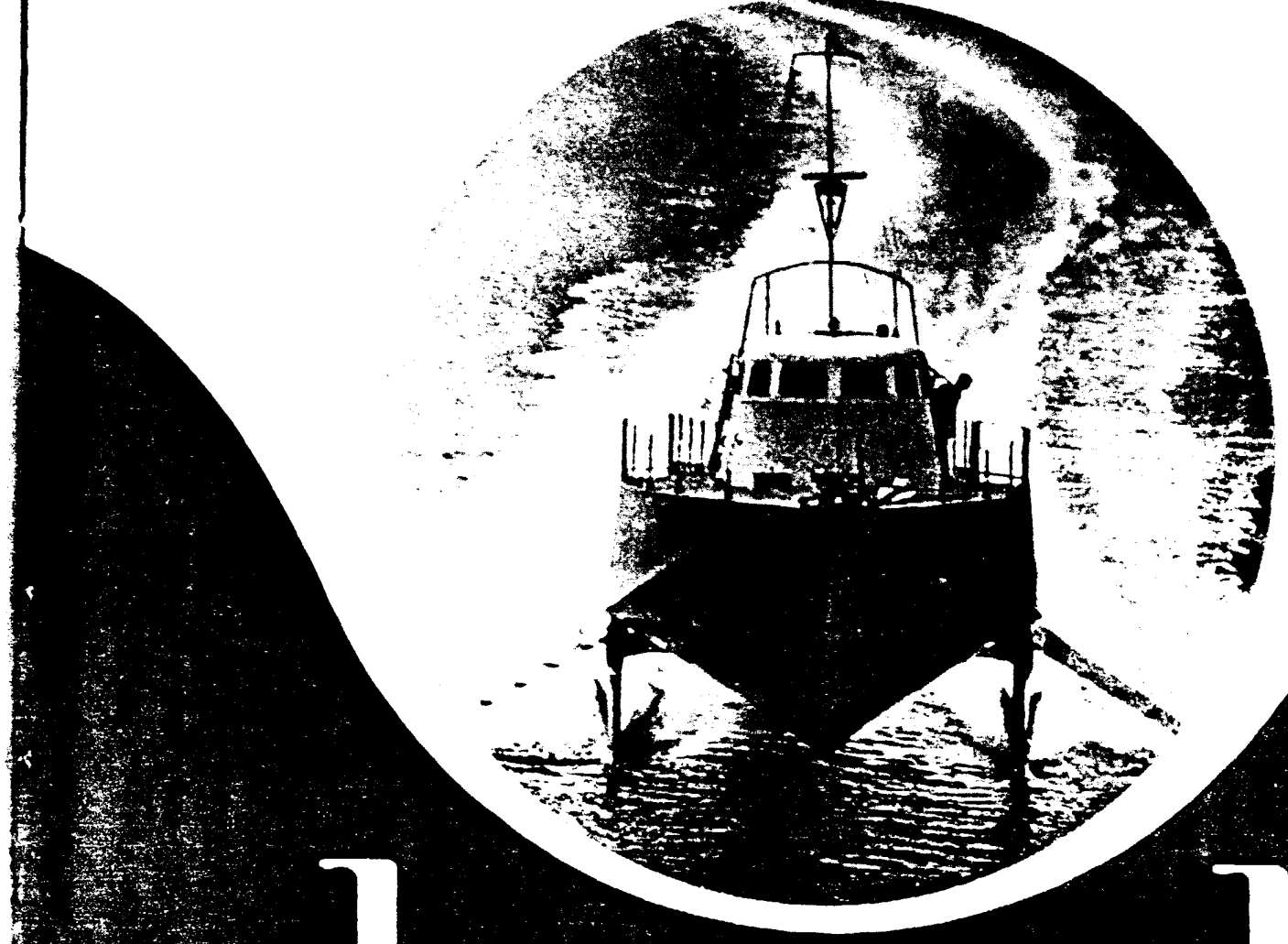
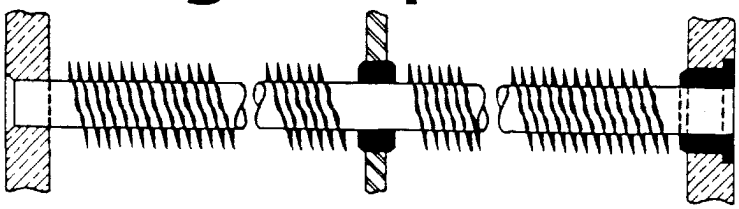


lead

LEAD INDUSTRIES ASSOCIATION, INC.

# Single Dip



# Double Duty

A hot-dip solder operation is accomplishing several things at once for The Whitlock Mfg. Co. of West Hartford, Connecticut. The company recently added finned heat transfer tubing to its product line and found that a molten lead-tin bath was the answer to two big problems. A quick and economical means was needed to bond fins to the tubing, and at the same time they wanted to give the entire assembly a corrosion resistant coating.

Corrosion resistance was desired because finned heat transfer tubing is widely used for cooling corrosive furnace gases and in heat exchangers for chemical plants, power stations and other often severe environments.

The finned tubing is made by spiraling a thin metal ribbon on edge around pipe or tubing of various kinds and sizes. Of course the solder-dip proves ideal for permanently bonding fin to pipe.

In addition to this double bonus, R. O. Morse of Whitlock points out that the lead bath offers other advantages too. For instance, the high heat conductivity of lead means that the lead-tin coating will allow heat to pass on through the fins without giving an "insulator" effect. One indication of this is the fact that Whitlock's finned tubing increases radiation from 4 to 10 times that of bare pipe.

