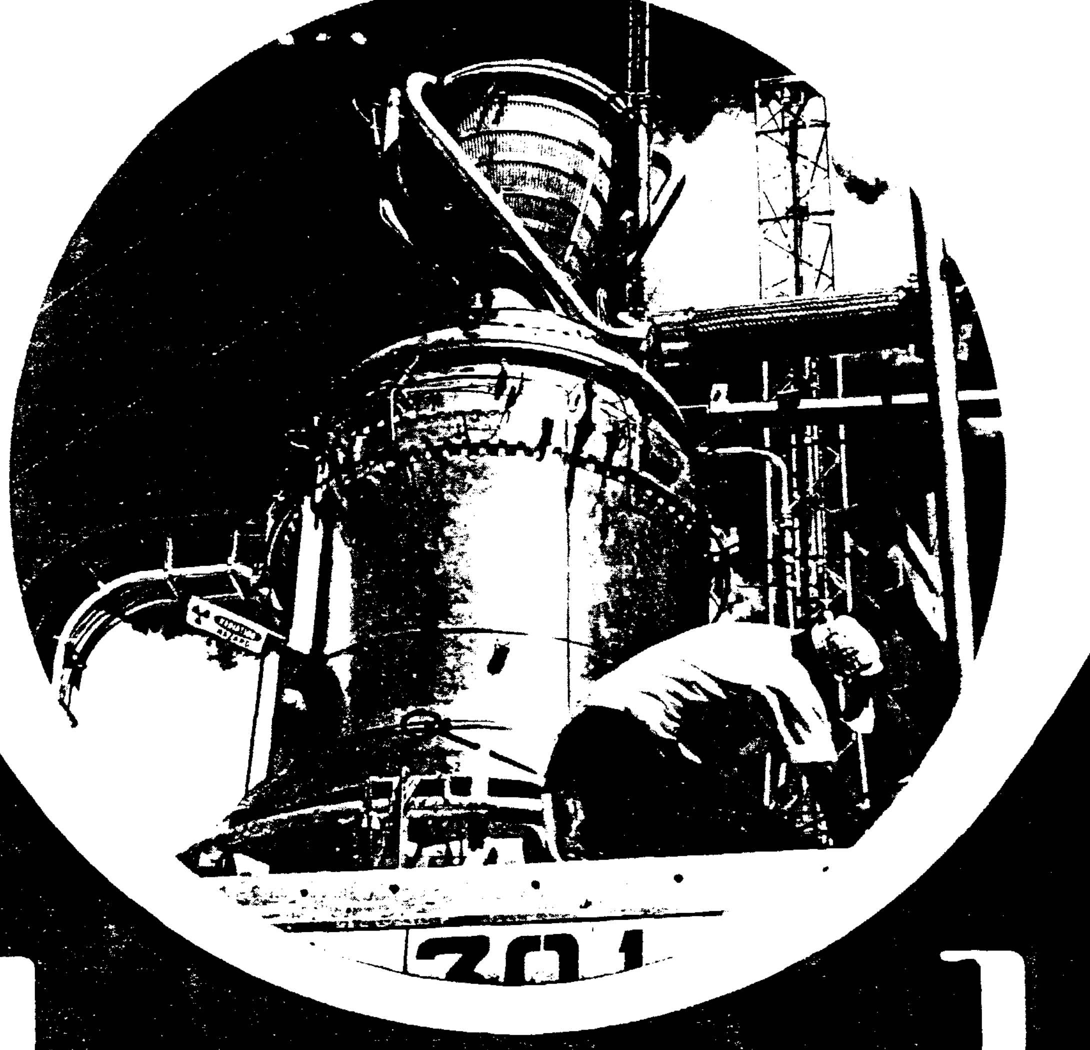
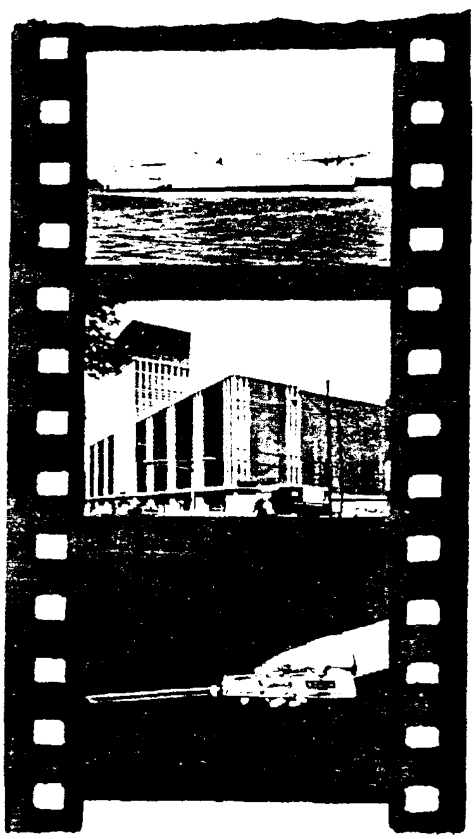


lead

LEAD INDUSTRIES ASSOCIATION, INC.

The Lead Matrix

So diverse are the uses of lead that few people outside the lead industry itself are familiar with more than a fraction of them. To provide a better idea of lead's roles, Lead Industries Association has had a motion picture made. "The Lead Matrix", a 26-minute color film, was the result.

