Lead gets the noise out

Two government agencies are agreed on one thing: it will cost U.S. industry $31-billion over the next three years to meet proposed in-plant 85dB noise levels. The unanimity shared by the Occupational Safety & Health Administration and the Environmental Protection Agency is not necessarily shared by industry. As the Chamber of Commerce points out, OSHA data and subsequent reduced economic impact estimates, are in many cases based on "arbitrary estimates" of the cost of noise reduction. Anyway you read it, the cost and the impact can be shattering.

LIA has taken an educative and pragmatic stance. In case history after case history, it has been documented that lead sheet and lead loaded vinyl curtain offer reasonable options both to the original equipment manufacturer and to the plant manager faced with a remedial noise problem. The noise control article on pages 12-13 of this issue of Lead Magazine is typical. One-pound lead loaded vinyl curtain, with a reduction of 6-9dB, can be made at approximately $6.85 per square foot, including installation cost. LIA publicity and advertising in the market garner unprecedented response. One wonders why there are not more suppliers and marketers out there to take advantage of this major market.

25% savings achieved by solar powered, battery-operated microwave system

A solar-powered, battery-operated microwave "repeater" relay system for telephone calls and other forms of communication may be the answer for reducing the costly investment normally associated with the installation of such systems. The first commercial installation of such a system is providing the first telephone service for a remote Navajo Indian outpost in Utah.

The new system uses solar generated energy stored in lead-acid batteries. It does not require the amount of electric energy standard microwave systems need and is therefore far less expensive to install. Provisions to provide power lines to the site are eliminated as are provisions to house electric power generating equipment. It is for these reasons the new system can be installed at about one-fourth the cost of existing stations powered by specially installed transmission lines.

Microwave repeater relay systems focus radio signals like a beam of light. The signals are relayed from one point to another over line-of-sight transmission paths through use of repeater stations which are usually about 30 miles apart. Generally speaking, the higher the line of sight, the longer the distance a microwave radio signal can be transmitted. It is for this reason that most microwave stations are installed atop high mountains. Installing totally electric powered microwave transmission equipment and the electric power lines required to operate them and building roads to construct and maintain them is expensive and time consuming.

To help solve such problems, GTE Lenkurt, a San Carlos, Calif. subsidiary of General Telephone & Electronics Corp., has developed a solar powered, battery operated microwave repeater relay system.

It eliminates the need for power lines, generators and other support systems.

The system, called the Lenkurt 700F1 RF Repeater package, can be transported by helicopter to remote sites. It includes a weather-proof equipment cabinet; two solar panels; lead-acid storage batteries; two shrouded dish-shaped microwave antennas; and a wood-pole structure for the overall installation.

Solar panels conversion medium

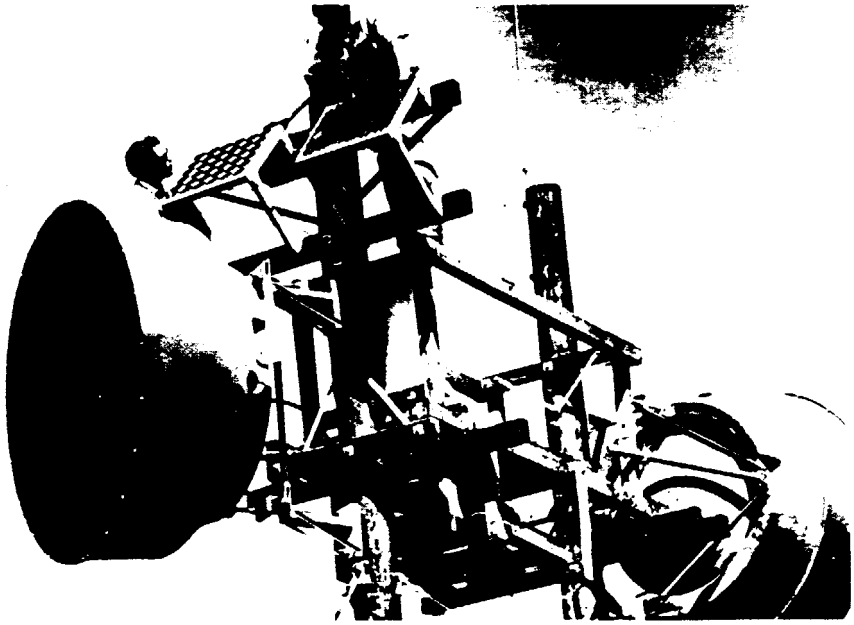
The sun's radiated light is converted directly into electrical energy through the two solar panels. Mounted side by side, the two panels were supplied by Solar Power Corporation, an Exxon affiliate headquartered in North Billerica, Mass. Each panel contains 36 individual silicon semiconductor solar cell "wafers" about 3½-in. in diameter.

Four lead-acid alloy batteries are used to store excess electricity. The batteries have the storage capacity to provide operation for up to 10 times the daily requirements to operate the system. Each of the six-volt batteries provides 80 ampere hours of storage. It should be noted that battery capacity varies according to the location of the repeater site. While 80 ampere hours is sufficient for the application in southeastern Utah, batteries for a repeater station in Alaska would require a higher amount of storage capacity to compensate for longer periods of darkness and cloudiness.

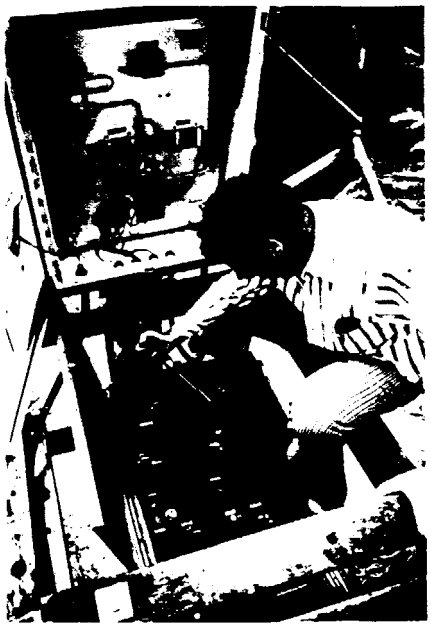
All equipment is mounted on two telephone poles connected by a catwalk 20-ft. above the ground. Galvanized pole guys provide the structure with added strength to withstand 100 mph wind loading. The lead batteries are located in a box beneath the platform which also provides shielding from the sun's heat.

GTE's installation for the Navajo outpost currently has the capability to transmit 36 telephone conversations simultaneously. Although not fully utilized at present, the system is expected to be operating at full capacity by next year.

According to the company, the system is available to telephone companies, railroads, pipeline companies and other organizations which operate microwave communications. In addition to remote locations, the 700F1 can be installed on the tops of buildings or other structures where its features of compactness, simplicity, and reliability are advantageous.



Two solar panels supplied by Solar Power Corp. convert sun's light into electrical power for the microwave repeater system. Four lead-acid alloy batteries, located in a box beneath the 20-ft high catwalk store excess electricity.



GTE Lenkurt engineer measures the specific gravity in electrolyte in the lead-acid alloy batteries.

Lead helps solve homeowner n

The cost and availability of energy, as well as the rapidly increasing price of maintenance and upkeep are problems all homeowners are facing. Adding to these problems are those dealing with the home environment, which is under increasing attack from a variety of bothersome sources of noise.

Architects and builders specializing in the residential construction market are beginning to think of new solutions. For one, they are becoming increasingly aware that lead can be used to reduce household energy, maintenance and upkeep costs, and to solve noise problems.

Some of the pressing problems faced by homeowners include:

- Energy shortages due to brownouts or downed power lines. In some areas the shortage of natural gas has created critical energy shortages for both cooking and heating. Added to the problem are financial losses due to spoiled meats and other perishables stored in freezers and refrigerators. The rapidly escalating cost of energy is also creating severe financial problems for many homeowners.
- Household noise emanating from dishwashers, food mixers, clothes washers and dryers and other appliances can disrupt conversation and make it difficult to concentrate on other household tasks.
- Maintenance and repair of roofs are more costly than ever before due to increases in the price of labor and materials. Since lead can help solve all of these problems, housing construction represents a significant growth market for this metal in the future.

ILZRO house serves as example

To illustrate how the residential building industry can take advantage of lead's benefits, the world-wide lead industry has sponsored construction of a house that incorporates the latest uses of the metal as a construction material. The result of a research and development program undertaken by the International Lead Zinc Research Organization (ILZRO), the house also makes extensive use of various forms of zinc construction materials. Built by the Rhode Island School of Design, the house is located near Providence.

Among the innovative uses of lead for the house is the use of lead batteries for standby power in case of emergency. This reserve battery power can be a lifesaver in areas where power failures may be frequent, or where utility repair units are distantly located. A no-maintenance lead battery pack, depending upon the number of batteries, can provide limited power for a number of days to maintain such essential services as lights, refrigerator, water pump, heat pump and sewer pump.

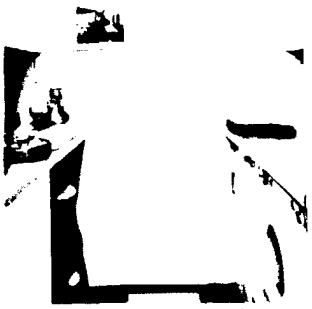
Lead batteries can also play an important role during "brownouts". When electrical power drops below 96V electric motors, gears and other components can be severely damaged by the sudden decrease in revolutions. With a standby battery system, the utility's reduced power can be cut out and the batteries will supply the proper voltage.