One of the problems that had to be solved before production could begin, however, was to design and build a good furnace that would rapidly melt 5 tons of lead-tin pigs. Since the bath is needed only at irregular intervals, not on a continuous basis, a rapid-firing automatic gas furnace was selected. It is capable of heating the solder to 700°F in two hours. The tank measures 21 ft. long by 20 in. wide by 1 ft. deep, and holds 250 solder 40-lb. pigs with ease.

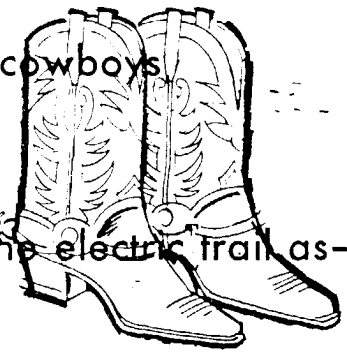
Tubes for the finned heat transfer tubing are made of a wide variety of materials: steel, stainless, copper, or copper-nickel. Fins are made from copper, steel or stainless steel.

Since the edge of the fin where it comes into contact with the tube is corrugated (see detail drawing above) the Whitlock tubes give superior performance over smooth fins. This is due to greater turbulence at the cooling surface caused by the crimps, and also because the crimps put more metal where it is needed to conduct heat from tube to wall.

The 21 foot long dip tank holds five tons of molten solder.

LIA26329

Fork truck cowboys



ride the electric trail as—

One event of the rodeo was a bullfight where the matador was pitted against a nimble, but not-too-ferocious bull.

# UNION ELECTRIC HOLDS A BATTERY TRUCK RODEO

Late this fall Union Electric Company of St. Louis held a rodeo for battery powered plant trucks. The corral was their own all electric Dorsett Warehouse and a city-fellow caterer supplied the chuck wagon and acted as wrangler for the 750 guests. In place of mustangs, cow ponies, and brahma bulls there was an array of 60 workhorse electric trucks. Most of the guests were so impressed with the performance of the steeds that some good old fashioned horsetrading took place and more than one battery powered truck had a new brand on its flank after the show.

In addition to reviving a good old American tradition, this rodeo served two other purposes: it showed potential users first-hand evidence of the advantages and economies of electric vehicles, and it helped to develop a new market for Union Electric Company's product, power.

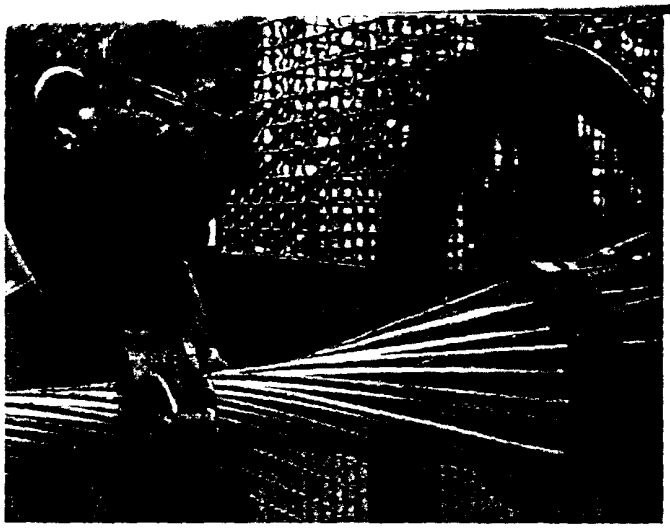
The guests had a chance to see for themselves that lead-acid battery powered trucks have a minimum of moving parts, thus low maintenance requirements. The utility pointed out, too, that electric power is more of a bargain than ever — it has not been part of the general inflationary movement which has carried maintenance labor, parts, and other expenses of competing trucks to as much as two or three times the pre-war figure. Savings in using electric trucks are so great that it is not at all unusual to pay off the difference between first cost of an electric and first cost of any other truck in the first year or so.*

From Union Electric's point of view, each electric truck is a desirable consumer of electric power. In the first place most of the battery charging is done at night when electrical loads are low. In the second, the hefty muscle power of a typical two-ton fork truck develops an appetite for electric power comparable to that of electric space heating in a typical home. The two-ton truck, for example, uses electric power at the same rate as 48 100-watt light bulbs.

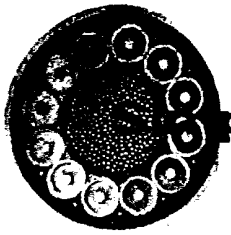
In the best tradition of rodeos, much of the interest was in looking over the horseflesh at the stables.

*Savings will, of course, vary with job conditions. To check out this statement for your particular requirements, send for a copy of "Industrial Trucks . . . What Do They Cost?", available from Lead Industries Assn., Inc.

LIA26330



Coaxial lines being wound into a single cable on the stranding machine.



plicity can

# LEAD SHEATHES NEWES

The symmetry and apparent simplicity of this new transcontinental telephone cable is misleading. It is, in fact, one of the most complex telephone cables made today. When the 3700 miles of this network with its 959 repeater stations and 9 switching centers is put into operation in late 1964 it will be capable of handling some 9,000 conversations simultaneously or 12 TV programs and 3,900 telephone conversations.

The cable is specially designed for a dual function: (1) it will be the "central nervous system" of a coast-to-coast telephone cable network and (2) being a buried cable it will help assure continued communications in the event of a nuclear attack on the United States.

Normally the cable will serve as part of the nation's vast and growing telephone network. As this complex of buried cables stretches across the continent, it must be as secure as possible against damage in the many different environments it encounters. Such maximum protection and reliability is achieved by encasing the 12 coaxial conductors and core of conventional wire conductors in a multiple sheath consisting of polyethylene lead and polyethylene combined with other protective coverings where required.

