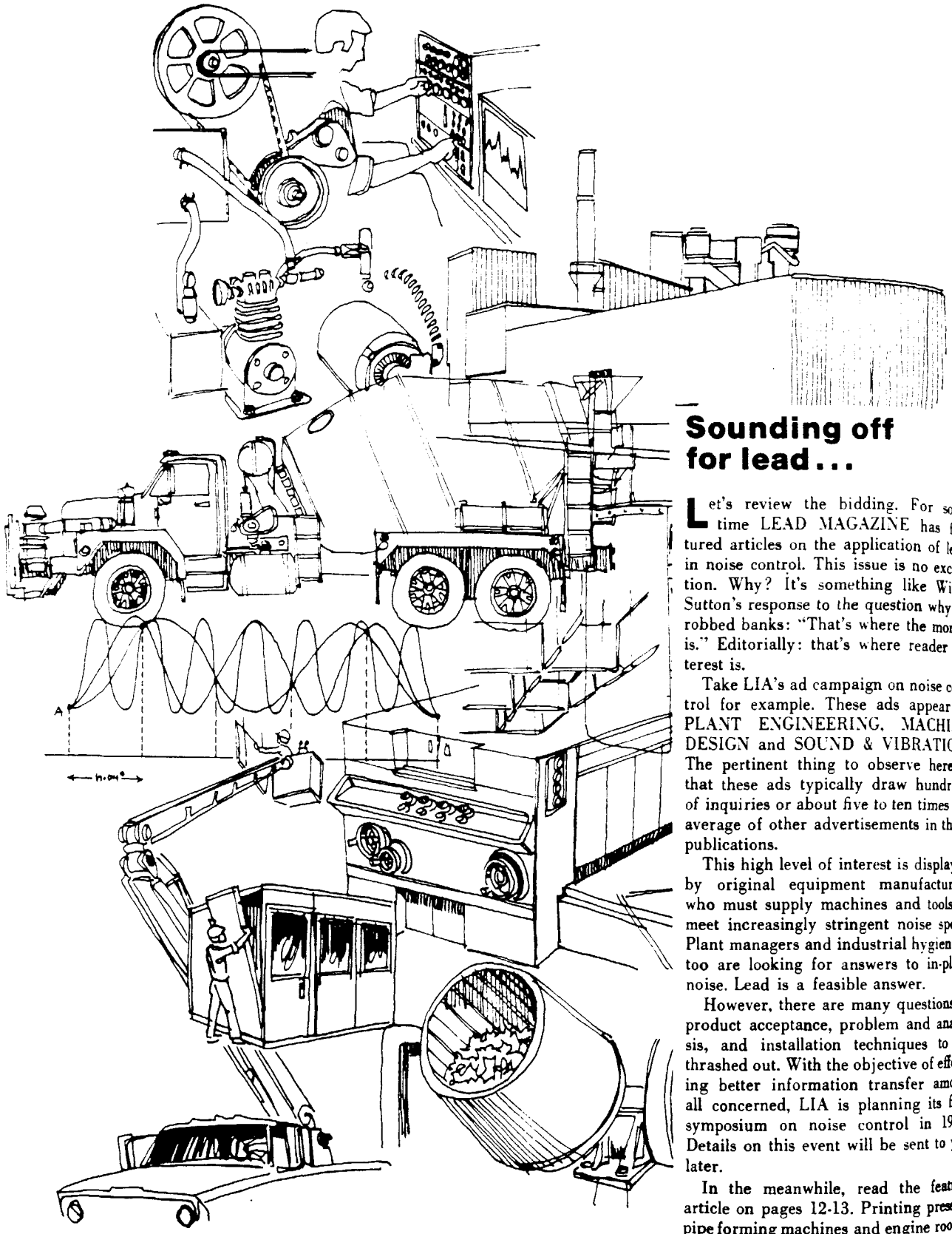


Art work courtesy of Industrial Noise Control, Inc.

Sounding off for lead...

