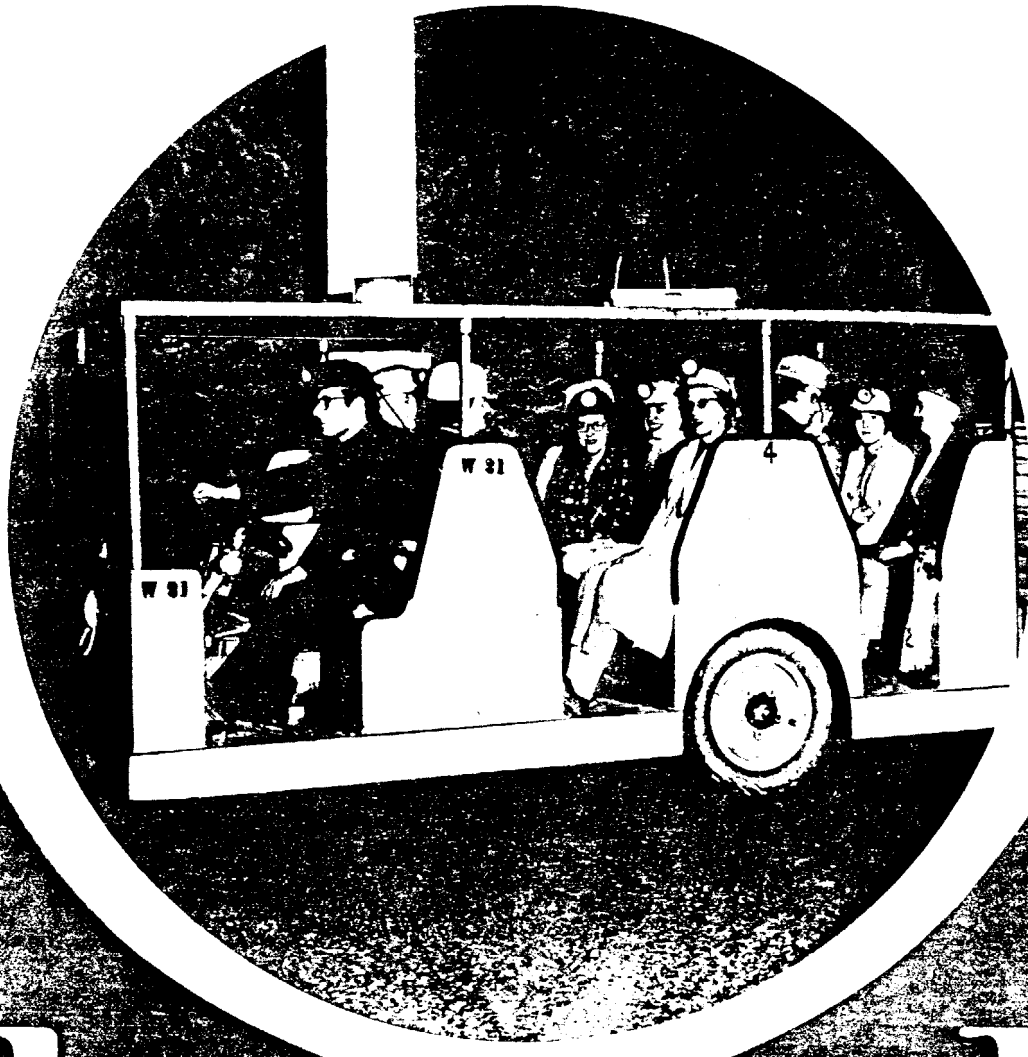


lead

LEAD INDUSTRIES ASSOCIATION, INC.

292 MADISON AVENUE, N.Y. N.Y. 10017

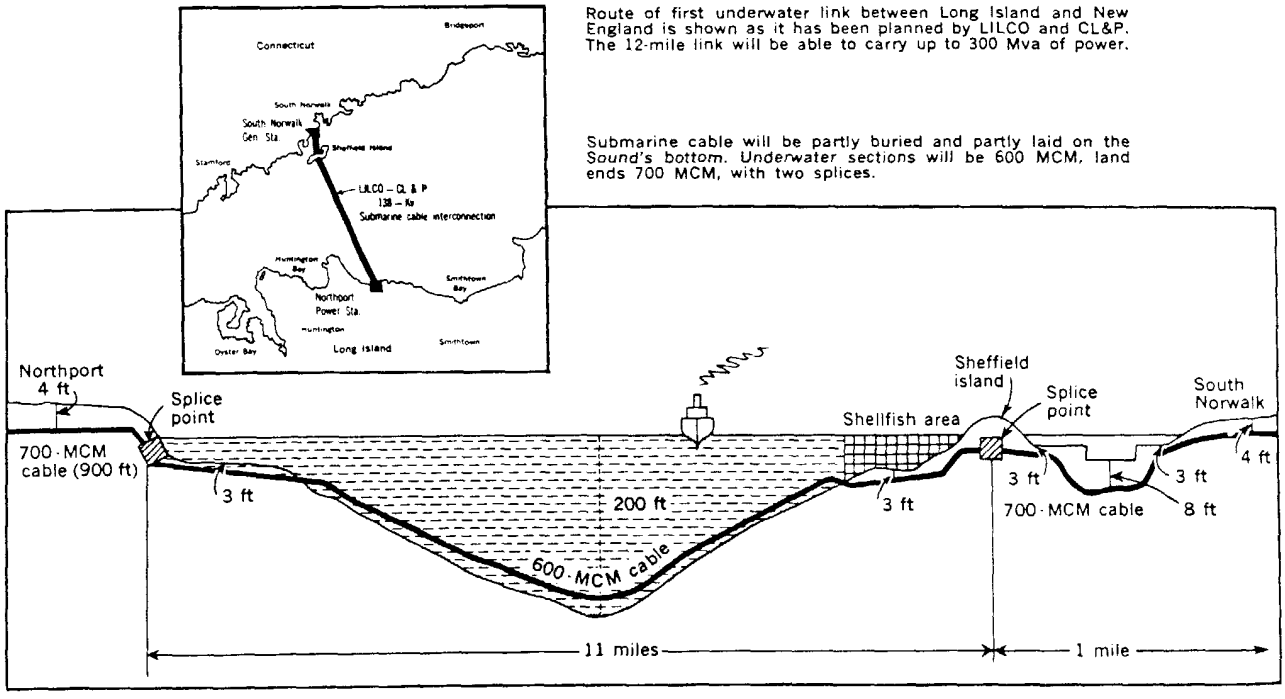
SUBMARINE POWER CABLE RELIES ON LEAD

By mid 1970, one of the world's longest oil filled submarine power transmission cable systems will become operational, providing the first underwater link between Connecticut and Long Island. A joint venture of Long Island Lighting Co. (LILCO) and the Connecticut Light and Power Company (CL&P), an affiliate of Northeast Utilities, the cable will connect LILCO's Northport generating station with CL&P's Norwalk Harbor plant. The plant-to-plant distance is 12 miles and the tie will require 84 miles of cable to complete the 3-phase circuit consisting of two cables per phase with a spare.