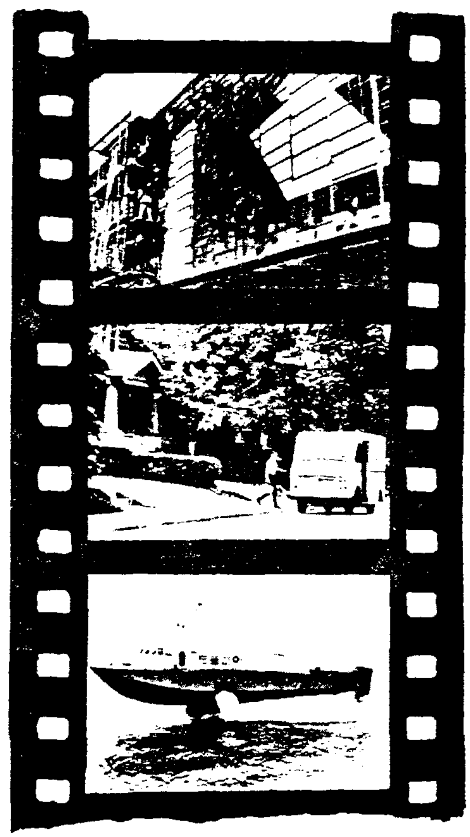


Of ships, and walls, and carving knives . . .

The title refers to the fact that while lead, as lead, is seldom seen and seldom purchased by the average American, it is around us at all times serving in dozens of ways. From the clock radio that wakes us in the morning to the lead sound-*proofing that may* make it possible to get to sleep at night it serves unseen. It is not only in alloys like solder, or as a building material like sheet for waterproofing or sound proofing, but in toothpaste tubes, X-ray shielding, cable sheathing, automobile and other batteries, stained glass windows, ceramics, paints, and all the newer developments like thermoelectric generators, high-efficiency piezoelectric materials, and better ceramic magnets.

A wide sampling of these uses is explained and dramatized by the movie. Though it will be of interest to technical people, it was produced with the average well-informed layman in mind.

Produced by Cullen Productions, Inc., 1776 Broadway, New York, the film is being distributed by the Sterling Films, Inc., 375 Park Avenue, New York and all requests for information about it should be referred directly to it.



. . . stained glass, trucks, and noise.

Infrared Heat Source . . .

Woman solders integrated circuit packages on new Argus Engineering Co. automatic infrared soldering unit. The soldering of glass-metal composites and other hard to join items is also successfully completed with simple infrared units such as these.

THROWS NEW LIGHT ON SOLDERING

Most of us turn on a light to read or write. Now you can use a light to solder! It's done with infrared light energy. Of course, infrared soldering has been around for years. What's new is that it's concentrated, or focused, so that very high temperatures (over 4000°F) may be quickly attained.

Anyone who, as a youngster, ever experimented with a magnifying glass in the sun is familiar with the principle. Radiant energy from the sun can be focused with a simple lens to a point where it will char and then ignite most any combustable material.

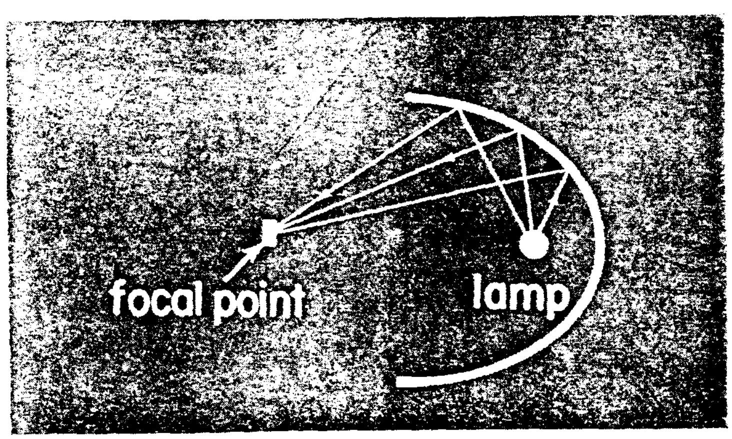
Using a highly polished elliptical mirror with an infrared-producing bulb as the energy source, Argus Engineering Company of Hopewell, New Jersey put this principle to work on the job of soldering. No other heating method is so simple yet produces such reliable results. It's simple because only light energy does the work. It's reliable because its performance can be consistently duplicated time and again.

Besides extremely high temperatures, the new focused infrared units can solder at the lowest possible temperatures, too. If low intensity lamps are used, joints with 60/40 solder can be made consistently at less than 50°F above the 361°F liquidus. This is an important bonus when heat-sensitive electronic devices must be soldered.

Contamination is another bugaboo in this day when even a piece of dust may cause a multimillion dollar missile to go astray. Because the infrared heater makes no contact whatsoever with the solder joint — nothing but light energy touches the solder—cleanliness joins reliability as a major feature of this new device.

Of course, economy and control are two other important characteristics that can make or break any soldering operation. How is the infrared unit controlled? Its operation is very accurately programmed through a silicon controlled power supply which has an internal timer. This control comes with the lamp and is considered an important adjunct by Argus, who also perform complete feasability and development studies on heating problems as well as desgining and constructing the equipment.