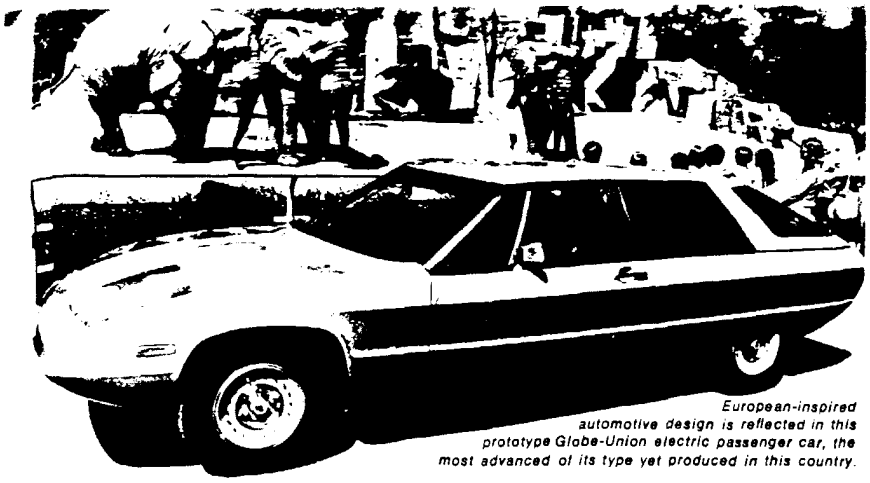
Let's review the bidding. For some time LEAD MAGAZINE has featured articles on the application of lead in noise control. This issue is no exception. Why? It's something like Willie Sutton's response to the question why he robbed banks: "That's where the money is." Editorially: that's where reader interest is.

Take LIA's ad campaign on noise control for example. These ads appear in PLANT ENGINEERING, MACHINE DESIGN and SOUND & VIBRATION. The pertinent thing to observe here is that these ads typically draw hundreds of inquiries or about five to ten times the average of other advertisements in these publications.

This high level of interest is displayed by original equipment manufacturers who must supply machines and tools to meet increasingly stringent noise specs. Plant managers and industrial hygienists too are looking for answers to in-plant noise. Lead is a feasible answer.

However, there are many questions of product acceptance, problem and analysis, and installation techniques to be thrashed out. With the objective of effecting better information transfer among all concerned, LIA is planning its first symposium on noise control in 1978. Details on this event will be sent to you later.

In the meanwhile, read the feature article on pages 12-13. Printing presses, pipe forming machines and engine rooms are cited as noise makers. And lead is there, knocking the dBs out of them.



European-inspired automotive design is reflected in this prototype Globe-Union electric passenger car, the most advanced of its type yet produced in this country.

Exciting new electric vehicles on the horizon

There have been significant advances in developing improved, maintenance-free batteries for use in electric vehicles. However, body and interior designs by electric vehicle producers have lagged.

It appears that's changing. Thanks to increased use of professional automotive designers, more attention is being paid to the sales appeal of both the exterior and interior of electric vehicles.

For example, one of the most dramatically styled battery-powered cars produced anywhere in the world was introduced during the International Electric Vehicle Exposition earlier this year in Chicago. Incorporating all the latest lead-acid battery technological innovations, the car was developed by Globe-Union. The car was designed by McKee Engineering, the company that designed ESB's well known Sundancer, a prototype two-seater electric passenger car whose streamlined design is as modern now as it was when the vehicle was introduced about six years ago.

The Globe-Union vehicle, named Endura, is powered by twenty 12-volt lead batteries. The most striking thing about the car is its appearance. It features an aerodynamic designed fiberglass body that looks as though it's a product of a leading Italian automotive body stylist. By replacing the car's removable hatchback, the car can function as a 2 + 2 coupe or a station wagon.

Another unique feature of the car is its elegant interior and monopanel electronic control board. One merely touches the desired control area on the panel to activate the ignition, lights and wipers. The system, which also activates the monitoring accessories, was developed by the company's Centralab Electronics Division.

Special 12-volt lead-acid batteries used to power the car reportedly provide higher efficiency per unit weight or volume than conventional units. The batteries incorporate a polypropylene heat-sealed container and cover, computer-aided grid designs, specially formulated high porosity active plate material, microporous polyethylene separators, safety vents with built-in flame arrestors; larger and increased number of plates for improved electrical performance at high current draws.

