaccurate it is a simple job with flexible lead to realign the roughing-in when fixtures are installed without having to redo the installation.



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, 292 MADISON AVE., 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, 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.

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.

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

LEAD WORK FOR MODERN PLUMBING
$2.00 Postpaid. $1.50 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.

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.

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.

BUILDING CONSTRUCTION BULLETINS
A series of specifications for the use of lead in building construction. (Available separately.)
No. 1 Specifications for Lead Waste Connections for Plumbing Fixtures with Integral Traps (Water Closets — Pedestal Urinals — Service Sinks).
No. 2 Specification for Lead Shower and Safe Pans.
No. 3 Specification for Lead Chemical Laboratory Drainage Systems.

SEAMLESS TERNE FOR ROOFING
Illustrated four-page architectural specification also provides data on strength and weight characteristics and color advantages of terneplate as roofing.

NEW LISTINGS

DESIGN ENGINEERING DATA
Twelve-page publication summarizes all main lead uses, tabulates data.

OILLESS BEARINGS — HELICOPTERS
Reprint from "Design News" shows use of lead-teflon bearings in helicopter. Photos and drawings included.

IMPROVED SOUND BARRIERS
Twelve-page engineering report with calculation methods for sound barriers, data on lead and common building materials.

NUCLEAR MATERIALS
Eight-page reprint from "Materials in Design Engineering" inspects current fuels, controls, moderators, reflectors and shielding.

1000°F BEARINGS
Data on dry high-temperature lead oxide bearings developed by N.A.S.A. Reprinted from "Materials in Design Engineering."

X-RAY DATA — LEAD CERAMICS
Detailed examination of X-ray and dilatometric data for four groups of lead salts. Six-page reprint from "Jour. Amer. Ceramic Soc."

LOW LOSS DIELECTRICS
Six-page reprint reports on several ceramic systems showing excellent loss behavior as dielectrics. Reprinted from "Jour. Amer. Ceramic Soc."

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