Lead batteries can also serve as the energy storage center for a home equipped with solar power installations that produce electricity. Such installations can include either a combination of wind generators and photovoltaic solar cells, or large-scale units of either device. Depending on the size and capacity of the photovoltaic or wind generators, they can be used to supplement energy from electric utilities or to provide all the electric energy required.

Photovoltaic solar cells are providing partial energy requirements at two solar energy demonstration homes: SOLAR ONE, Newark, Delaware, and DECADE 80, outside of Tucson, Arizona. SOLAR ONE, built by the University of Delaware's Institute of Energy Conversion, was the first such structure incorporat a system for directly converting sunli to both heat and electricity for dome use. Decade 80, a product of the Copp Development Association, has a sol array that powers low voltage applianc and the door's electronic latching devic

Acoustical privacy is important

Acoustical privacy is often overlooke in the design of conventional homes. Th expanding use of household appliance and the sounds of everyday living in creasingly impinge on auditory nerves The excellent sound attenuating proper ties of sheet lead provide a high degre of acoustical privacy. Sheet lead can b used as part of a composite panel syste to wall off appliance rooms and othe house areas where noise is a problem.



This appliance room uses sheet lead, combined in the wall panel system, to decrease noise from clothes washer and dryer, seen at right. Noise from sewing machine, seen at left, on counter, is also reduced by the sheet lead system.

Standing-seam lead sheet roof over clerestory area of ILZRO house demonstrates technical feasibility and low-maintenance advantages of this metal as a roofing material.

nergy and maintenance problems

When properly installed, such walls can dramatically decrease the noise throughout the house. A typical sound control panel system might include composite materials that consist of fiberglass insulation bonded to 1 to 1½ pounds per sq. ft. (psf) sheet lead, which, in turn, is bonded to a galvanized panel.

An example of lead's superiority in controlling noise in housing applications is a luxury apartment complex at Montauk, L. I., N. Y. Excessive noise was reduced by installing 3 psf sheet lead under the carpeting on the wood floor of the top apartments.

At the John Hancock Tower in Chicago, the problems involved the containment of noise in machinery rooms, as well as between residential apartments. Sheet lead applied to the exterior walls of the machinery rooms, and into closure panels between partition ends and window mullions in apartment walls provided the solution.

Lead roofing resists corrosion

Lead's prime advantage for roofing is in its resistance to corrosion. As the lead sheet weathers, it develops an attractive grey patina that needs no further protection from the elements. Recently, there has been an increased use of sheet lead for architectural applications both in Europe and the U.S. These involve exterior roofing, siding and fascia of hotels, apartments and private residences.

For example, 300 sq. ft. of sheet lead was specified for the steeply pitched roof of a boldly contemporary house near the shore in Atlantic County, N. J. Sheet lead was selected because it combines the corrosion resistance needed near the ocean, and the aesthetic need for a clean plane for the steeply-pitched, skylighted roof. In addition, the standing seam of the roof design echoes the vertical lines of the textured siding of the house.

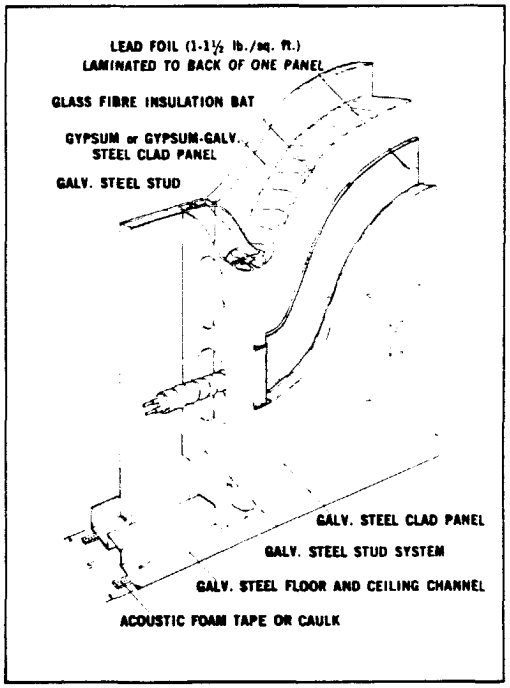
In England a technique, introduced a few years ago, of adhesively bonding sheet lead to hardboard is gaining quick acceptance for the roof fascia of hotels, apartment buildings and offices. The primary objective of using sheet lead bonded to a substrate is to decrease the total weight of material required to a given area. The practice also eliminates so-called "oil canning", wavy lines that can be seen in installations involving sheet metal that is not supported by being bonded to a rigid material.

Current examples of lead adhesively bonded to hardboard include the Gloucester Hotel in West London, where it is used for roof fascia and to cover the rooftop of a structure housing mechanical equipment. Also, the roof fascia, and adjoining top floor window sills and mechanical penthouse sheathing of a new office block on Baltic Street in London. The same technique can be used for housing construction in this country.

New lead-calcium-tin alloys were used in the construction of the ILZRO House rather than conventional wrought lead alloys. The former have the special advantage of being more rigid, thus lending themselves to preforming for industrial production. The inherent stiffness, strength, ductility, and physical integrity of these new wrought lead alloys facilitate handling, feeding and coiling by conventional equipment. These characteristics also permit fabrication by most of the common sheet metal techniques, including punching, expansion, embossing, roll forming, drawing, forging, bending and related operations. The material can be turned, bored, threaded, drilled, tapped, etc., by standard machine or hand tools.

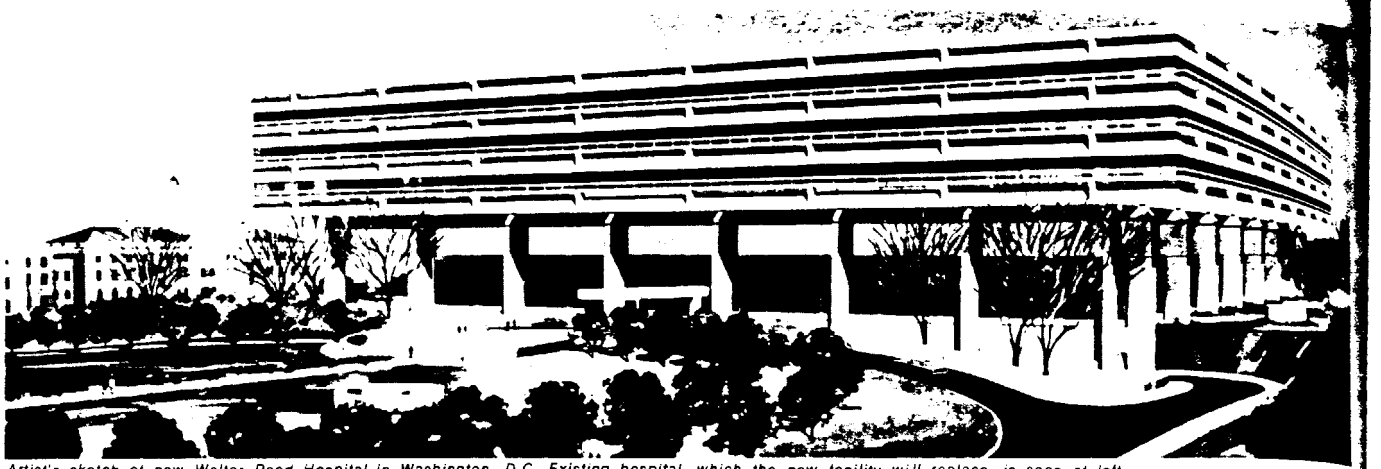
On the ILZRO House, one of the wrought lead sheets is 1mm (0.040-in.) thick, while the other is 0.8mm (0.32-in.) thick. Both are 35.5cm (14-in.) wide and in coil form.

The list of lead applications in the housing construction industry is expected to expand as both builders and architects learn about the advantages of the metal in solving a variety of maintenance, upkeep and noise problems.



Acoustical privacy in residential housing can be achieved by adding sheet lead to the interior partitions to cut flow of noise from one room to another. Installation sequence is shown in these photos.

Lead waterproofs fifth floor gardens at new Walter Reed Hospital



Artist's sketch of new Walter Reed Hospital in Washington, D.C. Existing hospital, which the new facility will replace, is seen at left.

The world-famous Walter Reed Army Medical Center in Washington, D.C., tends to the health care needs of military personnel and their families, as well as high-ranking U.S. and foreign government officials. The complex includes extensive medical research and educational facilities in addition to a hospital.

To modernize the Center's health care function, a spectacular new 1,280-bed hospital is being built to replace the existing outdated facility. The seven-story hospital, which will cost some $134 million, will include a variety of specialty clinics and diagnostic facilities.

The fifth through the seventh floors of the hospital are cantilevered to accommodate a series of eight open-air courts. The areas, which are 58-ft. wide and range from 58-ft. to 200-ft. in length, will be landscaped with trees, shrubs, planters and reflecting pools. This will enable patients and staff alike to enjoy a garden-like environment without leaving the building.

These courts are situated between the patient rooms on the periphery, and the core of the building. Enclosed walkways divide the courts and join the areas.

The lower three floors of the hospital will house most outpatient clinics and such services as radiology, the laboratories, central materiel and supply; and administrative offices. The upper four floors will contain in-patient services.

Because the eight courts are open to the sky it was necessary to install a waterproof lead membrane over these areas. Since the fourth floor is totally devoted to 16 major operating rooms, as well as intensive care and convalescent care units, water seepage would be detrimental to patient care.