In damp areas where corrosion may be a problem, lead's physical protection qualities are enhanced by an outer covering of polyethylene. Over the basic polyethylene and lead sheathing a covering of steel wire armor may be used in areas where this extra protection is needed to prevent damage by rock, boulders or water borne abrasive material. In the west where gophers gnaw on anything, a steel tape is wrapped between the lead sheath and outer polyethylene covering.

Every 24 hours huge machines at the Baltimore Works of Western Electric Company turn out nine miles of this special cable. This is Western Electric's only plant producing the coaxial cable for long distance telephone circuits, and the product is manufactured on highly automated lines. Included are 100-ft. long stranding machines that form the coaxial units into a cable core which is subsequently jacketed and armored if necessary to form a completed cable that measures about 2½ to 4 in. in diameter, depending on the outer jacketing and armor specifications.

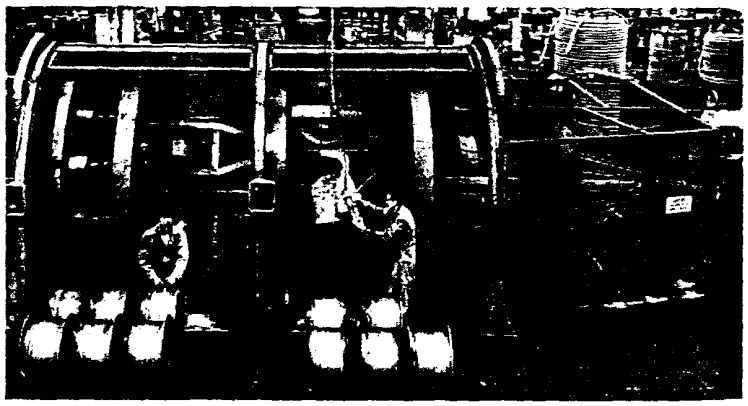
Finished cable is wound in approximately quarter-mile lengths on 7 ft diameter cable reels and shipped to various installation locations.

In the field the cable is laid in a 4 foot deep trench and selected fill is put around it as a cushion against damage by coarse back fill materials. Two special copper wires are installed above the cable to provide additional shielding against lightning damage.

In addition to the more than five and one-half million feet of polyethylene and lead sheathed coaxial cable, the Baltimore Works annually completes several million linear feet of lead sheathed toll and exchange cable. The combined total of all cable manufactured represents several billion conductor feet of wire each year.

At Baltimore the manufacture of lead covered cable requires the pur-

## NOW and



The 100-ft. long machine for stranding coaxial telephone cable. Reels of individual coaxial lines are ready for use in the foreground. This is one stage of the highly automated production line.

This cable composed of 12 coaxial units surrounding a core of conventional wire conductors can handle some 9,000 telephone conversations simultaneously.

eceiving . . .

# TELEPHONE CABLE

chase of material in huge quantities. Annually the transcontinental coaxial cable project uses some 75,000,000 lb of lead, 11,000,000 lb of polyethylene plastic, 30,000,000 lb of copper, 15,000,000 lb of steel and 7,000,000 lb of paper.

The materials employed in lead polyethylene cables are combined to attain built-in mechanical and electrical characteristics according to the type of service and environmental conditions that exist. In the case of the new telephone cable the purpose is primarily to transmit information at voice and carrier frequencies during an expected life upwards of 30 years.

The mechanical characteristics needed for this rugged cable include resistance to environmental heat, cold, wind, lightning, moisture, sunlight and oxygen, as well as resistance to damage by rodents, insects and workmen. These desirable characteristics are affected by factors of cost, convenience of manufacture, installation and joining.

The evolution of lead sheathed and other telephone cables goes back to about 1878 when Alexander Graham Bell in a talk in London stated "It is conceivable that cables of telephone wires could be laid underground, or suspended overhead, communicating with private dwellings, country houses, shops, etc., uniting them all with a central office where the wire would be connected as desired, establishing direct communication between any two places in the city."

About two years later his prediction became a fact when wires enclosed in a sheath crossed the Brooklyn Bridge.

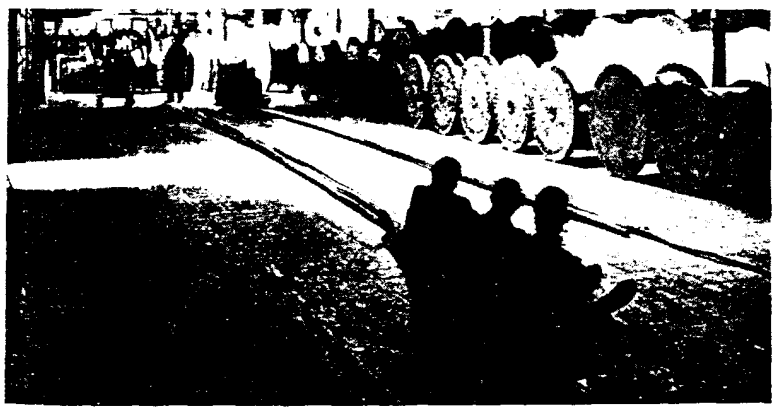
The first insulation in these cables was gutta-percha or rubber. It was soon discovered that these materials were not suitable for land telephone use. In 1881 the Western Electric Company began the manufacture of lead covered cable. The selection of lead as the cable sheathing material was dictated primarily by the physical requirements, notably its adaptability to extrusion and its corrosion-resistant properties. By today's standards these properties are still significant.

In early lead covered cables the electrical insulation was sisal and cotton which was impregnated to prevent the entrance of moisture. A significant development during this period was the introduction of strip paper insulation which became the dominant material for many years. The insulated wire was drawn through successive lengths of lead pipe previously extruded and laid out in straight pieces, the different lengths being joined together by plumbers' joints.