Because the project represents the installation of an underwater power transmission cable of the first magnitude, extensive engineering studies were made along with a penetrating underwater survey of the route. Both companies cooperated in the engineering which extended over a two year period. This engineering team, by joint decision, selected lead-sheathed, oil filled cable as the key to long lasting success for the project. Lead sheathing was chosen because the reliability and ease of repair. Then, too, lead sheathed cable is flexible, impermeable to water, corrosion resistant and chemically stable. A prime reason for the use of lead is its adaptability to continuous extruding over the cable in lengths long enough to span the width of the Sound with a minimum of splices. One splice point is on the Long Island shore, 900 ft. from LILCO's Northport station. Another splice point is on Sheffield Island off the Connecticut coast and about a mile from the Norwalk Harbor station.

The main cable crossing will be made using 600 MCM lead-sheathed polyetheline jacketed cable clad with armor wires. These wires are covered with bituminous-treated cloth for protection. The cables will be buried 3 ft. under the bottom of the Sound to a water depth of 35 ft. The link from Sheffield Island to the Norwalk Harbor station will utilize 700 MCM cable with the armor wires removed at the land end. Again the cable will be buried to a depth of 3 ft. except at the entrance channel into Norwalk Harbor where it will be covered to a depth of 8 ft. In the shellfish areas off the coast of Sheffield Island, where dragging is done, the cable will be buried under the bottom out to a depth of 35 ft. Spacing between the seven cables will be about 900 ft.

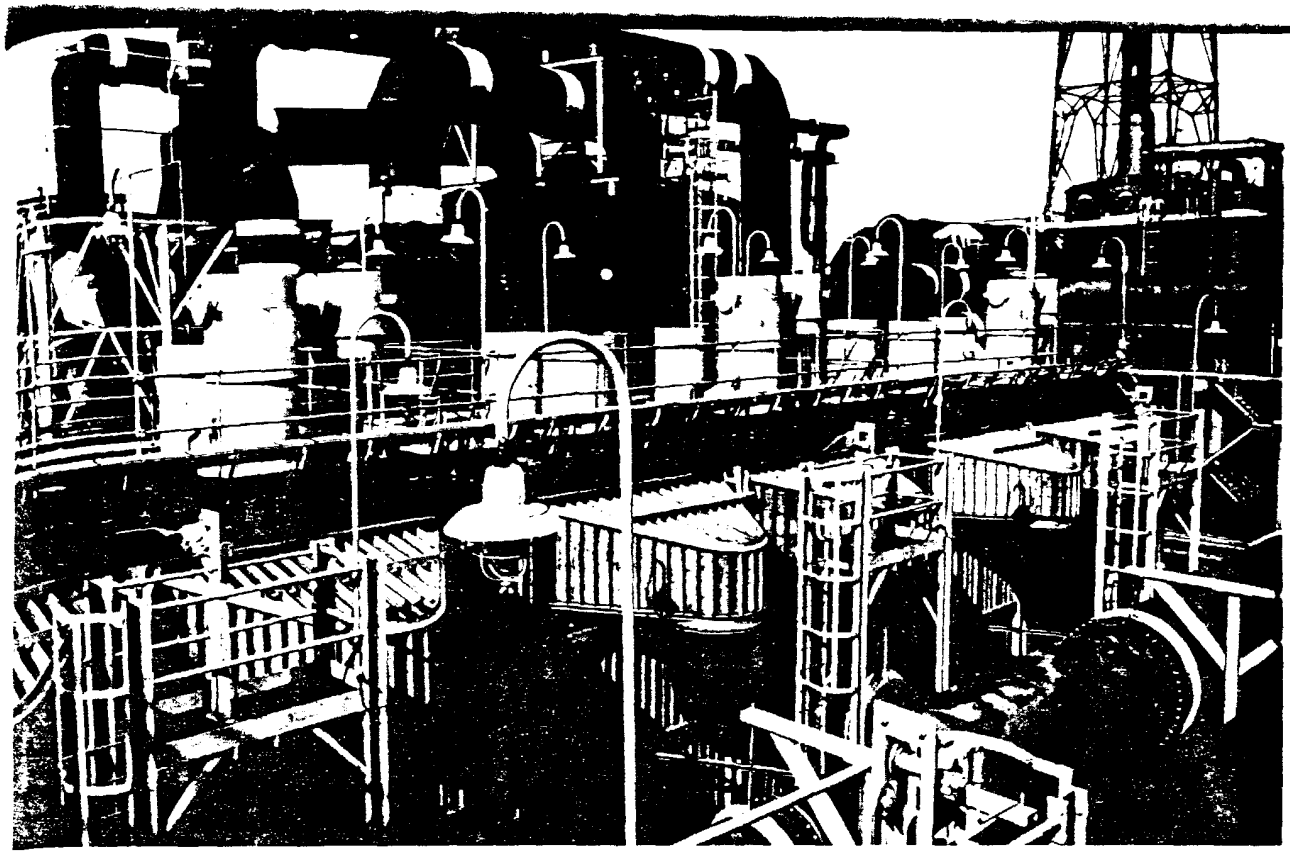
The $8 million interconnection will permit the two utilities to exchange power at any time during periods of heavy demand, resulting in savings for both companies. It will also allow them to increase electric power reliability. When the tie goes into operation, it will carry sufficient current to serve more than a quarter-million homes. The lead sheath of the cable will protect it against the environmental conditions for many years.