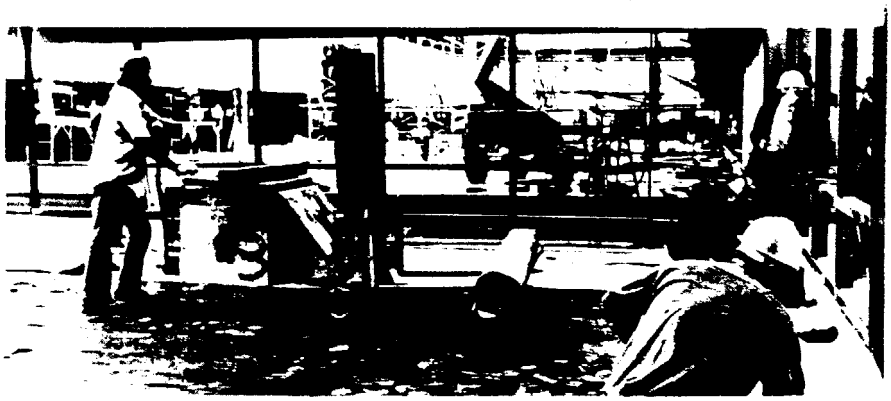
Over 480.00 pounds of 6-lb. (3/32-in. thick) lead was needed for this application. The lead used contains 4¼ percent antimony and an arsenic content of 0.07 percent to provide for increased corrosion resistance and to decrease thermal expansion. The lead sheets measured 96-in. in width, and varied from 197-in. to 240-in. in length. They were transported to the construction site in rolls on flatbed trailers and lifted to the fifth floor by crane. Of the total amount consumed, 18,000 lb. of lead burning bar was used to join this sheet lead moisture protection system.

The lead lining was installed by six lead burners from Baltimore Lead Burning Corp., Baltimore, Md. A hand-operated, battery-powered fork lift was used to handle the lead. The rolls were moved from the crane location to job site on the truck's forks. The rear of the vehicle was then employed to maneuver the lead into exact position and to unwind the rolls.

Lead checked for leakage

In the first installation step, the concrete base of the courtyard areas was covered with a cold-applied brush coat of bituminous coating, followed by an asphalt-impregnated felt covering. The sheet lead system was then laid down with a minimum overlap of 2-in. in both directions and the end joints and seams were burned (joined). The company then conducted a 24-hour hydrostatic water test, involving blue colored water, to check for leakage. After the watertight integrity of the lead membrane had been determined, a layer of asbestos felt paper ½-in. thick, with a thin plastic coating, was installed. The areas were then hot tarred and topped with a lightweight concrete. This prepared all eight courts for landscaping.

Construction agency for the hospital is the U.S. Army Corps of Engineers, Baltimore District. The project's architectural team is Stone, Marraccini & Patterson and Milton T. Pflueger Associates, a joint venture, both of San Francisco, Calif.



Battery-powered fork lift truck eases chore of moving lead for waterproofing one of eight outdoor courts on fifth floor of new Walter Reed Hospital in Washington, D.C. Two other courts in the process of completion are seen in background.

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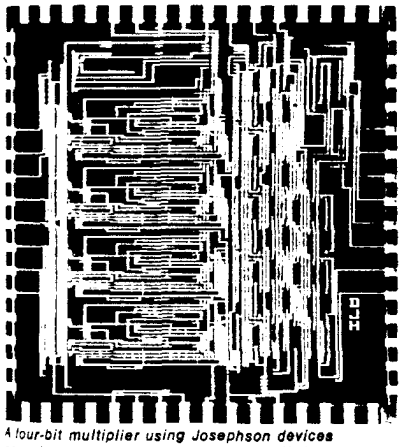
Future computer may increase data processing speed from millions to billions per second

Lead plays key role in Josephson Junction used in this experimental IBM computer switching device. It is estimated that the device would enable computers to process many times faster than transistor models.



A four-bit multiplier using Josephson devices occupies an electronic chip about ¼-in. square and contains 45 gates. (A gate performs a single logical operation such as "and" or "or.") The individual Josephson devices are relatively large, 150 by 90 microns, and the minimum linewidth used in the circuits is 25 microns. The left-hand portion of the chip contains four one-bit adders, while the right hand portion contains an accumulator-shift register and control circuitry.

Transistors have revolutionized data processing from the time they were first used to build computers almost 30 years ago. Beginning with their introduction in the late 1940's, the use of transistors increased the rate of data processing from 500 operations such as additions per second, to about 10 million today.

Such transistorized computers process data in the form of electronic "words" that consist of binary digits called "bits" of information. However, the transistors cannot be used to build the super-fast computers that are needed to forecast weather, explore space and perform a variety of other jobs. They require multi-billion arithmetic operations per second —a task that cannot be economically or realistically accomplished with transistorized data processing equipment.

Super-fast transistor circuits are limited by the heat they generate. The faster they operate, the more heat. Dissipating the heat requires the transistors to be placed relatively far apart. The time required to transmit electrical signals from one circuit to the next then limits the overall speed of the computer, no matter how fast the individual circuits operate.

IBM has developed an experimental electronic switch that is designed to overcome these problems. The switch may permit computers to process data from 10 to 100 times faster than transistor models. Use of the devices, called Josephson Junctions, permits switches to be as close together as desired and consequently decreases processing time. Also, because the Josephson Junctions don't generate as much heat as transistors, the size of computers could be drastically reduced.

The high speed data processing capability of the Josephson device results from the use of a physical effect that occurs at temperatures approaching absolute zero. At these low temperatures, many metals achieve a state known as "superconductive." In this superconductive state, electric current flows freely through an extremely thin insulator separating two metal layers. This can be accomplished in two ways. In one case the insulator acts like a super-conductor itself and current flows from one metal to the other without a voltage drop. If the current exceeds a critical value, or if a magnetic field is applied, a small voltage drop occurs across the barrier.

Because there is only a small energy difference between the two states, and the metal remains superconductive at all times. Josephson devices can switch with astounding rapidity and very little power dissipation, thus providing an ideal computer switch.

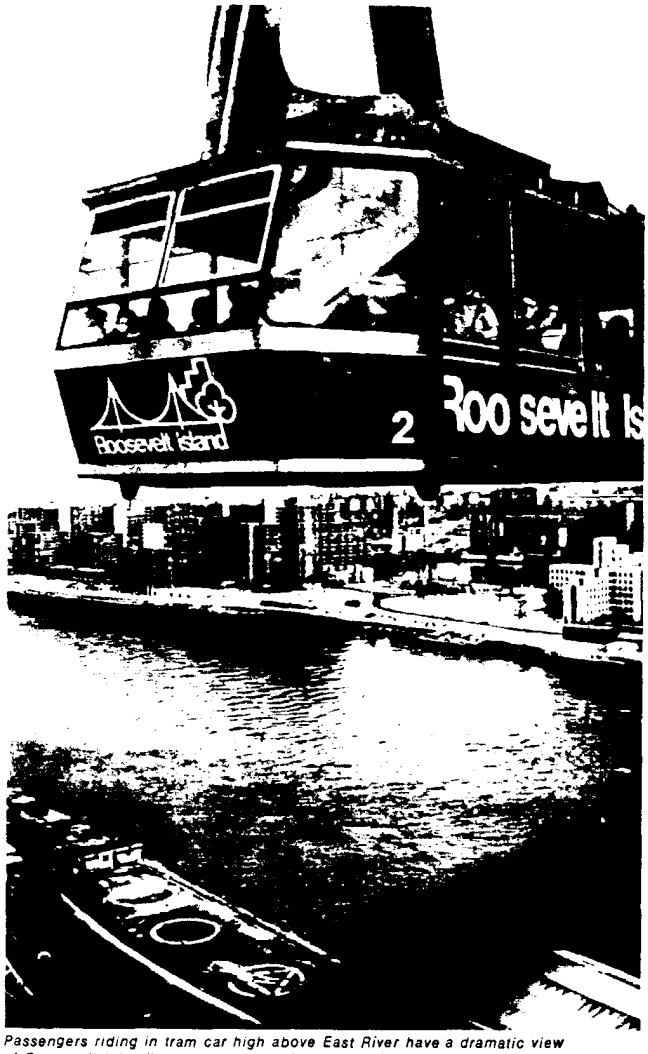
Lead alloys aid switch operation

A major problem faced by IBM researchers was to find a metal or alloy for the super-conducting metallic strips. They needed a material that would allow the Josephson device to work at as high a temperature as possible without introducing undesirable side effects. Although they found that pure lead would work, a lead/indium/gold alloy proved to be superior. The alloy's higher transition temperature improved the flow of electrons across the insulating barrier, thus improving efficiency.

A typical experimental device produced by IBM containing 51 Josephson circuits can perform multiplications in about 12 nanoseconds (billionths of a second). A memory device containing 300 such circuits can read out stored information in about 5 nanoseconds. Much higher speeds should be possible as device design and fabrication techniques are refined.

The physical effects that produce the high speed of the Josephson device were originally predicted by Brian Josephson, an English physicist, in 1962. Follow up research at IBM brought the knowledge that these effects could provide an extremely fast computer switch that would require very little energy. Many problems still must be solved before commercial units will appear on the market. These include regulating the electrical power inputs to the precise requirements, encasing a Josephson-based computer in a convenient package and developing reliable fabrication techniques. However, there's a good chance that computers will be able to operate many times faster thanks to switching circuits made of supercooled lead alloys.

Battery power plays key role in



Passengers riding in tram car high above East River have a dramatic view of Roosevelt Island's apartment complex seen at left just below front of car, which is en route to Manhattan.