Argus offers a choice of many different designs and arrays of lamps for joining operations. Lamps ranging all the way from 45-watts to 1500-watts may be employed — choice depends primarily on application requirements and economic considerations.



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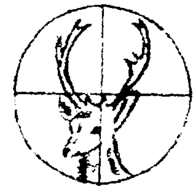
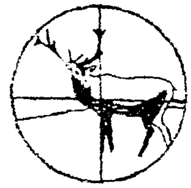
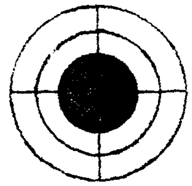
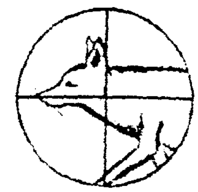
SHOT FROM GUNS!



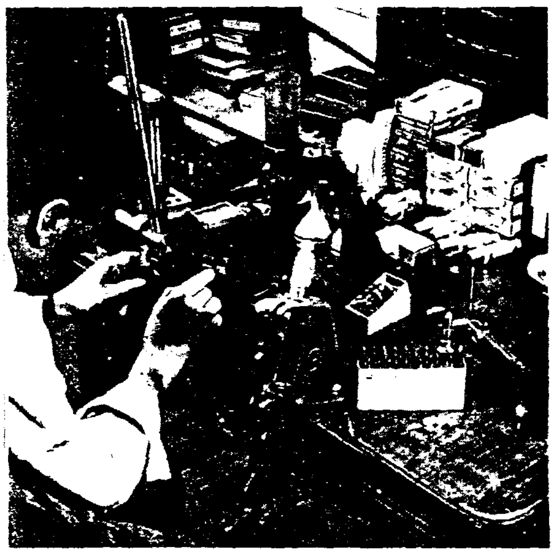






Photos: Guns Magazine

The basic steps of cartridge preparation, loading



with powder, and seating the bullet are shown.

Over the past twenty years the number of sportsmen interested in the shooting sports has doubled. Along with this sport has come the hobbyist who finds reloading or handloading a pleasant pastime. Not only is reloading satisfying in itself, but means a substantial savings to those sportsmen engaged in target and skeet shooting as well as hunting. Reloading is actually the reusing of fired cartridges over and over again. Shot shells may be reused as many as twenty times and metallic cartridges even more.

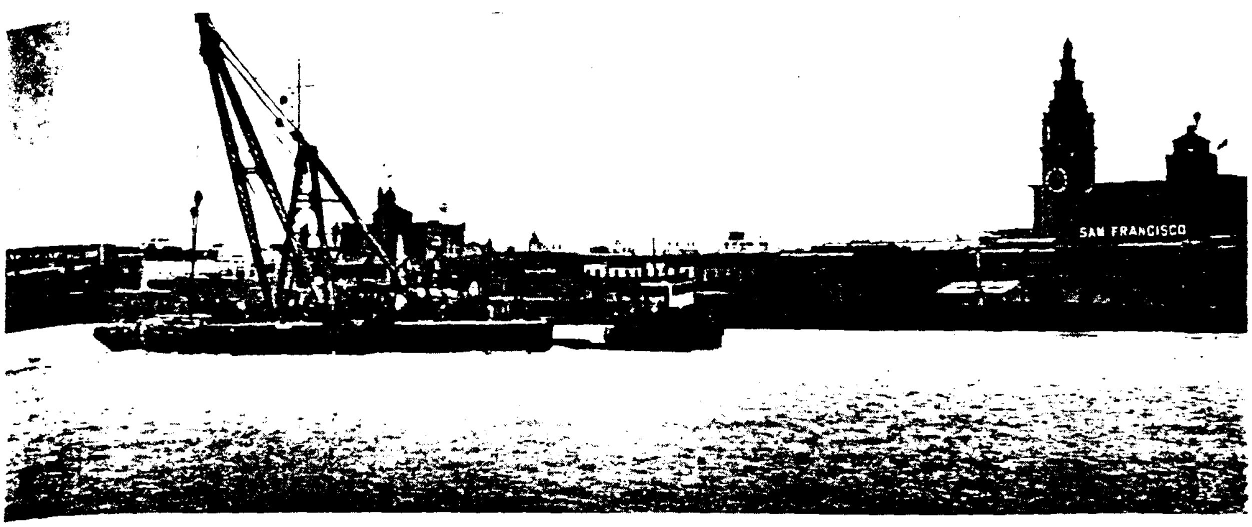
Hardly a new hobby, reloading goes back to the Civil War days when reloading equipment and accessories were supplied with the purchase of a firearm. Although this is no longer done, most large arms manufacturers continue to sell reloading equipment. Today there are over 100 manufacturers of reloading equipment and accessories.

Reflecting this increased interest in reloading, manufacturers have made a variety of bullets available to the hunter or target enthusiast. These are available through a number of small ammunition manufacturers who cater to special demands of the reloading craftsman.

Savings up to 60 per cent over the retail cost of the shot shells are possible, savings of two thirds can be made on metallic cartridges. By procuring their own metal, reloaders, by swaging, can enjoy additional savings. Swaging is the art of forming your own bullet to meet your specifications. Usually a type metal or other hard alloy is used for this purpose.