Route of first underwater link between Long Island and New England is shown as it has been planned by LILCO and CL&P. The 12-mile link will be able to carry up to 300 Mva of power.

Submarine cable will be partly buried and partly laid on the Sound's bottom. Underwater sections will be 600 MCM, land ends 700 MCM, with two splices.

LIA26545



A new plant of one of Great Britain's largest sulphuric acid manufacturers features lead lined electrostatic precipitators.

$Pb + H_2SO_4 = LCA^*$ *Low Corrosive Action

For many years, lead because of its excellent resistance to many corrosives, has been used in large quantities throughout the chemical processing industry. Lead has become the traditional material for use in the construction of electrostatic precipitators in sulphuric acid service.

A major construction breakthrough using new fabricating techniques may well extend lead's utility in other processing industries.

The new construction techniques were used to advantage in the building of a new plant for one of Great Britain's largest sulphuric acid manufacturers. A new precipitator was site-erected from shop fabricated parts in record time and with substantial savings. The prefabricating techniques recommended by Lead Fabricators, Ltd., resulted in reducing the erecting time from 12 to 6 months.

The actual installation was made up to two banks of three precipitators in the form of steel structures with lead shells and internal lead tubes and coated electrode wires. Attachment of the sheet lead shell to the steel supporting frame was important from the operational as well as the economic point of view. Because the precipitators operate on low pressure, the shell had to be designed to meet this condition. In the interests of low costs, the means of affixing the lead required careful consideration in order to keep the amount of welding to a minimum. After a comprehensive design study that included the making of a mock-up for evaluation purposes, the "lead-wing to steel strap" method of affixing was adopted.

Instead of fabricating large bore internal tubes from sheet lead on the site, Lead Fabricators developed extrusions of 10 in. bore x 3/16 in. wall chemical lead tube in straight lengths of approximately 15 ft. As tube straightness and concentricity are vital to the efficient operation of the precipitator, the extruded tubes were secured in the vertical position until installed at the site.

Each precipitator comprises a shell made up of six sections plus the internal arrangement of 10 in. bore lead tubes supported at the top by a tube plate and electrodes suspended from a support frame. Steel structural frames were completely lined with lead on Lead Fabricators' shop floor. Manufacturing efficiency was improved because the fabricator was able to perform 80% of the welding in the horizontal position.

On the site, the unloading and initial erection of the six-shell section was completed in one day using a mobile crane. This was followed by the steel welding operation at the vertical joints and internal welding to seal the lead lining. Prior to erection of the roof section, the 15 ft. long 10-in. bore tubes were lowered through the tube plate and secured to the top face. The lead star electrodes were fitted and tensioned after the roof was placed in position and sealed.

INTERNATIONAL WINNERS ... Lead Power '68

Winners in the International Competition held in conjunction with the "Lead Power '68" year were announced recently at the third International Lead Conference held in Venice, Italy. American entries won three of the six prizes.

* * *

In the category calling for "An Outstanding Application of a Lead Acid Battery Powered Truck" the top prize of $1000 was awarded to Control Engineering Division, Jervis B. Webb Company. The winning invention is a completely-automated, battery-powered driverless cart designed to meet the need of today's hospitals, industrial plants, offices and similar applications.

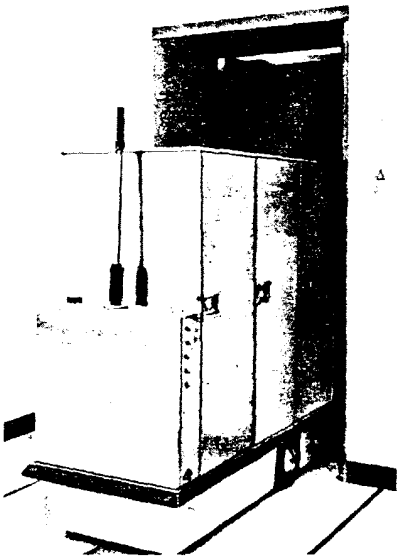
Called the "PronTow Mini-Cart," it receives commands from a dispatcher and will travel a predetermined path until it reaches its destination. The cart will automatically signal for an elevator and desired floor. It is driven by three 12-volt industrial batteries which operate a full day before charging is necessary. The self-contained charger can be plugged to any 110-volt outlet.

* * *

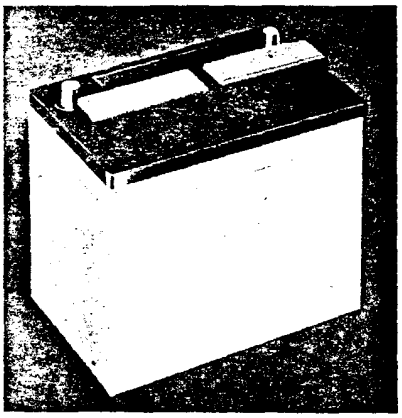
First prize of $700 in the Development in Battery Technology and Research category was awarded to Globe Union Inc. for the development of a polypropylene battery case. The thin walls of the new containers make it possible to use more and larger plates and a greater volume of electrolite without any increase in outside dimensions. This gives the batteries about 35% more power. The containers are nearly five pounds lighter than hard rubber ones.

* * *

A third prize of $250 was awarded to the entry of General Foods Corporation in the Lead Acid Battery Powered Truck Competition. The pallet truck is a 4000-lb. capacity, low-lift, and can be converted to a flatbed carrier. Built to General Foods' specifications by Moto-Truc, Baker Division, Otis Elevator Company, the truck features a hydraulic ram with pusher plates integrally mounted to deposit palletless loads. A special jackknife feature permits angling of the bed to reduce distances the load must drop. Power comes from a 12-volt system with batteries rated at 680 amperes at a 6-hr. rate of discharge. General Foods, with 30 of these now in operation and another 36 on order, says the system is reducing operating costs over $300,000 each year.



The PronTow Mini-Cart, winner of first prize in the "Outstanding Application of a Lead Acid Battery Powered Truck" category, is shown making the rounds of a hospital. The Mini-Cart can be guided either manually or automatically. It can make 24 stops, including those to call an elevator and select a desired floor. It is operated by three 12-volt industrial batteries.