Preliminary performance testing of Endura during a harsh Milwaukee winter produced remarkably good results. With a full charge, Endura was driven on suburban streets at city speeds of 30-35 miles per hour for over 100 miles. The car also has reached speeds in excess of 60 miles per hour under expressway conditions.

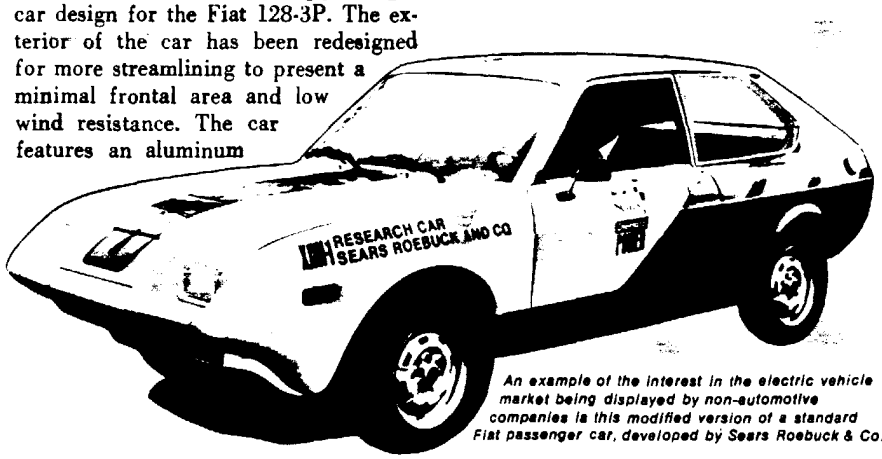
Sears now into electric cars

Meanwhile, another prototype electric passenger car has been introduced from an unexpected source, Sears. Designed to showcase the company's specially developed lead batteries for electric vehicles, the car is based on an existing passenger car design for the Fiat 128-3P. The exterior of the car has been redesigned for more streamlining to present a minimal frontal area and low wind resistance. The car features an aluminum front end cap with integral bumper, quad rectangular headlights with transparent covers, and a redesigned interior to provide a good passenger package for two, with adequate comfort and leg room.

Named the XDH-1, the car has exceeded 75 mph, and it will easily cruise at 65 mph according to Sears. The car has no trouble maintaining the legal 55-mph speed limit, with reserve speed for passing or emergency situations.

Twenty batteries are required for the desired range of the car. They are mounted in the car in 10 packs each located in the area formerly occupied by the rear seat and extending partially into the luggage compartment. Five batteries are located under the hood. A marine type battery provides power to operate accessories.

While both cars are prototypes, their acceptance by the general public is likely to influence the design of passenger cars reported to be in pre-production study by major Detroit companies. American Motors, whose wholly-owned subsidiary AM General has produced 350 electric Jeep-type vehicles for the U.S. Postal Service, recently released sketches of a streamlined electric three-passenger commuter car. A European division of Chrysler is known to be active in electric vehicle development. And, perhaps most significant of all, General Motors has apparently decided to enter the electric vehicle market in the immediate future. Elliott M. Estes, president of GM, told the Economic Club of New York that one kind of new technology GM "is excited about . . . is the progress we've made toward building an electric car that is suitable for use as a shopper or commuter vehicle in two- or three-car families."



An example of the interest in the electric vehicle market being displayed by non-automotive companies is this modified version of a standard Fiat passenger car, developed by Sears Roebuck & Co.

Aerospace house features solar-powered battery energy

What's the nation's space agency—the National Aeronautics and Space Administration (NASA)—doing building a house here on earth?

When NASA was assigned the job of guiding the nation's multi-billion dollar aerospace program, it was also given an additional task that few Americans know about: transfer the vast amount of aerospace technology to U.S. industry so that the general public—the taxpayers who paid the bill for the aerospace program—would benefit.

For example, NASA has erected a "technology utilization house" at its Langley Research Center in Hampton, Va., to show how technological spinoffs from the aerospace program can be used profitably by the construction industry. The house was designed with components and materials that are currently available or will be on the market within five years.

The house has many energy-saving features. Their incorporation in a house would result in an estimated $20,000 in savings over a 20-year period.

One of the most interesting energy-saving devices used in the house is a solar collector system that generates electricity directly from the sun's energy. Originally developed by NASA to power space satellites, the devices are called silicon solar cells. Simply stated, their use permits the conversion of energy from sunlight into electrical energy without moving parts.