Equipment is relatively inexpensive: a portable loader sells for $9 to 70, powder measures range in cost from $9 to 30. Dies for metallic cartridges start at about $6, and shotshell reloaders from $10 to 600. Thus, only a modest investment is needed to set up shop.

Among the standard reloading handbooks available to reloaders are: "Lyman Reloaders Handbook", $2.50; "Speer Manual for Reloading Ammunition", $2.95; "NRA Illustrated Reloading Handbook" published by the National Rifle Association of America, Washington, D.C., $4.50 to non-members and $3.50 to members. Additional reloading information may be received from the many gun clubs, rifle and cartridge manufacturers as well as the National Shooting Sports Foundation

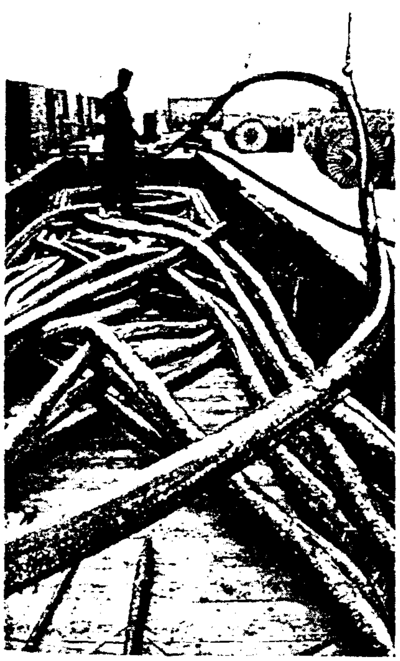


San Francisco Bound, a barge lays cables near one end of the route from Oakland across the Bay.

HELLO FRISCO, HELLO

In a massive communications operation, more than six million pounds of rugged, lead sheathed telephone cable is now being laid across San Francisco Bay. The job is part of a still bigger project for unsnarling the traffic-choked streets of San Francisco. Because tunnels for the area's new rapid transit system are scheduled to be dug along the routes of existing cables, the Pacific Telephone and Telegraph Company is laying 12 new ones in another path across the famous Bay.

Loading cables into gondola cars in a pattern of massive figure "8's" for shipment to California.



A total of 568,000 feet of cable are being manufactured by the Western Electric Company's Baltimore Works for installation along a ten-mile route which runs from San Francisco north of the Bay Bridge to Yerba Buena Island, then across the island and under the Bay again to downtown Oakland.

The biggest part of the job is laying 194,000 feet of cable in 12 lengths at the bottom of the Bay. When the entire job is cut in to service, in late 1966, the cables will carry inter-city calls as well as traffic between San Francisco and the Far East. As these cables are down on the bottom "for keeps" they are expected to provide completely reliable, trouble-free service for many years to come.

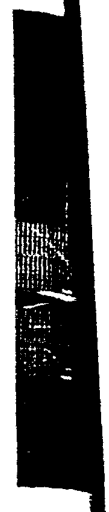
Two types of cable are being used, and both of them are sheathed in lead 0.159 in. thick and two alternate layers of four-gage steel armor and jute. One type cable contains 1,219 pairs of wire, weighs 33 lb. per ft. and is the thickest submarine cable manufactured by Western Electric. The other cable is the same thickness but contains 608 pairs of wire.

The five-inch thick cable posed a weighty transportation problem. Rather than carry the cable on large reels, each 1700-ft. length of cable is shipped in a gondola freight car where it is laid out in a figure eight pattern without any special restraint or container.

At the receiving end lengths of cable are spliced together on flat cars placed between the gondolas. Then 9,000 ft. of cable can be rapidly wound on the cable-laying barge's supply reel without interruption.

Splicers working in a flatcar force air through a completed splice in a water trough to test for leaks.

On left bins of small parts are being moved while foreman on personnel carrier takes right of way on errand to distant point. Note "PM" batteries receiving charge on right while "AM" battery works on Truck No. 16.



GATEWAY LOADBUILDER

UNION Electric Company, power supplier for St. Louis and environs, continues to be a leader in the dynamism pervading the "Gateway to The West." Currently, the company is achieving widespread notice for its association with the city in the re-streetlighting of the 81 square block central business area to a revolutionary high level (12 foot-candle average). This is a major contribution to the re-vitalization of downtown St. Louis, focal point of which is the 630 ft. high Jefferson National Expansion Memorial Arch.

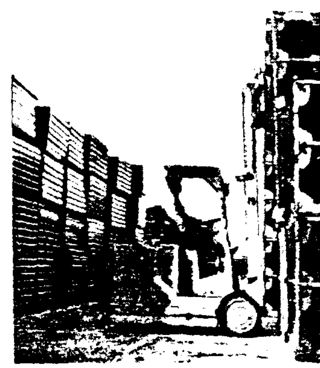
Although the company expects this new streetlighting system to bring in additional revenues, other less conspicuous but equally important load building programs are being developed. Outstanding is a motive power battery campaign launched in the fall of 1963 with a rodeo, or round-up showing, of electric trucks for more than 750 commercial and industrial customers (LEAD. 27 (4) 1964.)

Rexall's laboratory-clean charging room where 70 trucks are cared for.