During the period between 1881 and 1920 many changes were made to improve cable quality and increase production. In addition to improvement in insulation, extrusion presses were redesigned so that the lead alloy sheath could be extruded directly on the cable core, eliminating the time-consuming and laborious task of pulling cable through a pre-extruded pipe.

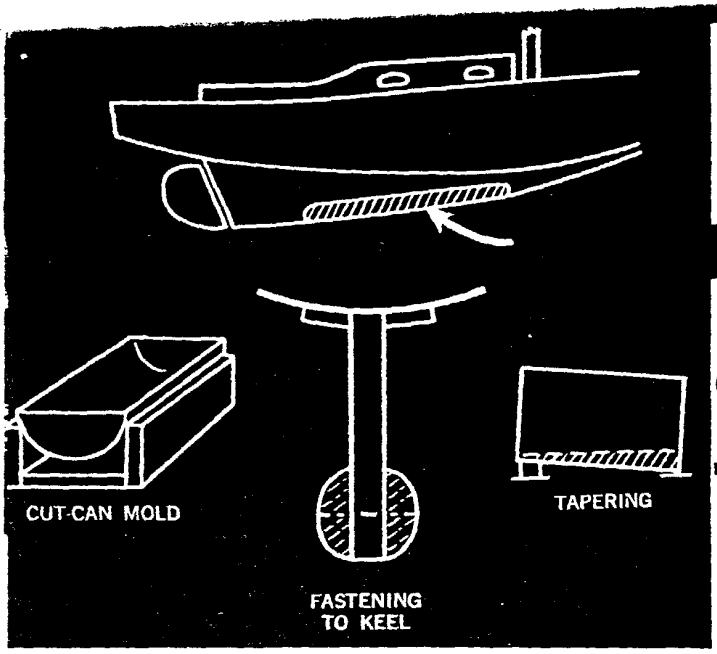
These lead covered telephone cables take on many outward appearances depending on the functional and environmental conditions under which they will be expected to operate maintenance free for many years.

## THEN

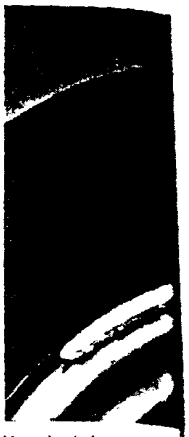


"Heave-ho" as in tug-of-war was the way they used to pull cable cores through lead pipes. Lead presses which automatically sheath the wires in lead made this method obsolete shortly before 1900.

LIA26332




# LS, WHEELS & OTHER WEIGHTY MATTERS



You don't have to lo
rims of your front wh
for close balance, a
weights for this use.

s an illustration of the ease of using lead for weight look at the builder's sketches f how he cast keel weights for a small sloop. A one-gallon antifreeze can was cut own the middle and lined with aluminum foil (to prevent sticking). Pouring in two ıches of lead resulted in a 20-pound half-round weight. Pairs of these were bolted n opposite sides of the keel for a streamlined surface. To fair the ends of the weight ack to the structure, he simply tilted the can and poured four weights which apered from 2 inches to nothing.

(Reprinted courtesy of *National Fisherman*, Camden, Maine.)

This pup has a well-balanced head on h shoulders. The lead counterweight and hoo and-eye support cause him to bob his hea and peer around whenever he's touched o moved.

ASK ten people to tell you something about lead and nine of them will say, "It's heavy." Actually it's dense—and there's a difference — but their point is well taken. There are an even dozen metals denser than lead: gold, iridium, mercury, osmium, palladium, platinum, rhodium, ruthenium, tantalum, thallium, thorium, and tungsten.

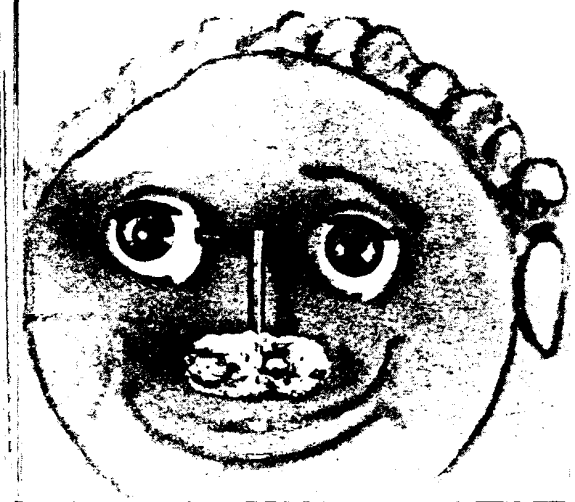
So long as cost is a consideration there's not much chance that lead will ever lose the fishing sinker market.

Lead's density of 11.3 (to 11.4 depending on whether it's cast or rolled, what alloying elements are present in small quantities, and so forth) grams per cc figures out to 707 pounds per cubic foot. In terms of things you lift every day, a coffee cup would hold five or six pounds of lead — think of that during your next coffee break.