Energy supplied by the silicon solar cells is stored in one of the most economical, readily available devices sold today—a 12-volt lead acid battery similar to starting, lighting and ignition (SLI) batteries used in automobiles. Energy stored in the batteries is used to power emergency indoor lighting during power failures, a fire detection system, a security system and a driveway spotlight.

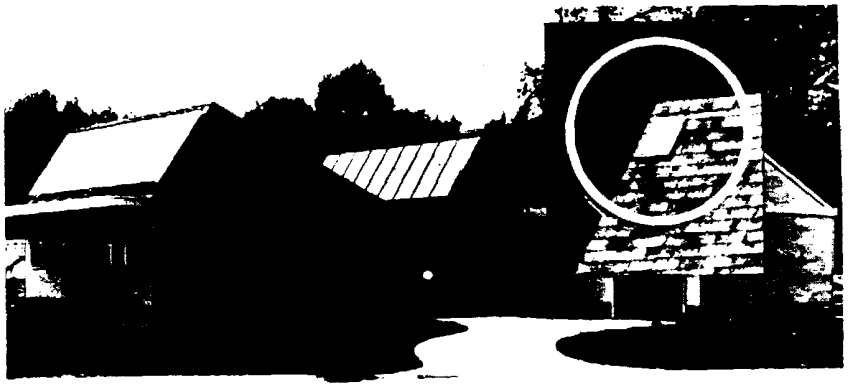
The multimode electronic lighting "satellight" used for the lead battery-powered emergency lighting system features the high efficiency and long life of fluorescent lamps. The extremely high light output results in low-cost electricity drain.

Other energy-saving devices include 432 sq. ft. of fluid-plate, fluid-type solar collectors. Used in combination with nighttime radiators and a heat pump, the collectors supply virtually all requirements for space heating and domestic hot water. A waste water recycling system similar to those developed for manned space satellites and interplanetary travel, light bulbs that incorporate a temperature-compensating thermister to protect them from current surges that decrease bulb life, and special insulation are also included.

The technology utilization house is of contemporary, one-story design. It features a large living room with fireplace, dining area, kitchen, two baths, laundry, two-car garage and outdoor living area. Total enclosed living space will be approximately 1,500 sq. ft.

Langley researchers determined that a contemporary house, occupied by a family of four, uses the equivalent of about 46,000 kilowatt hours of energy a year for central heating and air conditioning, water heating, lights, kitchen appliances, television, furnace fan and other equipment.

The NASA Tech House will use only about 15,000 kilowatt hours of energy a year. This two-thirds saving will not only conserve valuable energy resources, but will pay for the initial investment in a relatively short time.



Energy generated by photovoltaic solar cells mounted on roof of garage (circle) is stored in lead batteries to provide alternate electricity for special solar power demonstration house built by NASA at Hampton, Va.

Portable power for remote locations

Students at the Southern California Institute of Architecture in Santa Monica have solved a problem of providing electrical power for remote locations such as construction and temporary maintenance sites and forest fire spotting stations. They have developed a portable wind generator that charges a 12-volt DC lead storage battery.

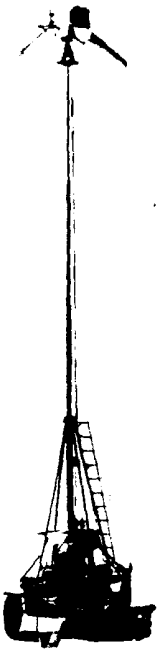
A surplus Air Force missile trailer was adapted to transport the generator. This enables the device to be moved from site to site to take advantage of ideal wind generating conditions.

On site, screwjacks on each corner of the 4-ft. by 8-ft. trailer stabilize the platform for the hydraulically-hoisted tower. The tower mechanism was converted from a surplus hydraulic lift. The equipment lifts the wind generator to a maximum height of 45-ft. (as shown). Guy wires from the base of the generator to the ground keep it upright in a variety of wind conditions.

At the top of the hydraulic-lift tower are three 8-ft. long stainless steel shafts, and a main outer shaft. The tower assembly pivots on an arm constructed from leftover missile carrier parts originally installed on the trailer. The hand fabricated blades automatically feather when wind speed increases so much the generator cannot operate safely.