The new polypropylene case by Globe Union won first prize in the "Developments in Battery Technology and Research" category. Because of thinner walls, the size of battery grids and amount of electrolite can be increased without increasing outside dimensions. The case is also lighter than conventional hard rubber.

HOFMANN MEMORIAL

A special feature of the Third International Conference on Lead was the awarding of the newly established Hofmann Memorial prize. Created in memory of the late Wilhelm Hofmann, an eminent specialist on lead, the award is made in recognition of outstanding lead research.

Awards went to I.S.R. Clark of Canada for a paper on Extractive Metallurgy; N. E. Bagshaw of England for his paper on Physical and Mechanical Metallurgy; and to P. L. Martini and A. Bianchini of Italy for Lead Research in Other Fields. A special award went to H. H. Cerjak of Austria.

Hofmann awards will be presented again at the International Conference on Lead in 1971. Those wishing to participate in the competition can contact Lead Development Association, 34 Berkeley Square, London, W1, England, for information.

LEAD PIGMENTS GO TO SEA

Since the advent of iron men who went to sea in steel ships, red lead has been an ever present part of the seascape. Historically, red lead primers have been used to prevent corrosion. Apprentice seamen cut their teeth hanging over the side in boatswain's chairs chipping and patching the hull with red lead primers. Even in the early days of steel ships, a simple formula of red lead, raw linseed oil and driers along with appropriate topcoats prevented environmental attack.

Present day formulas have done little more than improve the vehicle and make minor additions to the pigment. Newer vehicles include alkyd resins, vinyls and epoxies. But the red lead pigment gives the primer its power to inhibit rust and corrosion caused by the salt atmosphere.

One of today's modern formulas is exemplified by LIA No. 500. It is recommended for bottoms, boot topping, hulls and houses. This formula conforms to Corps of Engineers Formula V-101 and Military Specification MIL-P-15929.

Another excellent formula is LIA No. 900. This formula for an antifouling primer was service-tested by the U.S. Navy on three destroyers that were launched in 1959. This formula, based upon a red lead-coumarone pigment, performed comparably to No. 14N (MIL-P-19453) coating which is Navy standard for ship bottom service for antifouling systems.

Leading steamship companies rely on the red lead primer systems to protect their fleets. An outstanding one, the Moore McCormack Lines, Incorporated, uses them on all 22 of their vessels in the C3 class. According to Captain Dino Savastio, Marine Superintendent for the line, red lead is the ideal maintenance primer. The cost factor is very favorable also. The red lead system saves more than 50% as compared with other corrosion protective primers. He also notes that the red lead can be applied at sea under less than ideal conditions.

While at sea, rigging and house are painted. Boot topping and hull are done when the vessel is in port. During the once-a-year inspection in drydock, the ship bottom is painted if needed.

Because red lead has been used on vessels for so long, its performance can be predicted. This makes it possible to establish a scheduled maintenance program for each ship.

The surface preparation required for red lead primers is much easier to accomplish. Chipping or brushing with pneumatic tools is normally all that is done. When it comes to protection at sea it's difficult to find a primer that has all these advantages.

FORMULA L.I.A. NO. 500

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	100.0	220.0	2.9
		100.0		
VEHICLE:	Vinyl Resin	19.4	145.0	12.3
	Tricresyl Phosphate (Fed. Spec. TT-T-656)	2.0	15.0	1.5
	Methyl Isobutyl Ketone	39.3	295.0	43.3
	Toluene (Fed. Spec. TT-T-548)	39.3	295.0	40.0
		100.0	970.0	100.0

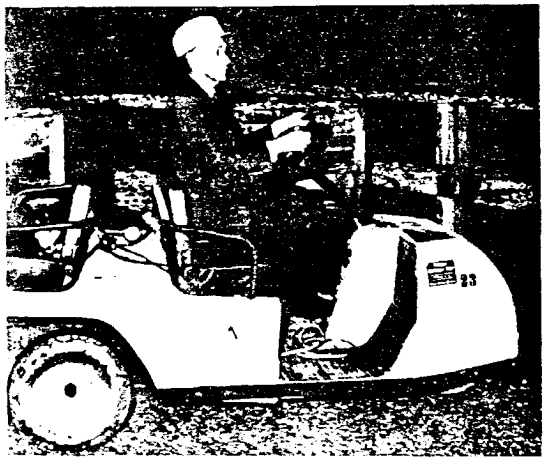
Pigment by weight 22.6% Vehicle by weight 77.4% Wt./Gal. 9.7 lb. PV 17.4

FORMULA L.I.A. NO. 900

	Composition	Per Cent	Pounds	Gallons
PIGMENT:	Red Lead (97% Grade)	47.0	332.0	4.51
	Zinc Oxide	8.3	58.1	1.24
	Zinc Yellow	8.8	62.2	2.08
	Mica, 325 Mesh	8.3	58.1	2.46
	Magnesium Silicate	27.2	192.0	8.07
	Aluminum Stearate	0.4	3.1	0.37
		100.0		
VEHICLE:	Coumarone-Indene Resin (M.R. 127-137°C.)	25.4	166.0	18.12
	Coumarone-Indene Resin (M.R. 5-15°C.)	8.7	57.0	6.22
	Liquid Coal Tar (MIL-T-15194)	8.9	58.1	5.87
	Zinc Resinate ("Zinar" or equivalent)	3.2	20.8	2.17
	Chlorinated Rubber 20 Centipoise Viscosity ("Parlon" or equivalent)	6.3	41.5	3.03
	Hi-Flash Naptha (MIL-N-15178, Type A)	31.7	208.0	28.50
	Aliphatic Petroleum Spirits (B.R. 205-260°F.)	15.0	98.5	16.69
	Pine Oil	0.8	5.2	0.67
		100.0	1360.6	100.00

Pigment by weight 51.9% Vehicle by weight 48.1% Wt./Gal. 13.6 lb. PV 35

MUSHROOM FARM IN A MINE



Steven Sinkevich, Butler's Plant Engineer, makes a tour of inspection through the growing galleries in a battery powered personnel carrier.

This specially designed lead acid battery powered personnel carrier transports the workers to their underground work stations.