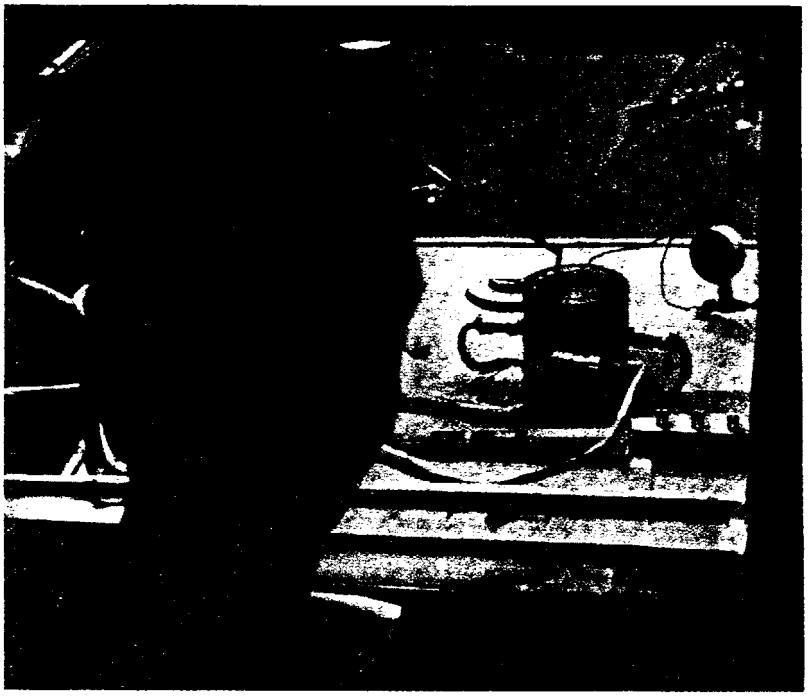
Lead as weight is used in so many ways that no collection of information like this one could hope to list them all or point out the interesting methods and wrinkles that have been worked out over the years. Most of these tricks depend on one of two properties of lead that make it easy to use for weighting. First, as sheet, lead is easy to work. It can be cut, stamped, punched, bent and easily fitted or fastened in place. Second, in bulk, lead is easy to melt. The temperature of 620°F required is within reach of anyone with a blowtorch or a gas burner. And molten lead for weighting can be put into "waste space" — corners and pockets of the item to be treated — or cast around projections or into keys so that no fastening or finishing is required.

If you have weighty problems of your own, Lead Industries Association, Inc. would like to help. Lead's density has been used, one way or another, since at least the time of Archimedes. LIA hasn't all the answers but its staff has worked with weights from tons to tenths of ounces. You can write with details of your problem for technical help.

ead is why dolly closes her eyes when you lay her down.



...ights! Chances are that they are crimped to the ... them. Inexpensive, available in incremental sizes ... exposure to weather they are the only practical



Installing a lead telluride thermoelectric element in the thulium-170 generator.

# LEAD
# THULIUM
# TELLURIUM

## *Partners in space-age power*

A new model thermoelectric generator for supplying electricity to small space satellites or solid state electronic equipment uses lead telluride elements to convert heat from radioactive thulium to electricity.

The conceptual design of the thermoelectric device has been assembled and successfully tested by engineers of General Electric Company's Special Purpose Nuclear Systems Operation and the Vallecitos Atomic Laboratory.

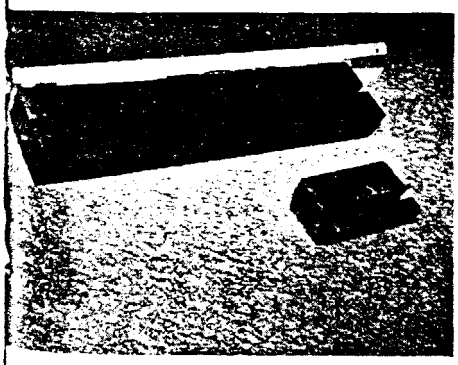
Pencil-sized thermocouple modules, each containing its own heat source and thermoelectric elements are connected in series and installed in an insulated container.

Each of the pencil modules in the generator consists of two lead telluride thermoelectric elements with an encapsulated thulium-170 heat source in the middle. The temperature drop along the lead telluride produces electrical current. Lead telluride was used because it is the most efficient converter of heat to electricity at low temperatures.

Special instruments are used to measure the temperatures and electrical output. During initial tests, the generator produced a power output of 1/2 watt. Tests are continuing to evaluate the long-term performance.

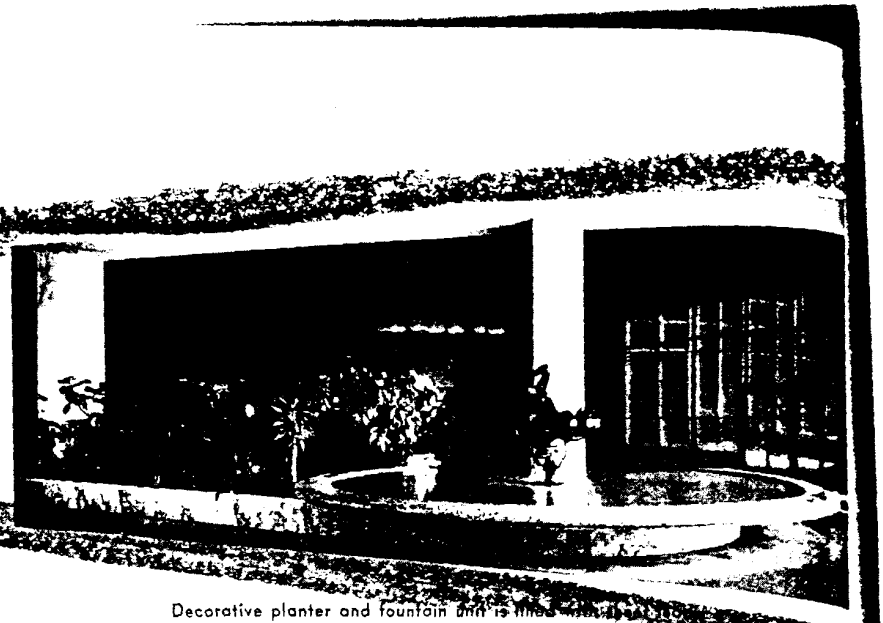
Development of the thermoelectric generator was sponsored by the U.S. Air Force which is interested in finding a reliable means of providing small but continuous amounts of electrical power primarily for aerospace applications. This small generator, General Electric says, could also be used to power underwater navigational beacons and other remote unattended devices needing small power supplies. Isotopes other than thulium-170 can also be used.