What progress to date? Well, Pat Dougherty, UE Supervising Engineer for Power Sales, mentions just three of the numerous examples in the area: Rexall Drug Co., Carter Carburetor Division of ACF Industries, Inc., and a major automotive assembly plant.

Six hundred and fifty thousand (650,000) square feet on seven floors, complete with elevators, is the theater of operations for a fleet of 70 electrics at Rexall Drug Company. Preventive maintenance is the gleam in the eye of Don Higgenbotham, Plant Engineer, when he shows the new charging and service room that will accommodate all 70 vehicles simultaneously! To prove the point his meticulous records show that the original 5 fork lift trucks, purchased in 1946, are still putting in a full day's work alongside their newer teammates. Downtime and delays, intolerable in the manufacture of more than 3600 items streaming constantly to 7 major distribution points, are avoided by such measures as scheduled steam cleaning, lubrications, controls adjustments—all under the responsibility of one maintenance technician.

In a world gone automation-happy, Carter Carburetor stands out among mass producers: for *not* automating material handling! Says Project Engineer George Kuhl, "This way, we stay 'loose'—ready to roll with the punches." Carter produces literally hundreds of carburetor and fuel pump models each year for original equipment and replacement markets; at any time it may be necessary to insert into production a run on short notice, or to set up for some special parts for a special customer. So, you will find no overhead convey[o]r [sys]tem, no belt line, no moving [...] An insert run doesn't disru[pt] entire plant. How are parts [...] from fabrication to stock to as[sembly] point? By electric truck, of c[ourse]. In fact, a total of 38 models lif[t] or push all shapes of bins cont[aining] all shapes of parts to and from [pre]cision machining, or from c[...] bench assembly to final close i[n...]



Racked radiators are stored in outdoor yard. Plant engineering says that electrics are not especially ordered for outdoors, but always seem to be there.

A walkie is used to shift trays of small components to strategic locations. (Huge machine in background is a fourteen-station monster capable of performing as many as 56 operations simultaneously.) Note complete lack of overhead conveyor system.

Dependable? Versatile? These ks *must* be, to provide carburetion significant portion of the new car ustry.

At the auto plant, an engineer talks "diversity"—and the evidence apparent in all areas of the huge d still expanding) complex, both oors and out. Trek in from the re-ving dock, through the passenger assembly, on to the truck chassis , then out to the marshalling yard. will see them all: high lifts, kies, riders, narrow aisle trucks, onnel carts, special purpose fire k, and tour train tugger. Essen-ly a two shift operation, the whole adron is powered by an "AM-PM" tem: two sets of batteries, one set g replenished while the other ors.

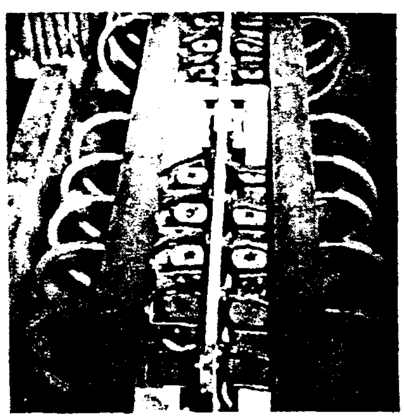
Recently, C. T. Heaton, Manager of es Promotion and Development for ion Electric, said: "As a result of accelerated activities more of our tomers than ever before are aware the capabilities of electric trucks, d therefore, are buying them."

PbO_2/Graphite, a tough, new electrochemical anode

What makes a chemical reaction take place? There are many complicated answers in today's view of the subject, but they boil down to *electrical* force. This being so, it might seem simple to do away with heat and high pressure, catalysts and other standard chemical means and use electrical force directly to produce the chemical reactions required in a process.

That attractive notion has been abroad for more than a century. The Hall process for producing aluminum is one famous example of its usefulness. But it has been impossible to apply to production of some chemicals because the ferocity of electrochemical force required would also destroy the electrodes.

Now, however, lead dioxide coated graphite anodes make it possible to effect direct electrochemical conversion to sodium perborate, sodium hypochlorite (the active chemical in common bleach), sodium perchlorate and sodium chlorate. Though this has all been done before, the electrolysis of sodium perchlorate, for example, required platinum anodes far more expensive than the lead-graphite types.



Top of two 5,000 amp chlorate-perchlorate cells utilizing cylindrical anodes. The cell consists of a 42 in. copper or stainless steel tube (the cathode) in which the lead dioxide plated anode is suspended.

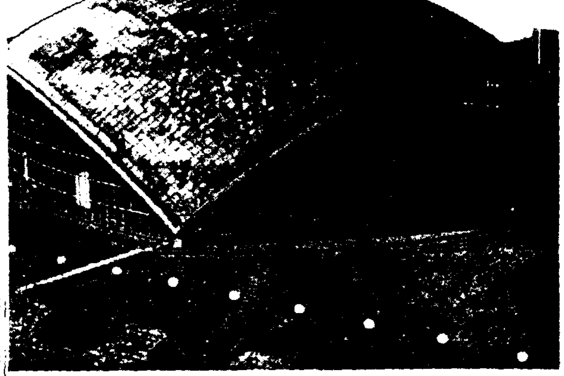
Cylindrical anodes 4.25-in. in dia. and 45 in. long used in the electrolytic production of chlorates, perchlorates, hypochlorites, iodates periodates, bromates and perbromates.