Mushroom farming is a big business, and Butler County Mushroom Farm, Inc., of Worthington, Pa., has found that lead acid battery powered vehicles help to make the operations profitable as well. Using about 60 battery powered vehicles of all types, Butler can attest to their reliability, clean, quiet operation and ability to adapt to environmental conditions. The vehicles also provide fast, low cost, dependable transportation, a fact that has led to Butler becoming one of the world's largest producers of mushrooms.

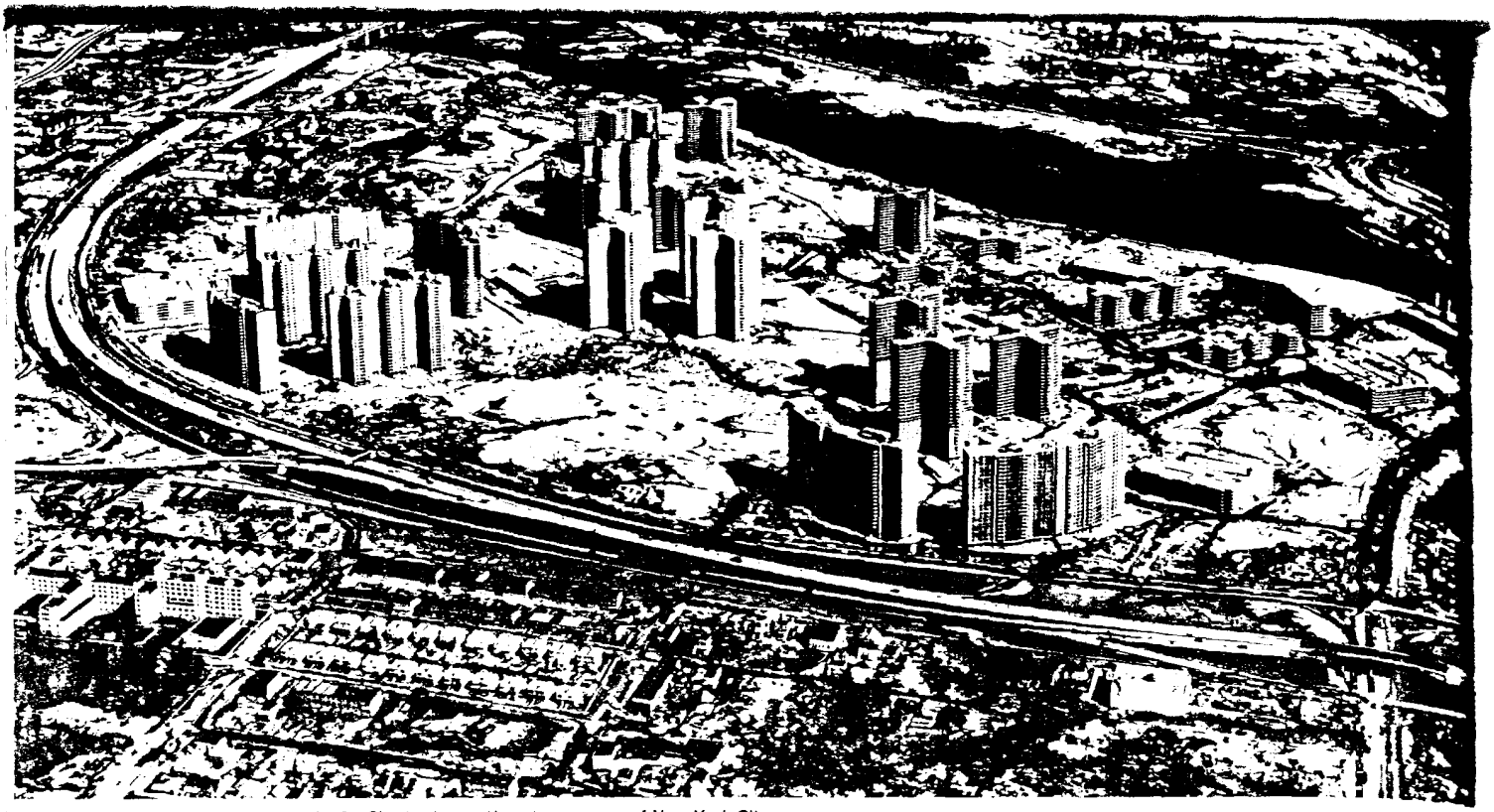
The farm is located in a worked-out limestone mine. The underground site with its high humidity and year-round temperature of 56°F makes it well suited for the purpose. Spread out over hundreds of acres underground, Butler grows more than 24-million pounds of mushrooms each year. They are sold under the "Moonlight" label and distributed country-wide.

Above ground production consists of a spawn laboratory, research department, and packaging and production facilities. From the collection of spores to the final dumping of compost trays, according to Mr. Steven Sinkevich, plant engineer, Butler's answer to the materials handling problem was to adopt the techniques of industrial plants. This includes the use of conveyors, fork lift trucks, flatbed trailers and personnel carriers.

The mushroom cycle starts with spores developed under sterile conditions to provide a spawn. Then compost that has been placed in large wooden trays, weighing 1,600 lbs. when filled, is placed in pasturizing rooms at 135°F for three days. The spawn is then planted in the compost. The trays are placed on trailers for transportation to spawn growing rooms in the upper mine. Using a special circulating system and air from the mine, temperature is maintained at 70°F to promote initial growth.

After three weeks the trays are moved by electric fork lift trucks to the machine room where the growth is covered with a layer of rich loamy soil. The trays are next transported to the lower mine for the rest of the growing period.

After 21 days picking begins. Pickers are transported underground in specially designed lead acid battery powered vehicles. The three-wheeled personnel carrier seats 12 pickers, a



An aerial view of Co-Op City in the northeastern corner of New York City.

WORLD'S BIGGEST PLUMBING JOB

The eerie silence of a deserted amusement park has been replaced by the sound of workmen busy with the task of building a huge housing project. On the site of the former Freedomland Amusement Park in the northeast corner of New York City, the housing complex, known as Co-Op City, will have, when completed in 1970, 60,000 residents—a population equal to that of Atlantic City, N.J. They will be living in 35 tower apartments and 236 town houses that make up the project.

The task of bringing the vast quantities of materials and supplies into this city within a city was almost as intricate as the logistics necessary to keep an army on the move. Requirements in many cases equalled or exceeded the entire output of suppliers. Carload after carload had to be brought to the site on schedule for immediate use. Stock piling had to be avoided as much as possible to prevent pilferage and damage in storage.