...o objects shown here are prototype and produc... ...ersions of lead weights for oceanographic use. ...aller was made by machining a five-pound cake ...ting lead. The groove has an enlarged circular ...along its root to engage a small pipe carrying ...sive and triggering mechanisms to the bottom. ...the idea was proved out, five pounds was found ...a trifle light in strong currents. In the production ...on a twenty-pound bar with the same groove pat... ...s cast and cut as needed into six and seven pound ...ts. Casting was designed and produced by Paraco ...ls, Inc., Elmhurst, N. Y.



LIA26334

# Putting a Pool in its Place— & Planters, too



Decorative planter and fountain unit is lined with lead. The lead is exposed in the planter but is an underlayment beneath the fountain tile.

Cobo Hall in Detroit is one of the largest exhibition buildings in the world. It covers 12 acres and contains 1,633,000 square feet of usable space in its three floors. Its water and sewer system are large enough to serve a city of 70,000 inhabitants and its air conditioning system is equivalent to 7,000 window air conditioners.

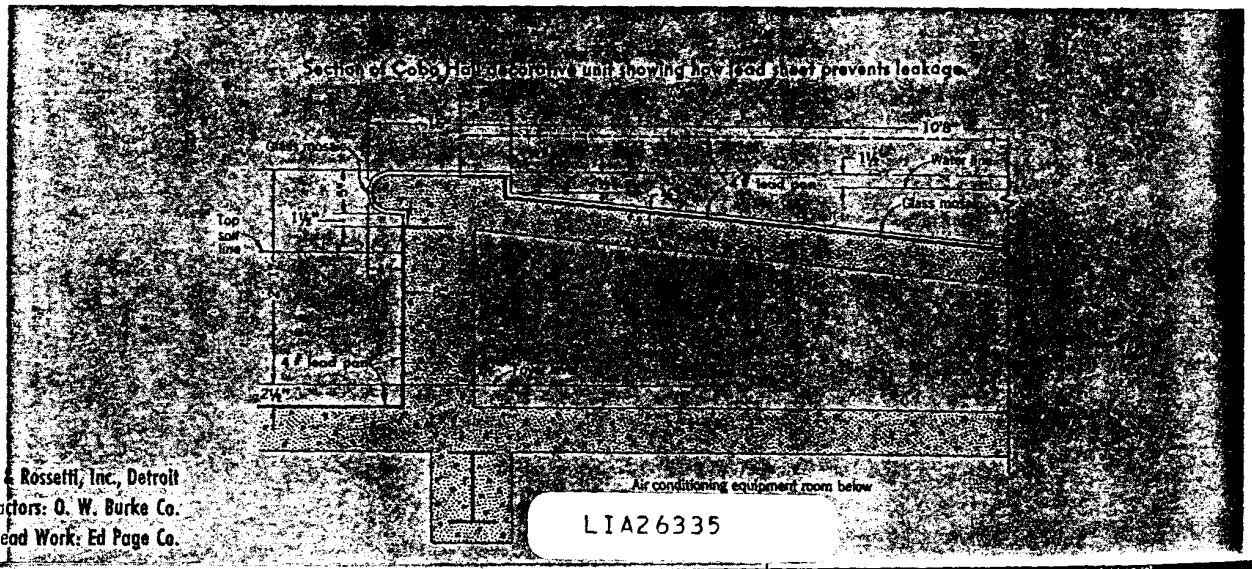
Good planning in a building this size demands more than vastness. Attention to detail is one of the hallmarks of good architecture and just as important as the staggering statistics at Cobo Hall.

For example, in a building like this, with a maximum length of as much as 900 feet, the monotony of endless corridors must be avoided or relieved. Devices to do this may take the form of changes in materials, areas or spots of color, built-in points of interest to focus attention or to divert it. One of these devices, used in a main corridor by the architects Giffels & Rossetti of Detroit, is a combined pool and plant box. It serves to mark the transition between the Convention Arena and the Exhibition Hall.

The pool itself is in the form of an almost complete circle, partially engaged at the wall. The planter is attached to the pool and runs parallel to the wall (photograph). Although the function of each is different, the need for completely waterproofing both is essential since they are located directly over an air conditioning equipment room. The architects chose lead as the most reliable form of waterproofing and made it an integral part of both the pool and the associated plant box.

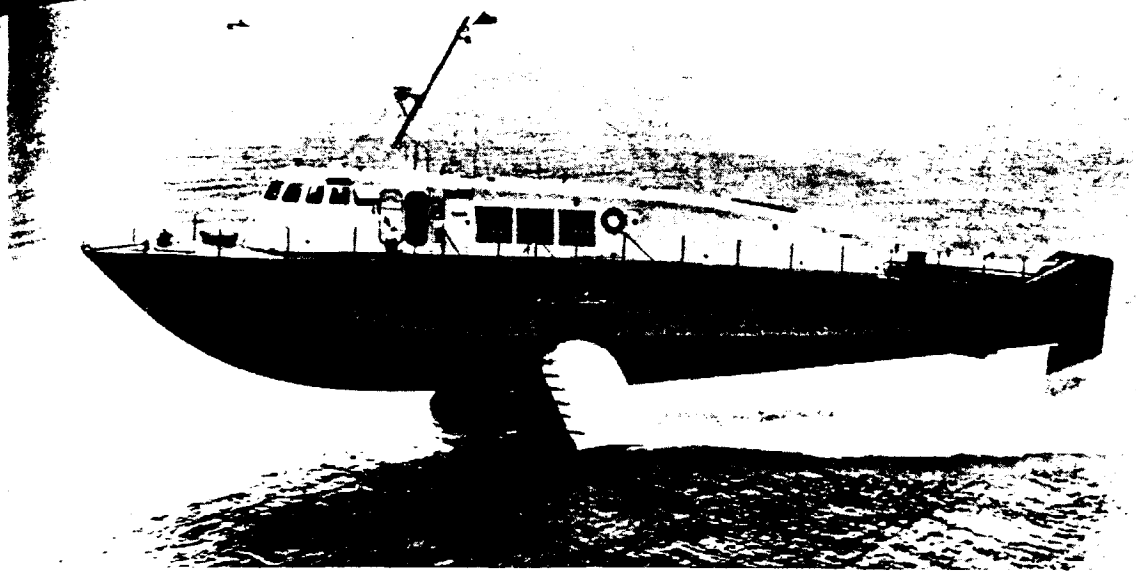
The pool itself, as a decorative element, was finished inside and out with tile. In this case the lead was used as an underlayment. In the case of the planter however, which would be filled with earth and plantings, there was no need to cover the lead lining with finish materials.