Because of the high energy potential of the technique, its developer, Pacific Engineering & Production Co., uses it at Henderson, Nevada to make millions of pounds a year of ammonium perchlorate — a power-packed component of rocket fuel. Paper people are using the process to produce high-powered bleaching chemicals.

"Electrolysis of chloride to sodium chlorate can be a batch or a continuous operation," according to an article in *Chemical Engineering.** "Either way, the anodes operate satisfactorily on a range of salt concentration from near zero to saturation, unlike other processes where final chloride concentrations usually above 100 g/1.

"Anode current density is varied to suit the cost of local power," the article continues. "Where electricity is cheap, current densities of 1 amp/sq. in. are economical; for power costing more than 6 mils/kwh, the density is reduced. Current efficiency averages about 85%. At higher current densities, power consumption is about 6,600 kwh/ton of chlorate produced. Average anode life is about two years."

*"New Anodes Show off for Chemical Producers," Anon., Chemical Engineering, July 19, 1965.



A New Kind of Lead Roof

Imagine a roof that changed its shape with variations in the weather. It happened at Kresge Auditorium at M.I.T. in Cambridge, Massachusetts. And it led to an entirely new concept in sheet lead roofing.

The auditorium roof, finished in 1955, is a triangular dome of concrete, supported at three points on massive concrete buttresses and structurally independent of both interior and exterior walls. It is the eighth part of a sphere. Its minimum thickness at the apex is 3½ inches: thinner in proportion to its area than an eggshell.

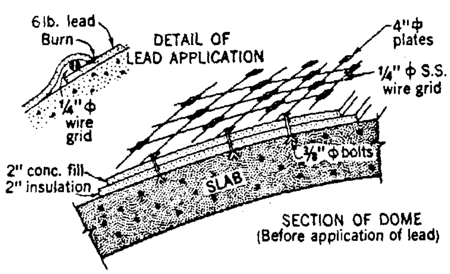
Originally, the concrete slab was covered first with a vapor barrier, then with 2 inches of insulation, next a 2-in. layer of cinder fill for acoustic purposes and finally, a finish made up of a clear acrylic containing a stone mix for texture.

Chiefly as a result of movement, difficulties developed in this assembly. In different parts of the dome, rates of expansion and contraction varied depending on the weather and the position of the sun.

Since the insulation and fill layers were not bonded or secured to the structural slab, the movement in and between them resulted in an accumulation of stresses which eventually ruptured the concrete topping causing cracks up to ½-in. in width. Introduction of water into these faults led to further complications—vapor pressures, created from this trapped moisture, raised a series of "bubbles" as the passage of the sun heated each panel in succession across the roof. The consequences are not difficult to imagine. Conferences were arranged with various roofing interests and, in some cases, sample installations were actually built full scale on parts of the roof surface itself. The problem had to be solved. Sheet lead was among the materials tried. It was evident that an entirely new concept in sheet lead roofing was needed.

The roof that finally evolved from this testing, design and conference was novel. The cinder fill was cut through with continuous ½-in. carborundum cuts on 48-inch centers both ways. At the four corners and the center of each panel thus created, a ⅜-inch diameter steel stud was anchored into the structural slab. These studs were allowed to project ¾-inch above the concrete fill surface and were then fitted with 4-inch square stainless steel shields, slipped over the studs and welded to them, thereby tying together the concrete topping and the structural shell, but allowing the topping to crack along the saw cuts. To the tops of these projecting studs a grid of ¼-inch diameter stainless steel wires was welded in a diamond pattern on 2-foot centers. Where wires crossed each other independently of studs they were welded together. Finally, 2-foot square sheets of 6-lb. soft lead were slipped under the lower "V" created by the wire grid and over the "V" at the top, thereby, in company with the next sheet, locking in a continuous wire support at each joint. Laps in sheets were 2-inches and all edges were burned.

The roof system has now been in place for more than two years. It was finished in June, 1963. Repeated inspection reveals no serious fault nor defect and Mr. James Murphy, Director of the Auditorium, reports no maintenance costs of any kind have been incurred nor have any leaks developed. The acoustics of the dome, if anything, have been improved since the capabilities of lead as a sound attenuator are well known.



Credits:

For the University:
C. M. F. Peterson, Director of Physical Plant & R. E. Collins, Assistant

Architects:
Eero Saarinen, Associates, Hamden, Conn., Anderson, Beckwith & Haible, Boston

General Contractor:
George A. Fuller, Boston

Lead Work:
O. G. Kelley Co., Boston

Structural Engineers:
Ammann and Whitney, New York

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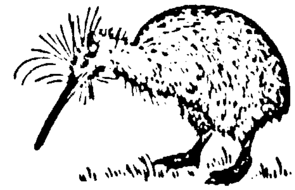
LEAD AND BORON IN THE KIWI



In designing and testing any new engine it is highly desirable to "look" inside to "see" what is happening. This is particularly true with a design as radical as a propulsion unit for rockets, such as the powerful nuclear propulsion reactor of the Kiwi type.

When radiation from a particular part of the reactor core is measured and analyzed, radiation from other parts of the engine must be blocked off so that it does not "blind" the detecting instruments. The shield device that permits selective measurement of the gamma rays and neutrons in the Kiwi is a collimator with components made from lead and boron carbide powders.