The plumbing contract alone is believed to be the largest ever let in New York City, possibly the entire country. With over 15,000 dwelling units there will be the same number of bathtubs, showers and kitchen sinks. There will also be 20,000 each of water closets and lavatories and literally miles and miles of piping and soil lines. This is plumbing on a grand scale and it requires a lot of planning, plus the use of time tested procedures.

The use of lead—the most reliable material in plumbing—was a natural on this project. Bell and spigot soil pipe was calked with oakum and the joints formed with lead to the depth of one inch to assure a long lasting closure. Water closets were connected to soil lines with lead bends.

Before the job is completed about 1,000,000 pounds of calking lead will have been used. Add this to the 15,000 lead bends which average 14 pounds each, and you have 1,210,000 pounds of lead—over 600 tons.

When completed, Co-Op City will have cost $300 million and will occupy a 300 acre tract of land. It is described as the biggest, most ambitious venture yet in cooperative housing. Besides the apartments, the area will also include six schools, several large shopping areas, plus eight parking garages, each a block long and seven stories high.

Credits:

Owner—Riverbay Corporation
Sponsor—United Housing Foundation
Architect—Herman J. Jessor
General Contractor—Community Services Inc.
Mechanical Engineers—Franzblau & Fitzimmons
Structural Engineers—Farkas, Barron & Partners
Plumbing Contractor—Wachtel Plumbing Co.
Landscape Architects & Site Planners—Zion & Breen Associates
Garage Consultants—Seymour Gage Associates
Power Plant Engineers—Utilities Engineering Associates

Oakum is placed in a horizontal joint prior to the pouring of the lead.

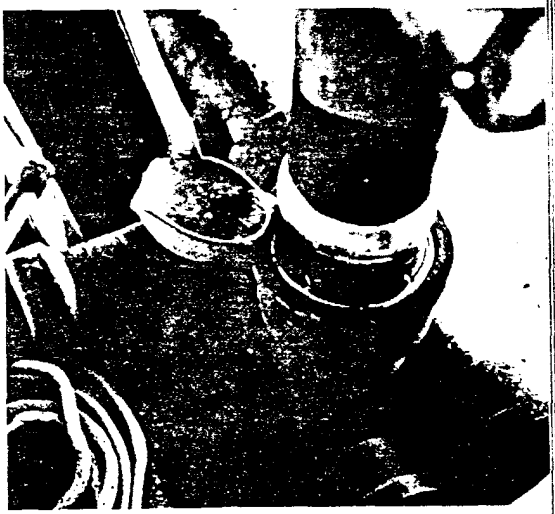
Lead-oakum joints provide maximum strength in every plumbing installation. They maintain their seal integrity at temperatures as high as 200°F. Unlike the rubber-based substitutes, lead-oakum joints are impervious to sewage, detergents, drain cleaners and a host of other materials, as attested to by research sponsored by the International Lead Zinc Research Organization. Final test results were given at annual meetings of the American Society for Sanitary Engineering.

Send for your copy of these reports along with pertinent facts about the advantages of lead-oakum joints in cast iron bell and spigot soil pipe. Use request card on back cover.

Brass ferrule and lead bend are prepared for wiping.

Molten solder is poured over the joint. This procedure is used to raise the base metals to the proper wiping temperature.

When all of the elements are at the proper temperature, the joint is formed with a wiping cloth.



Molten lead is poured into a vertical joint to a depth of one inch and calked to insure a long lasting closure.

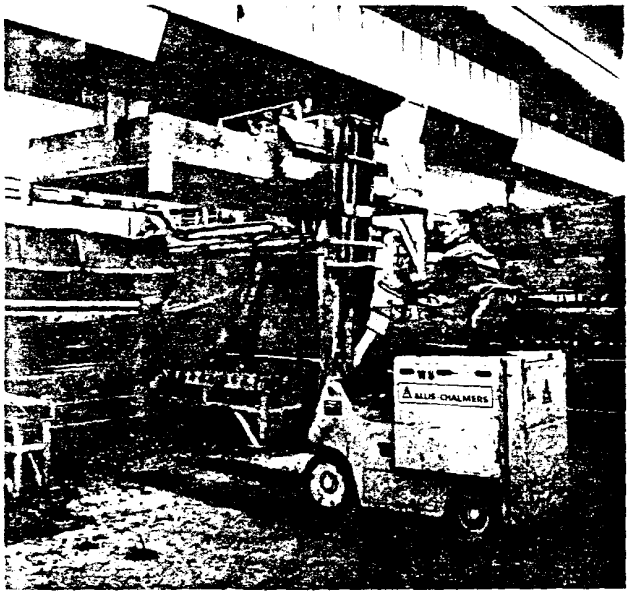
foreman and a driver. It also pulls a trailer that carries baskets of mature mushrooms and a large metal box for the root section cut off by the picker. The same vehicle carries the crews to and from a well lighted and heated underground cafeteria. Lead acid battery vehicles are also used by the food concessionaire to service the cafeteria.

Once picking starts, the trays are picked daily, seven days a week, to assure that the mushrooms are at the proper stage of maturity. Each tray is picked for 45 days. To provide working light, the pickers use hard hats equipped with miner's lamps. The lamps are powered by lead acid batteries worn at the waist.

When a tray is completely picked it is transported to the surface where fork lift trucks take it through a sterilization process and dumping. Trays are carried back to be refilled, and the growing process starts over again.

Above:
A rugged, fork lift truck that is used to handle the big growing trays pauses between shifts to have its lead acid battery recharged.

At Right:
Women wearing hard hats topped with lead acid battery powered miner's lights harvest the mushroom crop.



Trays of pasteurized compost are placed on a conveyor by a lead acid battery powered fork lift truck.

To speed food service to the underground cafeteria, the concessionarie uses lead acid battery powered trucks.

LIA26552

LOW MELTING POINT ALLOYS

Properly understood and applied, low melting point alloys are versatile industrial tools of great value. Lead is usually one of the major ingredients of such alloys, along with bismuth, cadmium, tin and indium. To a minor degree, silver, antimony, mercury, copper, thallium, gallium, arsenic and zinc are also used. Literally hundreds of alloy combinations are possible with progressive fusing points from 95°F (35°C) to 300°F (149°C).