In both cases 4 lb. soft lead sheet was used and all joints were burned. The accompanying section illustrates how the components were combined into a single decorative unit which, along with the not inconsiderable help of Carl Milles' bronze sculpture "Sun Glitter," forms an extremely attractive display.




Section of Cobo Hall decorative unit showing how lead sheet prevents leakage.

Architects: Giffels & Rossetti, Inc., Detroit
General Contractors: O. W. Burke Co.
Lead Work: Ed Page Co.



*HS Denison* show here "flying" at 60 knots

# QUIETING THE *DENISON*

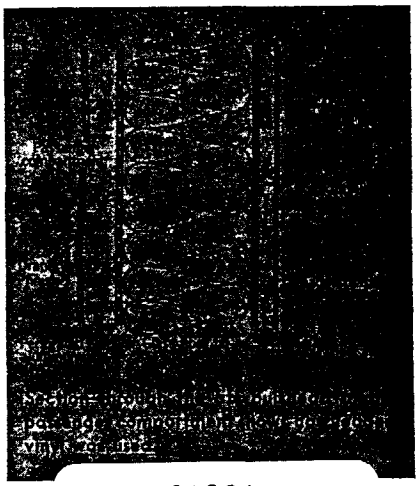
Hydrofoil vessels are not a new idea, but prior to the *HS Denison* nothing of her size and scope was seriously contemplated in this country. The craft is over 117 feet long, 23 feet abeam, weighs 95 tons and travels at better than 60 knots (70 mph).

Surface piercing foils located on each side of the hull carry 85% of the *Denison's* weight while a fully submerged tail foil carries the balance. Rough water operation is enhanced by a 5 foot clearance between the keel and the normal water surface when the boat is foilborne. Power is supplied by a big gas turbine engine not unlike those used to power jet airliners.

Because she was originally designed as a test vehicle, the *Denison's* interior had to be slightly modified when it was decided that the craft would also be used for demonstration purposes. The prime task was to furnish a compartment within the hull to accommodate 12 passengers. The compartment had to be comfortable and quiet. This meant that the roar of the huge turbine had to be subdued.

The passenger compartment is located well forward, below the pilot house. The aft bulkhead of the compartment is finished on the inside with glass fiber drapery hanging free of the surface. The forward face of the bulkhead is perforated sheet aluminum which retains a glass fiber batt two inches thick. This is supported, in turn, by the after face of the bulkhead, a sheet of 0.060 aluminum stiffened with vertical Z-bars. On the noise source side the facing is a leaded vinyl flexible sheet weighing 0.48 pounds per square foot and spaced ¼" off the bulkhead face.

In all, the bulkhead measures about 21 x 8 feet and takes only three inches of space to the face of the drapes. The combination of toughness with soft flexibility in the vinyl sheet has made it possible to seal the sheet to the hull with cement and seal it tightly around piping which must pass through the bulkhead. Both of these locations, if left unsealed, could pass enough sound to make the cabin quite noisy. The leaded vinyl is a coated fabric which has ample strength to support itself and resist wear and tear. It is fastened to the bulkhead by bolts, through one-quarter-inch washers, on two-foot centers.



LIA26336

By spacing the sheet away from the rigid bulkhead surface, Grumman engineers have assured themselves of obtaining the most efficient performance possible! Mass and limpness are two of the key factors in blocking noise transmission and this method of support permits the limp-mass of the high density barrier to exert itself.

Among the other soundproofing measures taken was use of a false deck floating on vibration isolators within the compartment, the use of sound absorbent materials within the compartment, and careful sealing of cracks and gaps with lead-loaded vinyl strip.

The lead-loaded vinyl fabric, Coustifab,® is 0.030 inches thick and contains powdered metallic lead dispersed in a vinyl binder. The base side is a pre-coated woven glass fabric which is coated with the lead vinyl, and then topcoated with a tough gray vinyl finish-coat. It is one of a number of standard weights, colors, and grades of Coustifab produced by the Cordo Division of Ferro Corporation, 34 Smith Street, Norwalk, Conn.

Not only have Grumman people been pleased with the results of their soundproofing, they have had many favorable comments from visitors. Some of them have said the cabin is quieter than the cabins of jet airliners — a real accomplishment considering the close proximity of the engine. Grumman engineers give much of the credit to the leaded vinyl sheeting.

# Soft lead tubes blast holes in steel

Short sections cut from the extruded lead tubes show the explosive filling in its characteristic "shaped charge."

Small diameter lead tubes filled with explosive are now being used for cutting sheet steel, separating stages in space vehicles, for controlled destruction of missiles and for conducting completely confined explosive detonation signals.