Lead is used for a gamma ray shield and boron carbide is added to suppress the production of hard gamma rays that would result from neutron capture in the lead.

Scientists and engineers of the Critical Assemblies Group and the Materials Technology Group at the Los Alamos Scientific Laboratory* used a powder metallurgy technique to solve their design problem. The collimator was to be essentially a hollow cylinder with a funnel shape bore at one end. Taper of the bore could be changed (to permit scanning different areas of the reactor) by replacing certain parts. All of the parts of the collimator had to fit very precisely to prevent radiation leaks.

Bismuth and boron or boron carbide were first proposed for the critical inner section of the collimator but a number of disadvantages including expense ruled out bismuth. It was decided to make these components from a lead-boron mixture.

The mixture of lead with boron carbide is a novel combination in the field of powder metallurgy, but the method devised by the Los Alamos personnel provided compacts of almost theoretical density ready for a fine machine finish.

The first step in the fabrication was thoroughly blending lead and boron carbide powders for eight hours. The lead powder was -325 mesh and 99 per cent pure; the boron carbide was $-100 + 230$ mesh.

The blended powder was then poured into the cavities of steel-reinforced graphite dies and pressed. First, the powder was cold pressed at approximately 800 psi, then heat and pressure were gradually increased to a temperature of about 530 F and a pressure approximately 1500 psi. Pressure and temperature were then gradually lowered in controlled steps until the piece was removed from the graphite die.

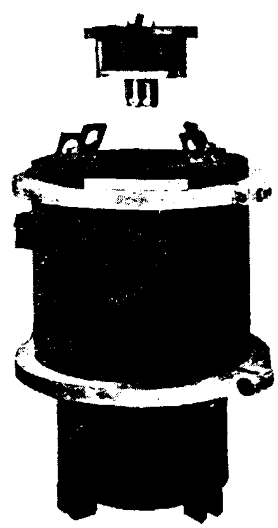
The surface of the finished parts was a function of the finish of the graphite dies. Diamond tools were needed to give the parts their final fine finish because of the extreme abrasiveness of the lead-boron carbide combination.

The Kiwi reactor engine mounted on its test stand at Los Alamos Scientific Laboratory.

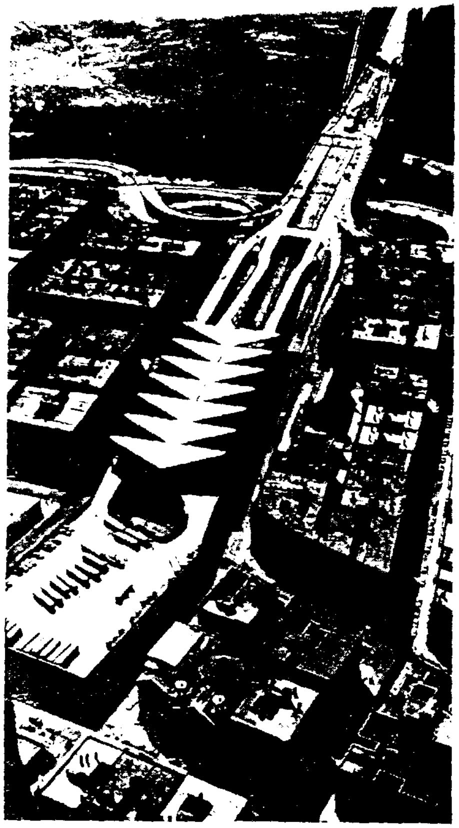
Individual pressed components varied in diameter from 4.5 to 26.1 in., in length from 1.1 to 8.7 in., and in weight from 16 to 403 lbs.

One of the problems that the scientists on the project anticipated was density variations along the length of the longer components. This was avoided by pressing the part in three sections, then machining step shoulders in them so that they would fit tightly together as a completely uniform assembly.

The completed collimator assembly. The lead-boron carbide components line the hole through the center of the assembly. The outer surface seen here is borated polyethlene.



* Source: Based on the paper "**The Fabrication of Lead-Boron Carbide Components for Kiwi Neutron-Gamma Collimator**" by H. Sheinberg, Los Alamos Scientific Laboratory of the University of California, Los Alamos, N.M.



Aerial view of George Washington Bridge Bus Station looking west to the bridge and Hudson River Palisades.

Over 100,000 sq. ft. of leaded porcelain enameled extrusions, similar to the ones shown here covering the ceiling of the long-haul loading area, were used throughout the Station. The ceiling of the depressed Expressway is covered with these panels

New bus station captures awards and economy through . . .

HARMONY

in Concrete and Porcelain

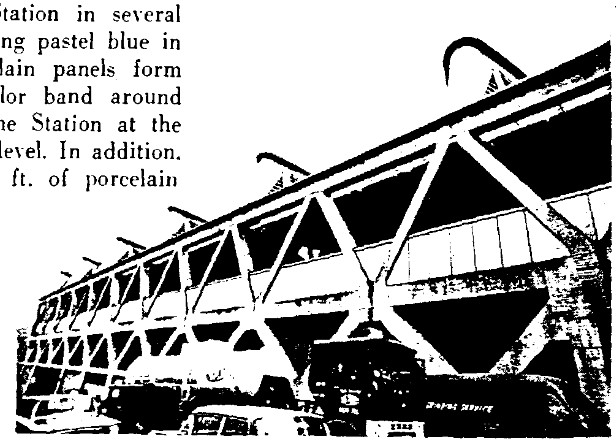
With a flair seldom seen in public works projects, the new George Washington Bridge Bus Station—straddling the famous bridge's New York approach—has earned both industry and public acclaim. The Station opened in January, 1963. Shortly afterwards, it received the Concrete Industry Board's 1963 Award as the best example of originality, concept and applicability of concrete.