By using varying amounts of bismuth, which expands 3.3% upon solidification, along with elements which shrink upon solidification, useful net shrinkage or expansion of each alloy mixture can be predicted. For instance, alloys with less than 48% bismuth shrink, those with 48% to 55% change but little, and with over 55% bismuth, they expand during solidification. By varying the quantity of lead in the alloy, controlled changes in volume can be attained. Thus the combination of the low melting points and predictable changes in volume provides numerous applications for these alloys. Some examples:

Anchoring—Used to join one component to another mechanically. Particularly valuable where a rapid joint or a low volume of connections is needed. Extremely useful where parts to be held are of irregular shape such as hold down bolts, blanking punches, etc. Little skill is needed once parameters have established the alloy required. See Figure 1.

Chucks, Jigs and Fixtures — Of vital importance when applied to irregular shapes. Simple nests for complex parts on indexing devices or assembly turntables can be used and reused.

Cores—Complex cores that must be easily and quickly removed are simple to make with low melting point alloys. Used for support of built up sections such as those made of glass fiber and those made for electroforming. Also used as foundry cores. A new technology incorporates "patterns" made from the spaces which eventually reproduce the complex vanes of an impeller for a centrifugal pump. When the refractory mass of the core is burnt off in the usual way the lead and tin alloy melts out leaving extremely smooth accurate impressions of the vanes in the impeller. After careful determination as to the proper lead and tin alloy that was best, the eutectic was selected. The low melting point is such that the blades can be completely removed from the core without damaging it. In addition more than 85% of the pattern alloy is recovered.

Dies and Punches—In this application, alloys have the unusual property of "memory", and return to shape after short impact. However, they cannot stand prolonged pressure because of cold flow. They are mainly used in drop hammer operations for short runs. Also as tailor-made trim dies for soft metals. See Figure 2.

Models and Patterns — Used for making proof castings such as for gun chambers and peculiarly shaped internal cavities.

Miscellaneous — In this catch-all category are such applications as materials for safety devices, special solders, filler for bending thin walled tubing, and alloys for use as a heat transfer medium.

Low melting point alloys deposited with a specially designed spray gun are now used for a variety of applications far surpassing their original use in mold making.

In basic design, for example, precise internal mandrels of the most unusual configurations can be simply made of alloy. The designer need not be concerned as to how it is to be made in production. Removal is by non-distorting, non-corrosive hot water or steam.

FIGURE 1.

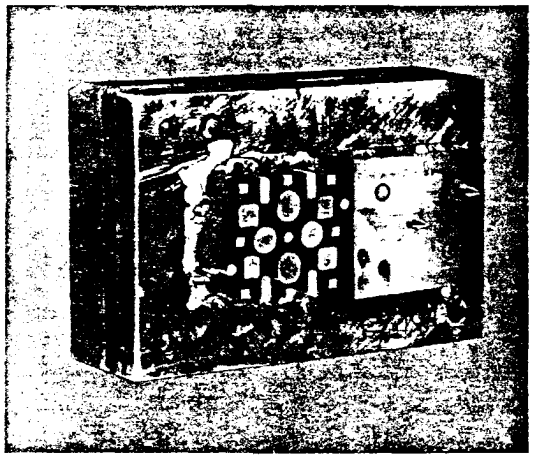
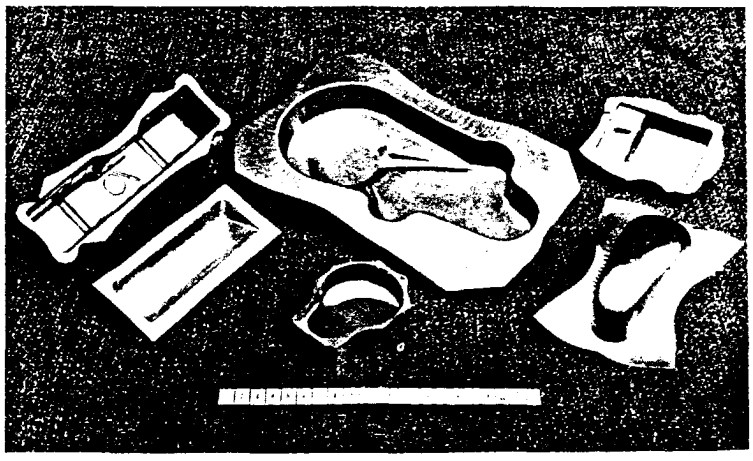


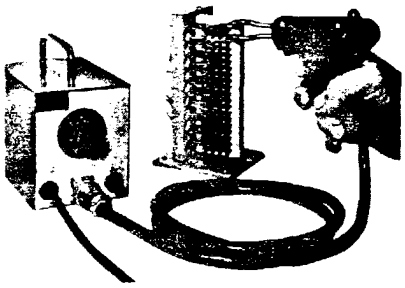
FIGURE 2.



LIA26553

INTERESTING ODDS AND ENDS ABOUT LEAD

Putting the Squeeze on Soldering



This new production tool for soldering of precision micro-miniature circuits utilizes the resistance method of heating. The gun holds the pieces together with a clamp-like pressure during the soldering operation, eliminating any possibility of a "cold" joint. Because the temperature can be controlled and localized, it is not necessary to use heat sinks to protect sensitive components. Current can only be applied after the parts are clamped.

Moving Becomes Electric

By mechanizing food carts with lead acid battery-powered drives, a caterer eliminated an employee turnover problem in food serving operations. The carts, formerly moved by "girl power", have been equipped with drives made by Ampulco Division of Universal American Corp. These units, powered by four 6-volt, lead acid industrial batteries, remove the need for physical exertion previously required to transport the 1,000-lb food wagons. In addition, the drive units help maintain on-time schedules within plants served.

A BRIGHT YELLOW SUBMARINE?

No—we're not putting you on. The U.S. Army has actually been operating one for over two years. It's a two-man, 18-ft. vessel that is powered by lead acid batteries and is capable of underwater speeds of up to 8 knots.

Based at Kuajalein Lagoon, the battery powered mite is used to assist in the recovery of ballistic missile nose cones fired from Vandenberg Air Force Base some 5,000 miles away.