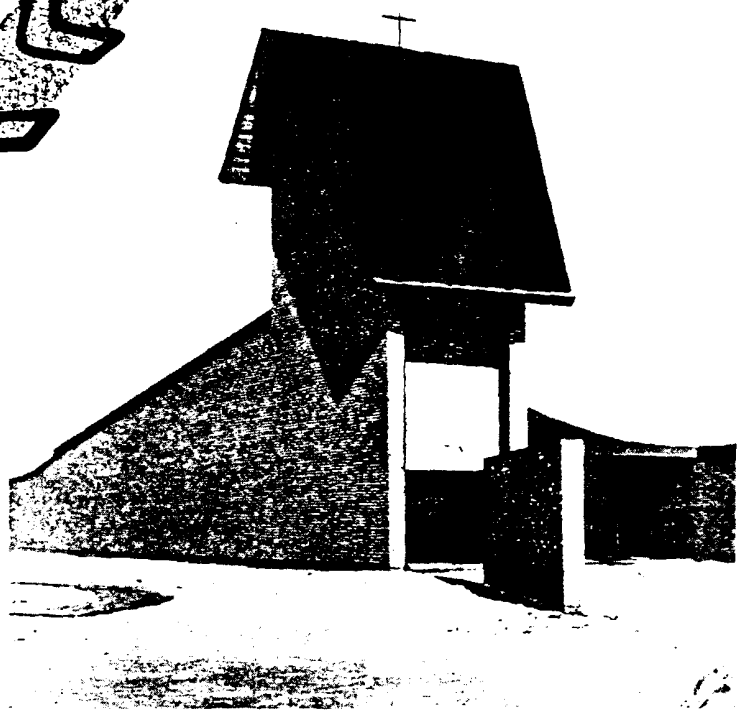
The explosive-loaded tubes have a V-groove on one side. When this grooved face is placed down on the metal to be severed and the explosive is detonated, the blast pressure focused by the sides of the groove cuts the metal. This "shaped charge" principle was widely used in World War II for armor piercing projectiles. These explosive loaded lead tubes or Flexible Linear Shaped Charge (FLSC) are designed and manufactured by The Ensign-Bickford Co., Simsbury, Connecticut.

Lead was selected for the shaped charge primarily because of the ease with which it can be cold worked. Lead is more ductile than other available metals and, particularly important when working with explosives, it does not heat up significantly during forming. Its flexibility and chemical stability are also advantageous, according to Ensign-Bickford.

In applications where total confinement of the detonation signal is desired, such as aerospace installations, an explosive loaded lead wire is employed. A low density material such as polyurethane foam fits around the wire and the entire structure is encased in a strong housing of Fiberglas/phenolic laminate or metal to complete the confining structure.

These are the actual sizes of the sections shown in the photo.

# Terne Accents Church Design



**A striking tower roofed with terne metal is the focal point of this award winning church in Lansing, Illinois. Architect Edward D. Dart's design uses the converging lines of three walls and the ascending line of the roof to direct the eye to the chancel directly beneath the tower. Walls of the church are pink tan brick. The architect took advantage of the adaptability of the terne metal, produced by Follansbee Steel Corporation, Follansbee, West Virginia, to specify that the terne roof be painted a harmonizing olive brown. In addition, the roof's standing seam construction provides [illegible] and shadow effects.**

# Interesting Odds 'N' Ends... about Lead

**Curses, foiled again!** This glowing, animated, scribbling monster, called the "Corrodent," demonstrates the futility of corrosives' attack on lead. The frustrated monster, clawing away at a lead sheet was probably the most popular feature of the Lead Industries Association exhibit at the recent Chemical Industries Show.

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**The hottest thing in transformers** is this LVDT or linear variable differential transformer. It is not the type used on power lines or with toy trains but a sensitive measuring instrument capable of detecting movements of only millionths of an inch. Instrument engineers make good use of its hair-splitting accuracy by coupling it to pressure, temperature, or other primary detectors to convert their outputs to precise electrical signals. Made by Schaevitz Engineering of Pennsauken, N. J. This particular transformer has been tested for 10 hours at a blistering 1200°F and is still accurate. In order to operate in such hot spots (the service rating suggests 450 to 1000°F — not exactly chilly), the windings

are made of wire which is insulated with leaded porcelain. Sufficiently flexible to permit handling and winding, the wire is then heat-treated to produce a continuous glass coating which offers good electrical resistance at high temperature and is not subject to oxidation or breakdown in normal operation — even in intense radiation ($3.5 \times 10^{20}$ NVT). Secon Metals Corp., of White Plains, New York produces the wire.

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**New way of cladding copper with lead** provides extremely heavy solder coats on copper and other metals. Tin solders as heavy as 0.04 in. have been applied to copper as thin as 0.005 in. The developers, Composite Industrial Metals, Inc., Providence, R.I., claim that many other metals can be coated with lead, tin or their alloys for use in automated and induction heated joining operations.

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**New wrinkle in cathodic protection** for ships has been developed in Germany. In addition to conventional lead anodes for impressed current the system uses a zinc reference anode. Current between the zinc anode and hull determine the current fed to the lead.

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**How High?** If a typical lead-acid automotive battery were fully charged and used to run a perfectly efficient hoist (without friction or weight other than the battery), how high would it be able to raise itself?

a) 3000 feet  b) 2 miles
c) to the moon  d) 7.5 miles

If you answered c, you're an incurable optimist — d is the correct answer.

## Thirty Years Ago

A silent propulsion unit for rowboats and canoes powered by lead-acid batteries was described in a 1933 issue of LEAD. The unit was said to be able to drive an ordinary boat at either two miles an hour or four. It was simple enough for a child to operate and was somewhat portable at 38 lb. Trim lightweight units descended from this development are still propelling successful bass fishermen for silent trolling along the shoreline today.

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# lead

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