The main shaft turns a set of gears which boost alternator speed. The alternator, with a maximum of 75 amps, is activated by a centrifugally operated microswitch at 1000 rpm.

It is estimated that the wind generator can provide a significant amount of energy for a small, energy conserving household.



Ancient recycled lead used to restore centuries-old stained glass windows

Visitors to the ancient Canterbury Cathedral at Canterbury, Kent, England, are impressed by the church's magnificent old leaded stained glass windows. But most of those making the pilgrimage to Canterbury are unaware that the windows are in the process of being restored using much of the original lead which joined the stained glass almost eight centuries ago.

The cathedral's windows represent the oldest and largest collection of leaded stained glass in England. The "Genealogical" sequence of windows, tracing the human ancestry of Christ, and the three "middle windows" portraying incidents from Christ's life and passion, date back to 1178. The "Theological" windows, which tell Bible stories in pictures, were also completed in the 12th century. There also are many fine windows dating from the 13th, 14th and 15th centuries.

Very few cathedrals in the world can match this beautiful, varied and historically important collection. Unfortunately, many of the windows have not withstood the ravages of time and the highly corrosive atmospheric conditions of modern times. In some cases the severity of the damage threatens to destroy the ancient windows. For this reason, an extensive restoration program was launched in 1973 to halt this progressive deterioration.

Original lead stands test of time

Interestingly enough, restoration operations have revealed that much of the lead that was originally used to frame the stained glass panels remains in good condition today. According to Frederick Cole, Director of Canterbury's Stained Glass Restoration Program, the lead used in the 12th and 13th century work has held up exceptionally well. Some experts consider this lead to be superior to the alloyed lead used in the 14th and 15th centuries.

Although the condition of the original lead demonstrates its characteristic durability, Cole cited one instance where environmental conditions had taken their toll. "When I examined the windows in the Cathedral's library," he related, "I was surprised to find the lead was decomposing. In doing so it had formed a grey slime on the inner surface of the windows. A subsequent investigation by the Lead Development Association revealed that the trouble was caused by the mingling of acid released from some new oak book shelves and the sulphur dioxide in the atmosphere. We overcame this with added ventilation."

Unlike the quality of the lead used in the ancient windows, the chemical composition of the glass itself made it unstable and less resistant to corrosion than modern glass. Most of the 12th and 13th century glass is heavily corroded. This takes the form of pitting on the exterior surface. In some cases the pitting has eaten all the way through the glass. The corrosion process is thought to have been accelerated by the increased accumulation of chemicals in the atmosphere since the advent of the Industrial Revolution.

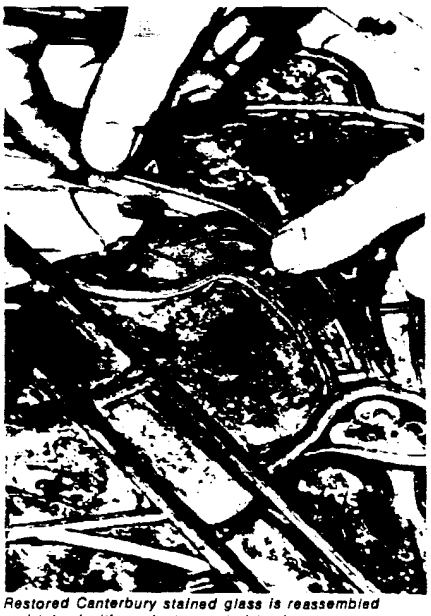
Lead recycled for new joining

A modern studio was set up on the Canterbury grounds to carry out the restorative program, which will take an estimated 20 years. When the windows are removed and taken apart the ancient lead is recycled, including the 60-40 tin lead solder used for joining. The unframed glass is thoroughly cleaned through the use of chemical solutions or ultrasonic baths. In addition, any broken glass is repaired. The panels are then reassembled and joined with the recycled lead.

The glass is then reinstalled and a second clear glass is installed outside the original window to protect it from reweathering. This external window is lightly leaded in general conformation to the leading on the inside windows. To date, one huge window, roughly the size of a tennis court, has been completed. Others are in various stages of refurbishing.