LEAD KEEPS THE RECORD STRAIGHT

At the recently concluded Summer Olympic Games that were held at Mexico City, many new World and Olympic records were entered into the record books. Accurate timing of all the events was assured through the use of sophisticated electronic devices. To make certain that these timers would function faultlessly and without interruption, reliable lead acid batteries were used as a power source during the 20 days of the Olympic games.

LEAD INDUSTRIES ASSOCIATION, INC.

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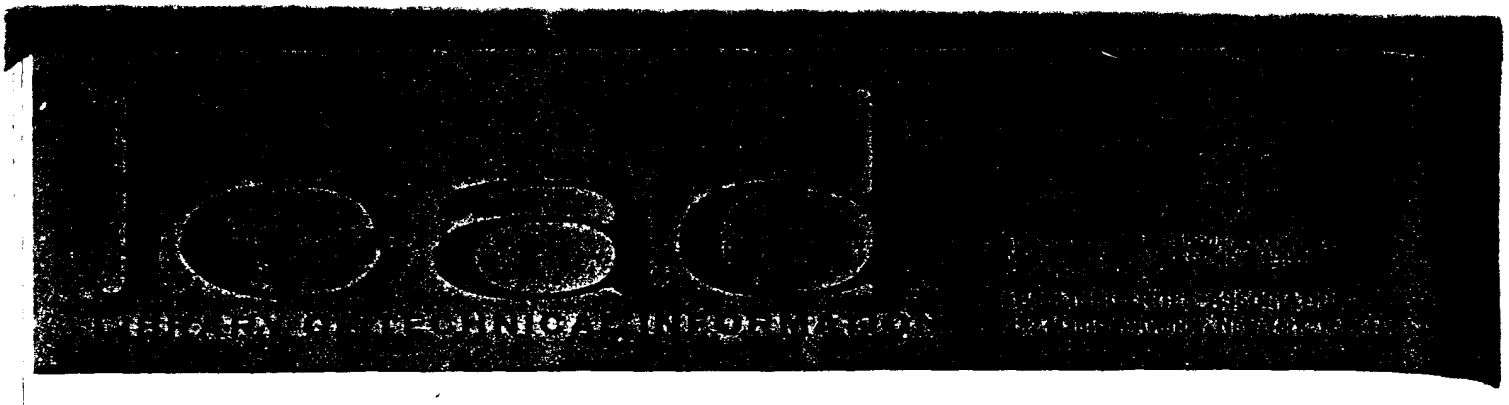

NEW LISTINGS

Publications and films

This booklet lists all the material currently available from Lead Industries Association, Inc. Sixteen pages. **M-13**

Phase equilibria in the system PbO-B_2O_3-SiO_2

A new supplement to LEAD IN THE CERAMIC INDUSTRIES dealing with the lead borosilicate system will be of interest to research ceramists. Four pages, illustrated. **B-8**

Lead armor soundproofs new arts center

Chicago's new Center for the Performing Arts is sheathed entirely in lead. A general description is given of the job and how the lead was handled. Four pages, illustrated. **A-7**

The effects of waist line effluents on synthetic rubber gaskets for cast iron soil pipe

Synthetic rubber of a type similar to that used as gaskets in waste line joints was exposed to many effluents found in the plumbing waste system. Twelve pages, charts, tables and illustrations. **D-5**

ARCHITECTURAL

Waterproofing with sheet lead

Describes uses of lead as a membrane waterproofing material for lining pools, planters, fountains, shower stalls and floors where positive waterproofing is required. Eight pages, illustrations. **A-2**

CERAMICS

Phase equilibria and liquid immiscibility in the system PbO-B_2O_3-SiO_2

Describes detailed investigation of entire lead borosilicate system. Gives ohase diagrams, rate of formation, time and temperature. Six page reprint, illustrated. **B-2**

CABLE SHEATHING

Lead sheathing for power cable

Design guide for use of lead sheathed power cable. Factors governing cable selection are aiso reviewed. Twenty-four pages, illustrated. **C-1**

PLUMBING

Will calked lead joints withstand high temperatures?

Describes tests on uncoated cast iron soil pipe with lead and oakum joints. Such joints were found to withstand temperatures to 170°F without leakage. Four pages, reprint. **D-4**

ANODES FOR CATHODIC PROTECTION

Lead-silver alloy anodes in cathodic protection of ships

Operating efficiency and behavior of lead-silver anodes for corrosion protection of ships. Other anodes are compared. Details of operation, costs and other important factors are discussed. Eight page reprint, tables and illustrations. **E-1**

PAINTS

Red lead based paint systems

Technical booklet lists properties and applications for twenty-four red lead paint systems. Specific uses, e.g. fresh water, marine, etc. suggested for a wide variety of formulations. Preparation of surfaces discussed in detail. Thirty-two pages, charts. **F-1**

ANTI-VIBRATION PADS

Ways to reduce press vibration

Two installations of lead asbestos pads to reduce heavy machinery vibrations. Sectional drawing and loadings are given. Two pages, illustrated. **G-1**

CHEMICAL CONSTRUCTION & CORROSION PROTECTION

Lead in modern chemical construction

Reprint from *Encyclopedia of Chemical Process Equipment.* Describes installation, proper design, application, and testing of lead linings. Twelve pages, illustrated. **H-1**

SOLDERING AND WELDING

Soldering alloys

Describes numerous alloys used as solders and discusses advantages and drawbacks of many. Flux requirements for soldering most metals, both ferrous and non-ferrous are listed. Four pages, tables and charts. **I-3**

SOUND BARRIERS

Practical application of sheet lead for sound barriers

Twelve page manual gives specific wall construction and performances. Tables, charts and illustrations. **J-1**

BATTERIES

Industrial truck cost calculator

Three nomographs permit estimation of costs for gas vs. battery powered industrial trucks in two or three minutes. Twelve pages, charts and tables. **L-1**

GENERAL

Working with lead and adhesives

Twelve-page manual tells how to do it. Covers which adhesive is used, joint configurations, surface preparation and suggested lead thicknesses. Charts and drawings. **M-4**

Primary lead production areas in the U.S.

For schools, libraries. 11"x14" map showing locations in U.S. of most lead smelters and refineries, and lead mines. **M-11**

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