View of tram car as it parallels Queensboro Bridge en route from Manhattan to Roosevelt Island. Lead batteries atop car provide emergency power to run two-way communications equipment and lights for cars.

One of the most innovative housing ideas to hit New York City in recent times is a new island city situated on a 2½-mile-long, 800 ft. wide stretch of land in the East River between the boroughs of Manhattan and Queens. Called Roosevelt Island, the complex is a mini-city that offers residents cooperative and rental apartments; spacious recreation areas; churches, schools, stores and its own fire house. Added to this is a spectacular view of Manhattan and an excellent vantage point for observing the variety of ships that continually ply the River. But perhaps the most unusual aspect of Roosevelt Island is its unique aerial tramway and an electric bus, the primary means of transportation.

For both residents and visitors alike, the aerial tramway, which connects Roosevelt Island with Second Avenue in Manhattan, is probably one of the most prominent transportation innovations. The 3600-ft. long, two-car tramway parallels the Queensboro Bridge, one of the major arteries linking Queens and Manhattan. Rising to a height of 250-ft. above ground at its highest point, the tram provides passengers with a picture postcard view of Manhattan and surrounding Queens.

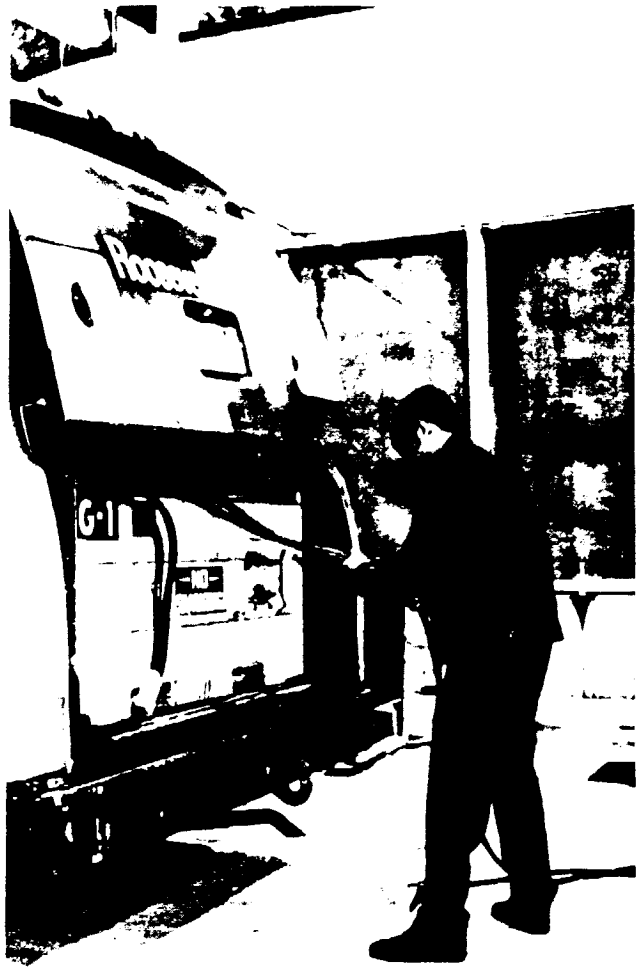
The tramway, the first aerial cable car commuter line to be installed in the U.S., can carry 1500 persons per hour in each direction. Time for each one-way run is a quick 3½ minutes. Price for a one-way trip is a $.50 token.

In designing the aerial tramway for Roosevelt Island, VSL Corp., New York and Los Gatos, Calif., included an emergency backup power system as a precaution against electrical power failures that could strand passengers in the tramway cars. An integral part of this system is lead acid batteries which store the standby electrical power.

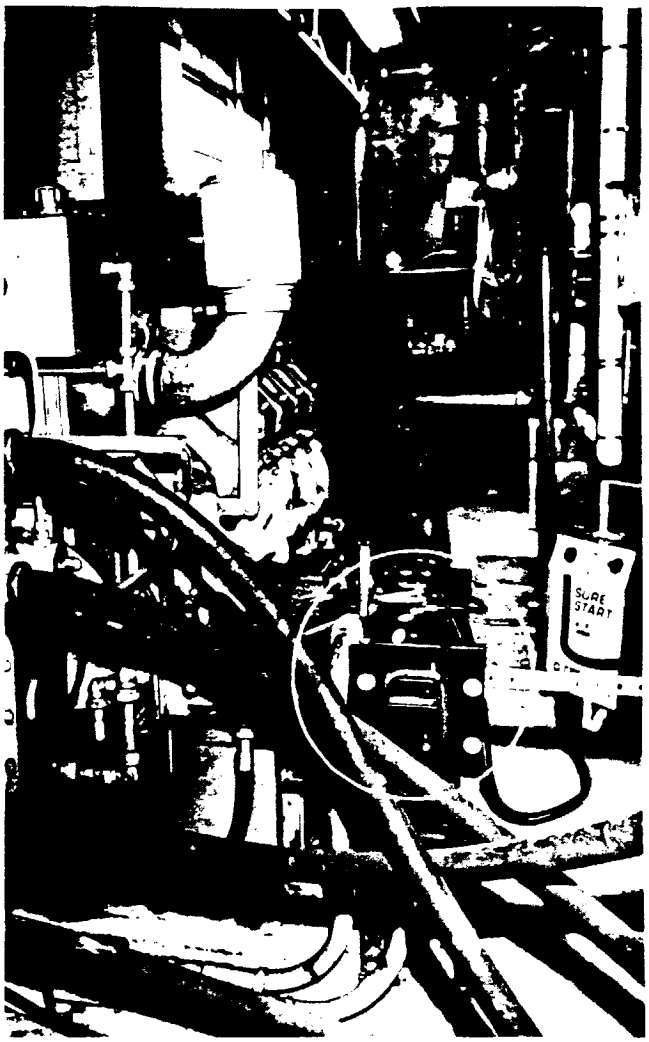
Lead batteries play several roles

David Ozerkis of VSL Corporation reports that lead batteries play three separate roles in the tramway's emergency power backup system—

- To supply electrical power within a stalled tram car. Lead batteries are stored on the roof of each tram car.
- To keep the tramway's electrically operated system operating in an emergency. Standby batteries are located in



Mechanic prepares to charge one of the 3500-lb. lead batteries which power the three electric buses on Roosevelt Island.



In the event of an electrical power failure, stranded tram cars can be returned to the stations by a standby diesel started by a 24-volt lead battery (circle).

the power station.

• To provide emergency power to start a standby diesel, which drives a hydraulically powered auxiliary drive. Batteries are located adjacent to the diesel which is also in the power station.

Each tram car contains two 24-volt lead batteries. They supply power for lighting within and outside of the cars and two-way telephone communications between the tram car and tram stations on Roosevelt Island and in Manhattan. The tramway's safety system, according to Ozerkis, can best be described as a monitoring system which continually checks the various safety components of the tramway. Should a power failure occur, two 24-volt lead batteries and one 48-volt battery at the tram stations will keep the monitoring system in operation.

Finally, in the event of a power failure the standby diesel drive with a hydraulic motor can be put into service to bring stranded cars to the stations. The diesel is started by a 24-volt lead battery.

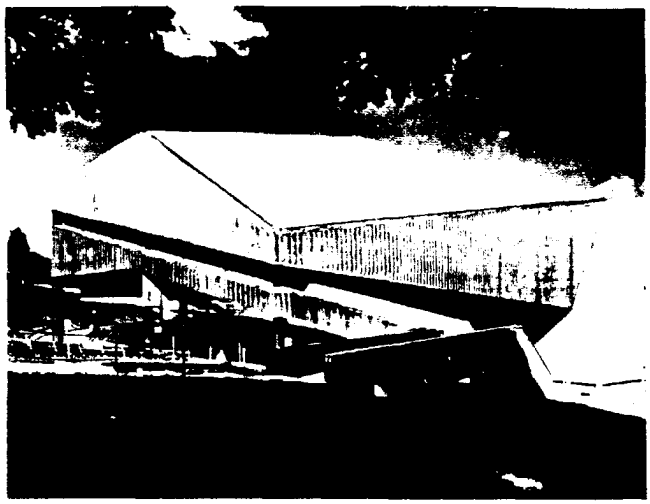
Says Ozerkis, "Even if there is a total power failure, the battery-powered emergency backup system will give us the necessary power to keep the tramway safety system operable.

Electric buses blend with environment

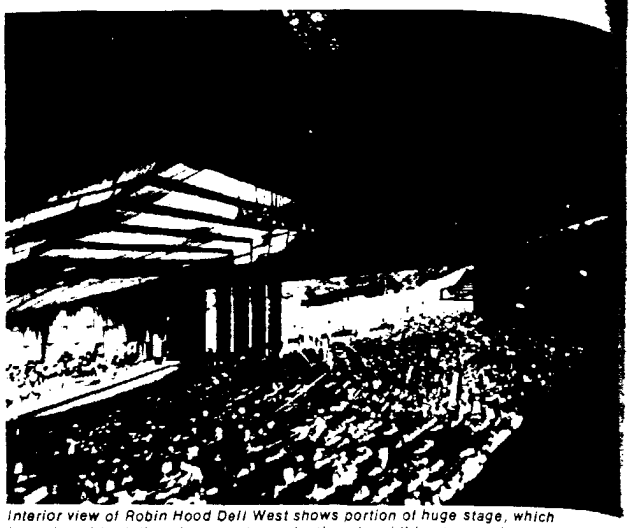
One of the most appealing features of Roosevelt Island is the almost country-like atmosphere that pervades. Although only a river separates the island from one of the largest cities in the world, the residents find themselves surrounded by trees, parks and a variety of flowers. Added to this setting is a quiet and clean environment, the result of a rule limiting the operation of internal combustion vehicles on the Island.