According to Cole, the qualities so many people admire in medieval glass are due to the aging process. "With age the stained glass and the people's faces become seamed, and they take on more character and beauty," he said. "The problem we face with the restoration is deciding how far we should go in restoring the windows to what they were originally."

One of Canterbury Cathedral's centuries-old leaded stained glass windows is dismantled in preparation for restorative treatment.



Restored Canterbury stained glass is reassembled and joined with ancient recycled lead.

Lead brick walls absorb high speed impact of spin test debris

Today's high-speed production lines call for steel wire to be fed off reels as fast as 16,000 feet per minute (ft/min). At such speeds, the reels are subjected to tremendous centrifugal forces that could cause them literally to be torn to pieces. Sections of the reel would then be hurled in all directions at very high speeds, which could injure workers and damage production equipment.

To make sure reels can withstand the extreme centrifugal forces, they are tested to the point of self-destruction, usually at speeds beyond those they would normally encounter in actual production. Such tests are conducted in specially designed circular enclosures called spin pits where speeds approach 24,000 revolutions per minute. When reels destruct at such speeds, sections are hurled at the spin pit walls with a tremendous impact. To absorb this enormous amount of energy, the walls are lined with lead bricks.

The design of spin pits for rotational testing is not standardized. Since they must be used for a variety of products, each is designed accordingly. Among the industries involved in this form of testing, aircraft companies are one of the largest. For example, Pratt & Whitney uses a testing pit extensively at its North Haven, Conn. plant to test such aircraft components as rotational elements for gas turbines. Another Connecticut-based firm, AKO, performs spin pit testing for other companies on a subcontract basis. And Worthington Pump, Buffalo, N.Y., uses a spin test pit to check high speed impellers for pump systems.

A wire reel industry "first"

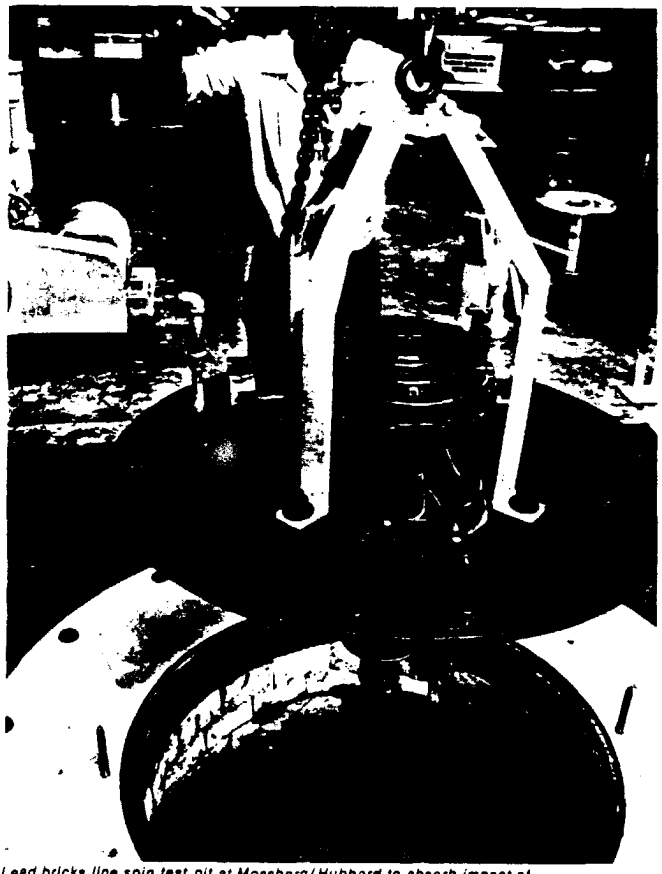
Mossberg/Hubbard, a major U.S. supplier of reels and spools for the wire industry, recently installed its own spin pit for testing its products. The New England firm is believed to be the only wire reel company to have such a facility. Previously, spin testing was accomplished by outside sources on a subcontract basis.

According to Paul Paulsen, chief engineer of the company, faster production rates in the wire reel industry are putting harder demands on the reel. "Wire speeds in the mills today are far greater than in the recent past," he said. "For example, 10,000 ft/min is as common today as 5,000 ft/min was five years ago. And no. 34-gage wire sometimes travels at as much as 16,000 ft/min."