First U.S. example of the work of Dr. Pier Luigi Nervi, noted Italian engineer-architect, the design was conceived to complement the nearby George Washington Bridge. Of course, the Station also offers the latest facilities to approximately 12,000.000 annual bus passengers. The Port of New York Authority's own engineers provided the technical know-how and knowledge of functional requirements necessary to translate Dr. Nervi's design into actuality here.

Colorful leaded porcelain enamel on aluminum contributes its share to both the economic and aesthetic success of the new Station in several ways, too. A pleasing pastel blue in shade, these porcelain panels form an eye-catching color band around the perimeter of the Station at the third, or bus deck level. In addition, nearly 133,000 sq. ft. of porcelain enameled extrusions cover ceilin areas throughout the Station.

Leaded porcelain enamel was use because it is the only way to achiev permanent low-maintenance color o aluminum. The enamelers, Porce-Len Inc., of Hamden, Connecticut, spe cialists in porcelain enameling alumi num supplied over 198,000 sq. ft. o porcelain enameled aluminum for thi job. Mr. Robert S. Goodman, Execu tive Vice President of Porce-Len notes that because most of the alumi num (all of which was 6061-T alloy) was enameled on both side with two coats, a total of nearly seven tons of lead went into the vitreous coating which his firm fused to the metal panels.

The 400-ft. long by 185-ft. wide Station handles both short-haul commuter buses and long distance buses —each on separate platform levels. Between the two is the Main Passenger Concourse where, on a typical weekday, about 40.000 passengers wind their way to and from work and other destinations.

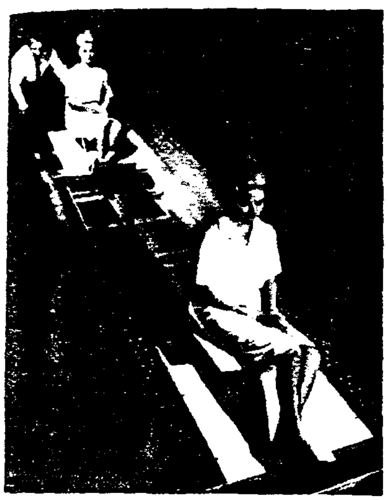


Rugged concrete trusses frame blue porcelain enameled aluminum panels that ring the Station and bus staging or turnaround platform.

Interesting Odds 'N' Ends about Lead

A hull of a protection job has been done on the famous wine tank ship *SS Angelo Petri*. An earlier issue of LEAD reported on installation of lead anodes in April 1964 to prevent hull corrosion. Now the ship has been dry-docked for a checkup after nearly a year-and-a-half of exposure to sea, brackish, and fresh waters. The results: no corrosion damage to hull, sea chests, or screw. The further results: contracts signed with Lockheed's Marine Services Div. for similar systems on four more ships!

No bumps in this highway! Magnetic levitation demonstrates a suspension principle which may be applied to "floating" transit cars of the future. Ceramic permanent magnets, located underneath the vehicle suspend it slightly above its track. Lead in the magnets helps give them the energy to do it. Westinghouse transit engineers believe the wheel-less "magnetic highway" has promise for high-speed commuter systems of the future.



Diamonds don't grow on trees. The attractive little ring holder is a lead diecasting. Flock finished, it shows the rings to best advantage in the jeweler's case. Anchor Alloys, of Brooklyn, producer of the gadget, diffidently admits lead was chosen for this holder of precious baubles on the basis of economy.

Color TV now looks better because of lead—The radiation-sensitive properties of many lead compounds have been known for years. Recently, however, several enterprising scientists have begun to take advantage of these properties. One example is the Plumbicon, an improved color pickup tube which is being used by C.B.S. Television cameras to pick up the Red Skelton shows on Tuesday nights and the Ed Sullivan programs on Sunday Evenings. The new pickup tubes and associated TV camera equipment were developed by N. V. Philips, the giant electronics company located in the Netherlands. The cameras are being assembled by North American Philips Company, Inc. (Norelco) of Mount Vernon, New York, their American counterpart.

Thirty Years Ago

(The following item is reprinted in its entirety from a 1935 issue of LEAD.)

Lead Register on Mt. Washington

A piece of sheet lead was the first register of visitors to Mount Washington in New Hampshire. This lead was taken to the summit in 1824 and installed in a tent there. It was eight or ten feet in length, seven inches wide and the thickness of pasteboard. It was put around a roller made for that purpose by Ethan A. Crawford, Builder of the first stone cabin at the peak in 1823. An iron pencil was provided so that visitors might carve their names in the sheet of lead. This device would have provided a permanent record of visitors' names for it would be little affected either by age or exposure. but unfortunately it was stolen by a party of vandals a year after it was installed on the peak.

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