Car owners park in a central garage, and use electric buses to get around the Island. At present, three fume-and-noise-free buses, each powered by a 4800-lb., 36 cell lead battery operate along a two-mile, 16-stop route between the garage and the island's tramway terminal. One bus operates on an around-the-clock basis while the other two are added during rush hours—6 to 9 A.M. and 4 to 7 P.M. As the result of the initial success of these electrics, plans are being made for the addition of more battery-powered buses in the future.

Lead alloy coating enhances beauty and drama of new entertainment center



Exterior view of dramatic terne coated stainless steel roofing and siding used to provide cover for Robin Hood Dell West.



Interior view of Robin Hood Dell West shows portion of huge stage, which is equipped for full-scale operatic productions in addition to symphonies. more than 5,000 seats are protected by terne coated steel roofing and siding.

The architectural community is becoming increasingly aware of the aesthetic and practical advantages offered by lead alloy (terne) coated stainless steel (TCS). For example, New York architects MacFadyen/De Vido recently made extensive use of TCS to achieve the eye-catching series of geometric planes, shapes and vertical elements that distinguish the exterior of Robin Hood Dell West, one of the country's biggest outdoor musical "tents."

Located in Philadelphia's Fairmount Park, the new music center will primarily serve as the summer home of the famed Philadelphia Symphony Orchestra. However, it is one of the few such facilities designed for full-scale operatic productions. In addition to providing the attractive soft-gray appearance of lead, the structure's roofing and siding offer the strength of steel.

The architectural focal point of Robin Hood Dell West is its dramatic 80,000 sq. ft. TCS roof. This shelters some 5,000 seats, as well as the huge performing stage. An additional 10,000 spectators can be accommodated outside.

Terne coated stainless steel is produced with modern metal production technology that combines the strength of steel with the centuries-old corrosion resistance and ease of maintenance advantages of lead alloy. The lead alloy, comprised of 20 per cent tin, 80 per cent lead, is mill-applied to the surface of the stainless steel. The chrome-nickel stainless steel, known as Type 304, is produced in a condition known as "dead soft." This permits ease of fabrication since it is easy to form and has virtually no springback, an advantage in fabricating architectural components such as roofing, gutters and downspouts, as well as flashing and fascia.

The architects also used lead alloy's attractive appearance to an advantage in designing Robin Hood Dell West. The roof's multi-faceted surfaces, as seen during the day from various angles, provide an interesting contrast of light and shadow. At night, special lighting plays off the surfaces in glimmering patterns that change with each point of vantage.

The #40 terne coating on the TCS used for Robin Hood Dell West has about 1.16 oz. of lead alloy per square foot. This translated to about 7.25 lbs. of lead alloy per square. The roof required 800 squares, and the terne coated stainless was produced by Follansbee Steel Corp., Follansbee, W. Va.

Lead helps TCS wear well

Terne-coated stainless steel does not have to be painted, a particular advantage when the material is used for roofing. TCS weathers in the atmosphere without danger of unsightly staining of surrounding surfaces. The high lead content of the alloy applied to the stainless steel surface helps make this possible. In addition, lead helps to provide the soft, gray architecturally attractive color.

More than 7,000 TCS panels were required to install the roofing and siding for the structure that covers the seating area and stage. The roofing and siding were installed by Warren-Ehret-Linck, a Philadelphia roofing company. According to Bob Linck, president of the company, no unusual problems were encountered in installing the TCS since it handles in much the same manner as lead. To allow for expansion and contraction of the metal, the ends of the sheets were overlapped. It was not necessary to join the panel ends because of the extreme pitch of the roof, which was as much as 3-in. per ft., and the combination vertical and extreme angle arrangement of the panels used for the siding.

The large expanse covered for the roof made it necessary to provide for a comprehensive water run-off system. This was incorporated in a gutter system that extended around the perimeter of the edge of the roof. Pans for the gutter system, which was incorporated in the overall design structure, were fabricated from 18-gage (.0478-in.) TCS. The same material was used to form downspouts to carry water run-off from the gutters to the ground level. Linck reports that 50/50 tin-lead solder was used to join the roofing pans.

Two electro-acoustical amplifying systems, one for outside, one for inside insure that audiences seated in the enclosure as well as outside it can hear the music and voices as clearly and distinctly as possible. The 5,000 interior seats are angled downward toward the stage to permit the audience seated outside the enclosure to have an unobstructed view. The front of the stage is about 72-ft wide, 34-ft. high and the gross stage area is a monumental 14,000 sq. ft. to accommodate a full symphony orchestra as well as full-scale operas.

Vapor-phase process insures quality control for difficult soldering applications

Reliable solder connections on parts with unusual configurations or geometry are sometimes difficult to achieve. Now, such parts can often be joined quickly, easily and reliably with vapor-phase soldering.

Vapor-phase, or condensation soldering as it is sometimes called, uses the high temperature vapor provided by boiling fluorinated hydrocarbons as the heat transfer medium. The process, which is similar to vapor degreasing, is accomplished within an enclosed specially-equipped tank. Soldering time varies from 10 to 15 seconds, depending on the mass of the part involved.

Developed three years ago, the technique has just recently become commercially available. It lends itself to the soldering of complex shapes, while providing the exact temperature control and contamination-free environment that are inherent in achieving a high quality end product.

The first step in the vapor-phase technique is to apply some form of solder, either paste, preforms, plating, or pretinning to the surface to be joined. This is followed by the application of a mildly activated rosin flux. The part is then lowered into an enclosed stainless steel tank containing saturated vapor of the heat transfer fluid.

Immersion heaters installed at the bottom of the tank are used to bring the working fluid to a boil. At this point, vapor rises from the surface of the liquid, much the same as steam rises from boiling water. The only difference is that the liquid in this case has a higher boiling point (419 F) than water. The vapor's temperature is the same as that of the fluid, just as steam temperature matches that of the water. Cooling coils at the top of the open vessel are used to contain and condense the vapor generated by the boiling fluid.

When the relatively cool part is immersed in saturated vapor, the vapor condenses on it, like moisture in the summer air on a cold glass. The vapor energy is rapidly transferred to the part in the form of heat, thus uniformly melting the solder and joining the assembly. This uniform heating ability permits the simultaneous soldering of many component parts, regardless of configuration. It also practically eliminates the chance of thermal shock.

Process insures quality product

The fact that soldering takes place in the vapor area and not in the fluid eliminates contamination. And the exclusion of air minimizes the effects of oxidation on both product and flux. Thus, the process has a demonstrated ability to provide highly reliable solder connections without product or joint degradation.

When the part is soldered and removed from the vapor, it continues to drip condensate while it dries. Except for a small diffusion loss, this condensate drops to the bottom of the tank to rejoin the boiling fluid for recycling.

The equipment needed for the vapor-phase process is now commercially available in several size ranges. Some are supplied with a secondary vapor blanket for vapor conservation. The technique has been successfully employed by a number of companies involved in critical soldering processes.

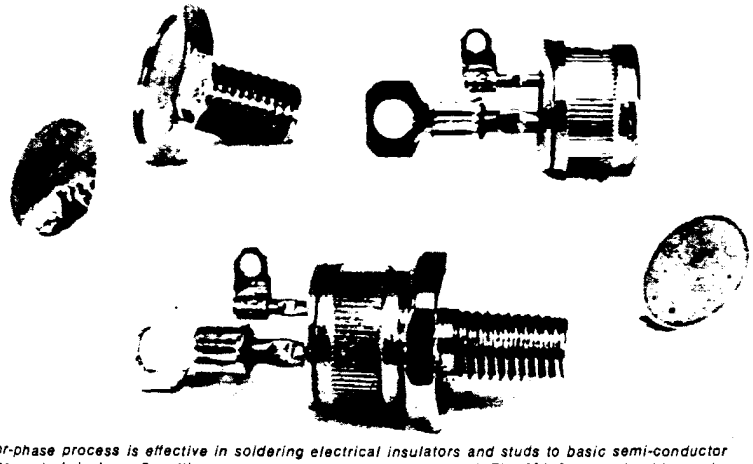
One manufacturer of vapor-phase equipment is Hybrid Technology Corp. (HTC), Concord, Mass. According to HTC, a major electronics manufacturer found the vapor-phase process particularly applicable in the soldering of studs and insulators to power control devices. The rapid and uniform heating of the process permits the soldering of these devices at once. And the minimum temperature exposure avoids excessive heat which tends to cause degradation.

In this application, 60/40 tin lead solder preforms, flux coated, are inserted between the press-fit package and the stud. Typical reflow time is 15 to 20 seconds, and the resulting solder fillet provides optimum heat conduction between the device and a heat sink in application.

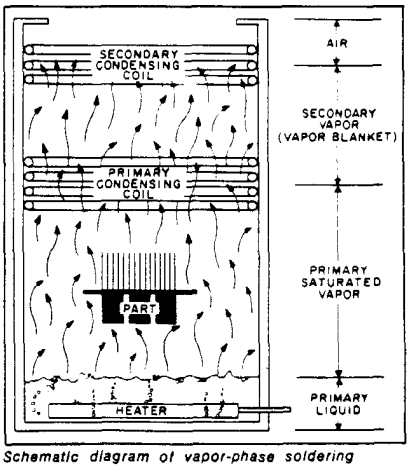
The power control device is protected from oxidation during soldering and the resulting component is bright and shiny after processing. Productivity depends on the parts loading rate. According to HTC, the system's capability ranges from 7,500 to 10,000 parts an hour, with high reliability.