The new spin pit is 45-in. wide and 28-in. deep. An air-driven turbine capable of 25,000 rpm is mounted on the cover of the pit. Reels are fastened to an arbor which is suspended from the turbine spindle. After the spindle is secured, air is pumped out of the chamber to avoid windage on the piece being tested.

Several thousand pounds of 4x4x8-in. lead bricks were used to line the interior of the pit to absorb the energy from flying debris when there is a reel destruct during a spin test. Fragments are imbedded in the lead, which protects the rest of the interior. The 4-in.-thick lead bricks are enclosed with three concentric cylinders of armor-plate steel and cased in reinforced concrete.

The pit is large enough to accept a 36-in.-dia. reel weighing up to 500 lb. Controls provide a digital readout for rpm, plus a paper tape printout to validate or certify speeds reached.



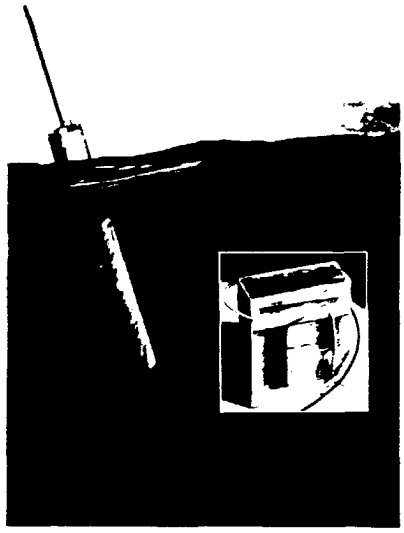
Lead bricks line spin test pit at Mossberg/Hubbard to absorb impact of wire reel sections when they self-destruct.

Before and after photo shows result of spin testing standard 8-in. G-type wire reel at 23,752 rpm, which is 366 percent over normal running speed.

Lead cuts cost of underwater sound systems

The substitution of lead for silver in a water-activated battery that powers a sophisticated underwater sound detection device is saving the U.S. Navy considerable money. The conversion has been accomplished without sacrificing the capacity, dependability and efficiency of the devices, known as sonobuoys.

Sonobuoys are air-dropped into oceans to detect and track nuclear submarines. After serving their purposes, the devices sink to the ocean floor where the valuable silver cannot be economically recovered. Although each battery contains only an ounce of silver, the Navy expends several hundred thousand sonobuoys each year. With the current price of silver running about $4.40 an ounce, the cost becomes significant.



Substitution of lead for silver in water-activated battery (inset) for underwater sound detection devices known as sonobuoys is saving the Navy considerable money.

Now a magnesium lead chloride battery has been developed that is a viable alternative to silver in the simplest sonobuoy system. The inexpensive lead chloride costs 6 cents an ounce, and only two ounces are required for each battery. This brings the cost down to only 12 cents per battery, a saving of about $4.28 per sonobuoy.

The simplest sonobuoy consists of a non-directional hydrophone, an audio amplifier, a radio transmitter and a battery. It is activated when sea-water floods the battery compartment.

The battery powers the transmitter which transmits submarine sounds picked up by the hydrophone to the aircraft above. The battery also initiates action that sinks the sonobuoy after use.

This ability to pinpoint the location of a submarine nullifies its inherent ability to avoid detection.

Source: ESB, Inc.

Solar energy provides in-place corrosion control for underground electrical cable

Solar power and a special lead-acid battery are proving to be an efficient combination for Florida Power Corp.

The utility's problem was insuring that a new mile-long 15kv lead sheathed cable feeding power to downtown St. Petersburg would not suffer from galvanic corrosion. Such corrosive attack could in time eat through the cable's protective sheath and subsequently cause electrical failure.

The 4-ft. burial depth of the cable only served to aggravate the problem, since this depth is below the water level for the coastal area. Moisture in the soil is one of the factors responsible for galvanic corrosion. When this moisture combines with the soil's corrosive chemicals it forms an environment that, in time, creates an electrolyte which causes an electric current. Although cable engineers agree that lead sheath is still the superior cable protection, under these conditions even lead could corrode to the point of failure.