Manufacturers of vapor-phase equipment state that the reduced operating cost of the system makes it economically attractive for many soldering applications. This is especially true in cases where hand soldering or other difficult manufacturing procedures are currently being used. Reportedly, the significant improvement in product quality and yield can often cover the capital cost of equipment and fluid expense and also provide a reduction in manufacturing costs.

Source: Alpha Metals

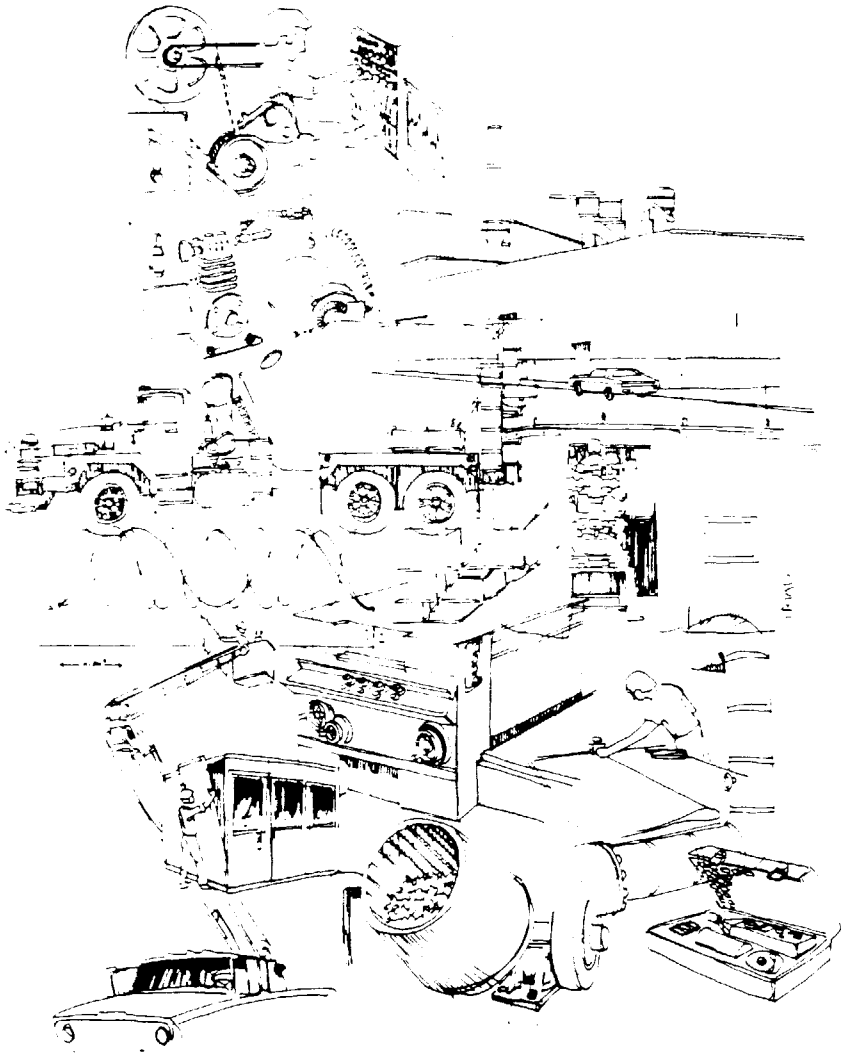


Vapor-phase process is effective in soldering electrical insulators and studs to basic semi-conductor power control devices. Resulting component is shown in foreground. The 60/40 tin lead solder preform, at left, is inserted between pressfit package and stud. Reflow time averages 15 to 20 seconds.



Schematic diagram of vapor-phase soldering process, including secondary blanket for vapor conservation.

Flexible lead products help solve noise control problems



Companies involved in supplying products to the increasingly complex industrial and commercial noise control market are turning to lead to help solve a wide variety of sound abatement problems.

Major factors that are adding to the complexity of industrial noise control requirements are the many Federal regulations resulting from the Occupational Safety and Health Act (OSHA). The regulations require manufacturers to limit noise levels to which employees are exposed.

In other cases, employee productivity has been considerably increased by a quieter working environment. Meanwhile, both state and municipal agencies are placing more emphasis on enforcing existing noise control regulations for communities, and new regulations are constantly being promulgated.

To comply with the various Federal, State and local municipal noise control regulations, product manufacturers as well as machinery manufacturers who sell to commercial and industrial markets are turning to companies who specialize in noise abatement. Such companies know how to surround all types of offending machines with materials to either reduce noise to accepted OSHA levels, or to the point where an employee can perform more effectively or a community can live and work without bothersome noise. In many cases, these noise control materials are either combined with, or wholly made from lead. It is for these reasons that some companies are becoming known for their use of lead noise control materials.

Lead used in many materials

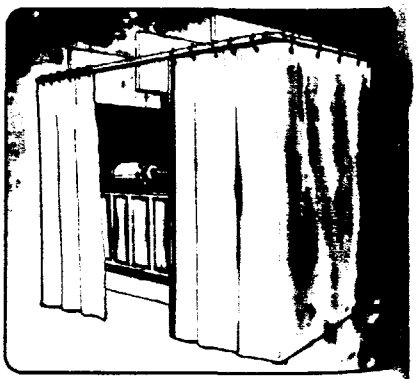
For example, Industrial Noise Control (INC) of Addison, Ill. uses lead for more than a dozen different noise control materials. They include free-hanging lead sound barriers, acoustical foam combined with sheet lead, acoustical absorbers combining lead with quilted sound-absorbing materials, and lead-loaded vinyls. The company sells these materials to individual companies who have an in-house installation capability. In addition, INC has a team of noise abatement engineers who specialize in installing the company's products on a custom-order basis.

A typical problem the company has solved was achieved through the use of lead septum divided blankets to wall off sound. A large manufacturer of locomotives had such divider walls installed at strategic worker rest areas in the plant, thus reducing the noise in these areas 5 to 12 dB from the prevailing 96 dB level. With the lead septum blanket installed on either side of the work area through the use of floor-supported strands, the company was able to comply with OSHA regulations.

The lead septum blankets meet ASTM-E84 Class I flame and smoke tests. This qualification permits elimination of other possible OSHA violations regarding flammability and fire resistance requirements.

Three steps required to curb noise

INC stresses that a successful noise control project requires proper planning, appropriate materials, and competent installation. As an example, INC points to an OSHA-related problem involving huge punch presses. The presses, which were installed prior to the time



For easy accessability, leaded vinyl can be attached to rings mounted to piping that hangs from the ceiling. Low-hung baffles help dissipate noise.

OSHA regulations took effect, were in such close proximity that they generated a noise level which varied from between 95 to 100 dB. Punch press operators as well as nearby plant personnel had to be protected from the excessive noise, which can be compared to the sounds of city traffic.

Existing space between the punch presses had to be conserved to allow access by operators and maintenance personnel. Adequate air circulation around the machinery was also necessary. And the material used to cover the presses had to have a good fire rating. It was for these reasons that a fixed enclosure was found to be impractical.

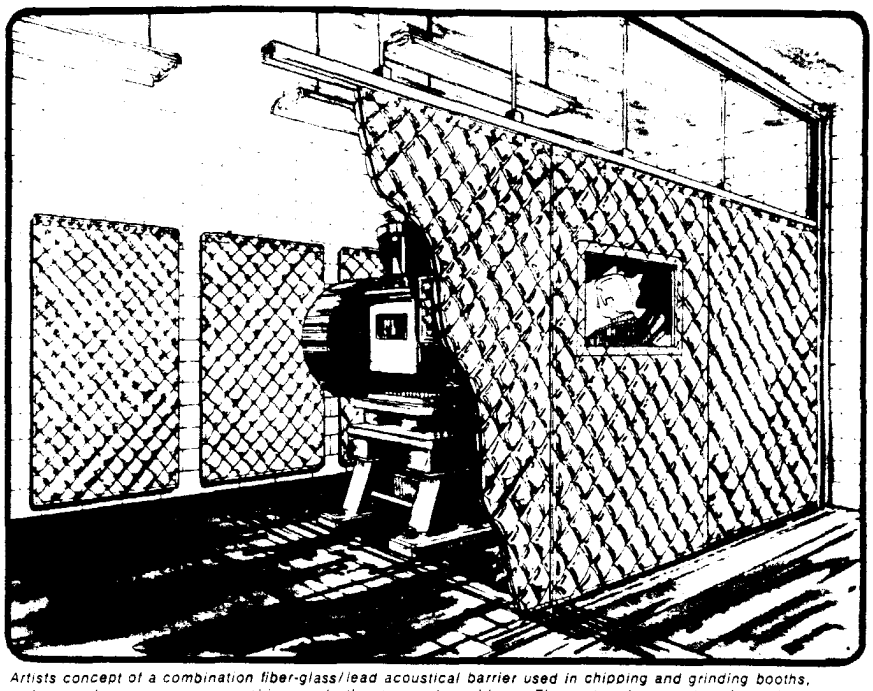
To solve the problem, INC designed an encircling curtain barrier system incorporating the use of lead impregnated vinyl curtains. Access for occasional inspection, adjustments, etc., was obtained by parting curtain sections held together with Velcro strips. For die changes, major maintenance, etc., the entire curtain enclosure can be moved vertically through the use of an electric hoist. The top of the enclosure was left open to provide for air circulation and noise absorbing baffles were suspended above the enclosure near the roof to dissipate noise deflected upward from the open top of the enclosure.

Use of the circular leaded vinyl noise barriers resulted in a 7 to 8 dB noise reduction from the 95 to 100 dB level. If needed, further noise reduction, from 8 to 15 dB, could have been achieved, with the use of absorber lining in combination with the ceiling-mounted absorbers.

Outside noise offends too

Another noise abatement program involved a centrifugal fan-type pump located outside an electro-plating plant. The noise output from the pump was at a noise level well above the community zoning limits. The pump operates continuously and a reduction of 20 dB was required to comply with local noise control regulations.

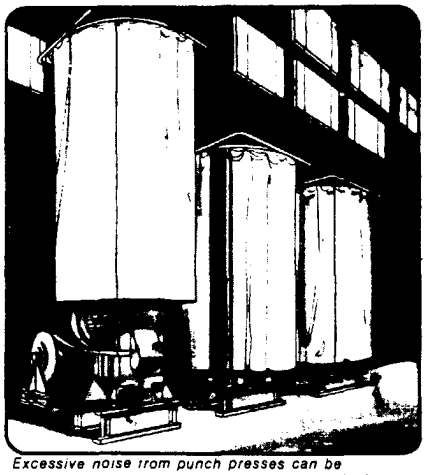
A number of factors had to be considered in reducing the noise levels emanating from the pump. Operation of the pump required axially flowing air for cooling. Occasional inspection was necessary from the top of the pump. Noise control materials had to be vermin-proof, resistant to corrosive chemicals, and be able to withstand year-round climatic changes ranging from freezing to summertime heat.



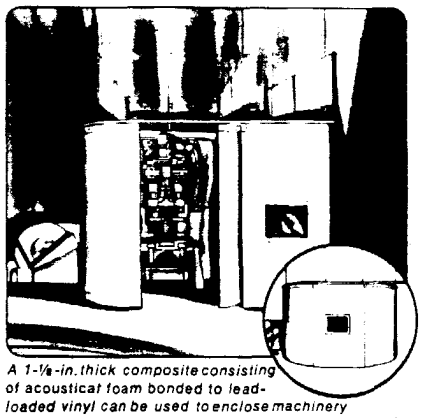
Artists concept of a combination fiber-glass/lead acoustical barrier used in chipping and grinding booths, or for punch presses, screw machines and other types of machinery. The system has a noise absorption capability on both the front and back surfaces, which are covered with impervious facings; and a lead noise barrier in the center, which is seen as the heavy dark line in the cut-away section.

To solve these problems, the fan-type pump was surrounded with a metal frame system. A composite material consisting of 1 pound per sq. ft. (psf) leaded vinyl combined with a 1-in. foam material was used to form a wrap-around cover around the base of the pump. A top cover with mitred corners was formed of 1 psf leaded vinyl.

Installation of the sound control materials, which cost only $250, reduced the noise to the point where there was no violations of community regulations. Noise levels monitored adjacent to the pump showed a 23 dBA reduction.



Excessive noise from punch presses can be decreased through the use of a leaded vinyl circular enclosure, which can be raised and lowered to permit access. To dissipate noise deflected upward from the enclosures, noise absorbing baffles also can be installed.



A 1-½-in. thick composite consisting of acoustical foam bonded to lead-loaded vinyl can be used to enclose machinery spaces to decrease excessive noise. Baffles at top of enclosure dissipate upward noise. Large view shows sliding door open to permit entry for maintenance while circled area shows how portal can be used to view machinery when door is closed.

According to Alan J. Morris, President and General Manager of INC, the company has worked with more than 300 firms to help solve their noise control problems. Some of these companies are nationally known and include General Electric, General Foods and General Motors. Others are less known companies whose noise control problems were nonetheless just as significant.

Leaded steels: key to better machining

Although steel's inherent strength is its primary advantage, it is this strength that becomes a disadvantage during the production of a wide variety of consumer and industrial products. They include steel parts and components that must be machined to form the desired shape and size.

Steel that has been alloyed with other materials is easier to machine than non-alloyed steel. Machining non-alloyed steels takes longer and can wear down cutting tools. The time it takes to machine the desired shape and size depends on how hard the steel is and how much it resists the force of cutting tools. Friction also builds up between the tool and the non-alloyed steel and this requires additional lubrication and cooling. All these factors increase production costs and, consequently, the cost of the components being machined.

One answer to minimizing such production problems is the use of leaded steels. Lead is added to the steel ingot during pouring. Generally, about .15 to .35 percent lead is added. The lead remains in the solidified steel as a fine dispersion, and acts as a built-in lubricant and as a chipbreaker to reduce friction and tool-edge buildup.

Users of leaded steels find that machining tools have a longer life-span, require fewer tool grinds, and that downtime is reduced due to the steel's machinability. Additionally, dimensional tolerances are easier to maintain, and quite often, grinding and deburring operations can be eliminated while time for heavy cuts can be reduced.

Leaded steel solves chip problem

A typical example of the successful use of leaded steel can be found at the Davenport Machine Tool Co., Rochester, N.Y. The company purchased a tape-controlled automatic bar machine to produce the outer spindles for their own automatic screw machines. Because the bar machine combined five separate manual operations into one preprogrammed automatic cycle, Davenport projected considerable savings in production time.

However, once in operation the equipment's heavy metal removal capability and combined cuts produced long, stringy steel chips which threatened to clog the machine. Machine operators found that removing the chips required considerable time, to the extent that it was impossible to run more than one machine at a time. As an alternative solution, specially-ground, brazed, carbide-tip tools were used but these only produced a few pieces per grind. And on occasion, heat generated by uncleared chips welded a fairly long drill into the workpiece.

The conventional steel was replaced with an American Iron and Steel Institute (AISI) 16L15 steel produced by Copperweld Steel Co., Warren, Ohio. (It is of interest to note that the use of lead in free-machining steels is of sufficient significance that AISI has recognized such steels and has given them an "L" (lead) designation within the numerical code assigned).

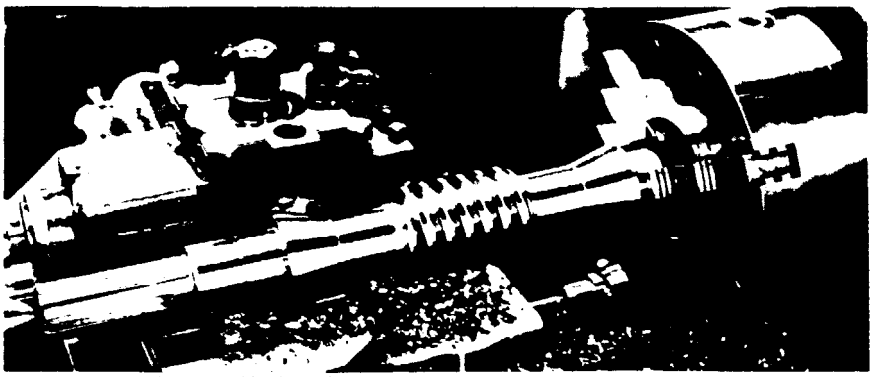
Cycle time cut 51½ minutes

The advantages of leaded steel were immediately apparent. Unlike the long, stringy chips produced by the unleaded steel, the leaded steel broke into small, tightly curled chips that were easily cleared from the cutting area. And the first lot of spindles ran so well that the operator switched from tape to conventional automatic control and began increasing speeds and feeds. A one-hour cycle time was reduced to 8½ minutes. Many of the special hand-ground, brazed-tip cutters were replaced with standard insert tooling which lasted for several hundred pieces. Dimensional tolerances and surface finish also improved.

According to Joseph A. Hoffman, Product Manager, Copperweld Steel, leaded steels are not new. Lead has been added to carbon steels since the late 1930's. Alloyed steels have been produced with lead since about 1952. Hoffman reports that one of the reasons for increased use of lead alloy steels is the consistency of today's product.

In the past, many machining advantages of leaded steels were offset by lack of consistency. With today's modern steel-making technology, fine lead is dispersed throughout the steel. This improves consistency to the point where lead alloy steels can be used to their full advantage in producing steel that provides higher machine speeds that decrease production costs while maintaining high quality.

Lead, in the form of fine shot, is added to the steel ingot during pouring.



An air compressor shaft is machined out of leaded steel bar.

The '70's—decade of decision for electric vehicles

EV Exposition in Chicago, multi-million dollar government funding to provide growth for industry

The International Electric Vehicle Exposition and Conference, (April 26-29) at Chicago's McCormick Place will have a significant impact on the growth of the electric vehicle industry in the United States. Nearly 100 U.S. and foreign firms will display electric vehicles or components for vehicles such as batteries, electric motors, etc. For the first time, there will be a major potential for the sale of electric cars, buses, and trucks exhibited at the EV Exposition and Conference.

The Electric and Hybrid Vehicle Research, Development and Demonstration Act of 1976 has been funded in the amount of $160 million to purchase approximately 7,500 battery powered and hybrid vehicles during the next three years. The vehicles will be placed in service throughout the country in a variety of situations that will be designed to demonstrate the effectiveness of electric and hybrid electric vehicles to perform transportation tasks now performed by fossil fuel powered vehicles.

Among the exhibits (Booth 701) at the EV Exposition and Conference will be "GoLIAth II", a modernized and updated version of the Lead Industries Association's (LIA) lightweight battery powered truck that has been in demonstration service throughout the U.S. and Canada during the past four years.

Modernized, updated version of GoLIAth, the Lead Industries Association's lead battery-powered lightweight electric truck, is checked by technician of Battronic Corp., Boyertown, Pa., where latest in EV technology was incorporated before continuing demonstration service with LIA.

"GoLIAth I", which has been in service in more than 30 U.S. and Canadian cities delivering newspapers, magazines, books, printed material and performing pickup and delivery service for a variety of service industries, was given a new look for the show at McCormick Place.

In addition to a new, streamlined body, GoLIAth will be sporting a variety of other innovations that will make it the most modern electric vehicle of its type produced in this country.

Less obvious, but illustrating technical advances since GoLIAth's inception in 1974, will be a number of improved components that add to the efficiency and performance of lightweight battery powered trucks that weigh less than 10,000 lbs. For example, a major addition will be the first especially designed radial tires for electric vans. Produced by Firestone especially for GoLIAth, the tires decrease rolling resistance and increase driver comfort. Under-hood improvements include the latest electronic motor controller and a new "fuel" gage that shows how much charge remains in the battery system after completing a trip. Not to be overlooked is one of the newest maintenance-free lead batteries serving accessories such as lights, windshield wipers, heater fan, etc.

Because lead batteries are the most readily available economic energy storage systems available today, they will likely be the primary power source for most of the initial 2,500 electric vehicles authorized in the first phase of the electric and hybrid vehicle program. This fact will add emphasis to various research and development programs now underway to further improve the performance of lead batteries to power electric vehicles.

The technical program for the EV Exposition and Conference includes technical, application and marketing presentations that are devoted to a non-automotive market where lead batteries also dominate: materials handling equipment. LIA has also been in the forefront in bringing the advantages of lead battery powered personnel carriers, work vehicles and special duty vehicles to the attention of end users.

LEAD

ARCHITECTURAL

Lead Roofing and Flashing

Detailed instructions on the simplest and most usual methods for forming or joining lead for roofing and flashing applications. Complete specifications. Diagrammatic drawings. Sixteen pages. **A-5**

Lead in Building

A four-part data sheet containing information on waterproofing, sound barriers, roofing and flashing and anti-vibration application. **A-13**

CERAMICS

Facts about Lead Glazes for Art Potters and Hobbyists

Detailed information on the proper formulation, firing techniques, handling, etc. of lead fluxed glazes used by art potters and hobby ceramists. Illustrated. Sixteen pages. **B-11**

Proceedings of First International Conference on Ceramic Foodware Safety

Top international experts in ceramics, Food and Drug agency officials, and the international lead research community met in Geneva in November, 1974 to discuss heavy metal release from glazed ceramic foodware. Full proceedings—speeches as well as question and answer dialog—were taped, translated and transcribed. 272 pages. **B-13**

PAINTS

Lead Pigments Bulletin

Brochure, 12-pages, describes the advantages and varieties of lead pigments in anti-corrosion paints. Covers red lead, dibasic lead phopshite, basic silicate white lead, basic lead phosphosilicate, basic lead chromosilicate, basic lead silico chromate. Lists major suppliers. **F-7**

CHEMICAL CONSTRUCTION & CORROSION PROTECTION

Lead for Corrosion Resistant Applications

Soft cover book, 156-pages, designed to familiarize engineers and engineering students with the corrosion resistance, design and fabrication data on lead and lead-based equipment. Defines plumbum series and corrosion resistance of series. **H-6**

Lead Chemicals

Soft cover book, 334-pages, is designed as a working manual for the chemist or chemical engineer engaged in applied technology or pure research. Covers organolead compounds, oxides and hydroxides, sulfides and tellurides, halides binary compounds, lead salts, lead chelates, safety in handling compounds. Purchasing price: $3.00. **H-7**

SOLDERING AND WELDING

Solders and Soldering

New 16-page booklet filled with basic information on soldering and the selection of the right solder alloy for the application. Data is presented on a variety of tin lead as well as other solder alloys. Several case history treatments of typical soldering applications are included. **I-6**

"Solder Puts It All Together for Manufacturer of Zippo Lighters"

Two-page reprint from Production Magazine details production soldering of lighters at Zippo Mfg. Co. **I-7**

SOUND BARRIERS

Directory of Acoustic Specialties

Summary of available materials for sound insulation by barrier, damping and absorption methods. Sixteen page list of materials by brand name and manufacturer. Eighteen pages. **J-4**

Lead a Major Factor in New Machinery Noise Suppression Systems

Description of techniques used to lower machinery noise levels with lead and lead composites. Lists machines that normally exceed noise level allowed by Walsh-Healey Public Contracts Act. Two pages. **J-9**

Sheet Lead Plenum Barriers

Detailed description of acoustical plenum barriers and how to install them. Materials and installation procedures described and illustrated. Eight pages. **J-10**

Practical Application of Sheet Lead for Noise Barriers

Discusses how the use of various thicknesses of lead bonded to or used in conjunction with other construction materials determines the Sound Transmission Class (STC) rating of walls and partitions. **J-15**

Lead Proves a Heavy Favorite as Sound Control Material

A reprint of a feature from *Product Engineering* illustrating lead's usefulness in sound attenuation to help meet OSHA noise requirements in factories and also on planes and trains. **J-17**

Specifying Lead for Noise Control

Eight-page reprint contains guidelines to help architects and engineers fully utilize the advantages of lead as a noise control material. A number of case histories are included to show how some of these guidelines were used to solve a variety of commercial, industrial and residential noise problems. **J-18**

The Use of Absorber/Barrier Materials for Noise Control Enclosures

Four-page reprint is concerned with noise abatement applications within the 10 to 15 dB range. It describes an installation using a quilted absorber/barrier enclosure suitable for achieving these reductions, and presents the advantages of this material. Acoustical, economic, operational and maintenance aspects are considered. **J-19**

BATTERIES

A Primer on the Lead-Acid Battery

A condensed story of the principles of the lead-acid battery and its chemistry, including some of the fundamentals and definitions of direct-current electric energy. Two pages. **L-6**

Electrics Get Key Post Office Tests

Reprint of a feature from Electrical World describing tests on the suitability and economy of electric battery-powered delivery trucks for the Postal Service. **L-18**

Electric Work Vehicles

A 12-page folder describing battery-powered short-haul delivery vehicles and comparing their economics to internal combustion delivery trucks. **L-19**

Battery Powered Electric Work Vehicles

A 16-page bulletin on electric vehicles for short-haul, multi-stop commercial application. Lists major vehicle manufacturers as well as comparative costs electric vs. I.C. vehicles in closed-looped service. **L-21**

Battery-Powered Industrial Trucks Spark Energy and Cost Savings

This 16-page booklet offers an in-depth look at the many factors favoring the purchase of electrics for industrial applications. A pull-out set of work sheets allows the reader to determine how electrics stack up against IC types in his own operation. **L-22**

Saving Battery Dollars—What You Need to Know

Three-part reprint from Modern Materials Handling deals with proper procedure in picking the right battery for the truck and job. It also discusses considerations in battery charger selection. The third part offers guidelines for planning an efficient battery charging-room layout. **L-23**

GENERAL

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**

Lead—a Modern Design Material

Summary of properties and available forms of lead for radiation control, sound/vibration control, electrical energy sources, soldering and ceramics. Eight pages. **M-15**

Use of Lead in the Automobile

Reprint of article from *Metals Week* discussing in detail the various applications of lead in the automobile. Four pages. **M-17**

Lead Industries Association

Sixteen-page brochure contains brief description of Association's purposes, structure and management, history, function and major activites. Current member list is included, along with other foreign and domestic trade associations with whom cooperation is maintained. **M-18**

Lead—The "Clydesdale" Workhorse in Space

Reprint from *Space World* detailing the applications of lead in space exploration. Illustrated. Four pages. **M-19**

Ecology in the New Lead Belt

Reprint describes cooperation of industry and environmentalists in developing southern Missouri lead mines. Four pages. **M-23**

Lead, "The Cinderella Metal"

Booklet is reprint of talk given at the First National Conference on Materials Availability/Utilization. K. C. Hendrick, President, Noranda Sales Corp., a Canadian lead producer, discusses supply and pricing trends for the metal and emphasizes its significance and value both now and in the future. **M-31**

Leaded Grades: Answer to Free-Machining Needs

Reprint reports on benefits derived from using leaded steels for free machining. Case histories are employed to demonstrate that these grades can enable partsmakers to raise production of quality components with efficiency and economy. **M-32**

Lead and Zinc Outlook 1976-1980

Booklet examines demand prospects and production for lead and zinc over the next four years. Current markets and growth applications are also discussed. 16-pages. **M-33**

Occupational Lead Poisoning . . . It Needn't Be . . . A Manual for Managers

Contains information of use to the industrial manager on the safe handling of lead and lead products in industry. Types and permissible levels of occupational lead exposure are discussed. Some practical controls and safeguards are suggested. 16 pages, bibliography. **M-34**

FILMS

Lead in Motion

A 21-min., 16mm color film. Lead's properties and its potential for unlimited future applications are explored from the viewpoint that an atom of lead—like all elemental matter—is an arrangement of energy—part of a universal system. To order specify desired show date and one alternate date. No charge to borrow; viewer pays only return postage. **N-2**

Occupational Lead Poisoning . . . It Needn't Be

A 16mm, 20 min., sound color film. Narrated by the environmental health experts of international calibre, the film introduces the basic principles of a health program for the lead industry. The intention is to motivate the cooperation of both management and employees in developing an effective health program for their particular operation. To order, specify desired show date and allow one alternate date. Allow at least five weeks for delivery. No charge to borrow; viewer pays only return postage. **N-3**

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