Florida Power turned to its major product, electricity, for the necessary solution. In this case however, the electricity was supplied from a source outside the utility's own generating facilities. For some time the company had been investigating the feasibility of using solar energy to meet various needs. Research had indicated its suitability for this particular application.

Photovoltaic cells supply power

Installed at the utility's 16th Street substation in St. Petersburg, the electric power comes from a system of photovoltaic solar cells. They convert sunlight directly into electricity which is applied to the sheathed cable. The protective sheath, which could experience considerable corrosion in a short time, will reportedly last indefinitely with the application of the galvanic-current neutralizing charge.

Solar-powered rectifier feeds 30 watts at 6 volts d-c to 15kv underground cable to minimize galvanic corrosion.

The silicon-filled solar cells convert sunlight into electric energy without the use of any moving parts. The electrical output of 30 watts is greater than that required to generate the desired current. Therefore, the excess energy is diverted to a special 6-volt, 200 ampere-hour capacity lead-acid storage battery. The battery provides the energy requirements during the night and on days when cloud cover prevents the photovoltaic cells from functioning.

After a 12-month study of the effectiveness of the solar-powered rectifier, Florida Power has determined that the application is a trouble-free, effective method of corrosion protection in applications such as this. The solar device, which cost the utility $1,300, is a small price to pay for the protection it provides. It would be far more costly to dig up the mile-long cable for repair if problems developed.

The device is the same type used by the Coast Guard to light marker buoys in marine navigation channels and, more recently, to power a lighthouse at Key Largo. The National Park Service uses photovoltaic cells to power mountain-top radio-repeater communications facilities. NPS also has experimented with photovoltaic solar cells to recharge batteries used to power electric work and personnel transportation vehicles.

Major paint specifiers rely on lead-based products

New York City, famed throughout the world for its theaters, museums, shopping and restaurants, is also known for its bridges. The maintenance of many of these bridges connecting the various boroughs that make up the city is relegated to the Triborough Bridge and Tunnel Authority—better known by its initials—TBTA.

Because of the waters they span and their exposure to rain, snow and fumes, the seven bridges maintained by the TBTA are continually under attack by corrosion. New York also is an area where salt-laden Atlantic Ocean and Long Island Sound mists and fog add to the corrosion problem. The road salt and sand dispersed during the winter also take their toll, particularly alongside barricades and roadway center dividers.

One of TBTA's responsibilities is to specify a paint system that will offer maximum corrosion protection for the bridges under its jurisdiction and at the same time provide a good overall decorative appearance. The Authority invariably specifies lead-based paints to achieve these goals. And, because TBTA maintains so many bridges, other agencies with like responsibilities look to it for guidance in paint specification.

TBTA favors lead-based paints

TBTA officials report that, in so far as maintenance painting is concerned, lead-based pigments will perform better at a given cost than other paints on the market today. They have been using these paints for over 40 years. The lead-based products require minimum surface preparation and the cost per gallon is less than most other paints.

Typical of the TBTA bridges is the Throggs Neck, situated in the Northeastern section of the city, spanning the East River. It connects the mainland borough of the Bronx with Queens on Long Island. To the east lies Long Island Sound, and beyond, the Atlantic Ocean.

Like the six other structural steel bridges under TBTA jurisdiction—the others being the Triborough, Bronx Whitestone, Henry Hudson, Cross Bay Veterans Memorial, Marine Parkway and the newest, Verrazano Narrows—the Throggs Neck is being coated with blue-grey paint. This color was selected because it blends with the sky and water.

TBTA reports that a key element in the paint system used for its bridges is lead silico chromate. It is a highly effective, anti-corrosive, weather resistant protective pigment. The lead content of the pigment provides a compatible and durable paint system that not only offers superior protection against corrosion, but also helps the painted areas retain a "just painted" appearance. The lead-based paint is used both in prime and finish coats.

As an example, prior to the opening of the Verrazano Narrows Bridge in November, 1964, the entire steelwork was coated with three or more coats of basic lead silico chromate paint. Areas included the 70-story towers, and structural steel for the twin decks. In addition, about 5,300 gallons of red lead contained in a linseed oil paste was ap-

TBTA maintenance crew applies coating of lead-based paint to roadway center divider of Throggs Neck Bridge.

to guard steel structures against corrosion

plied to the more than mile-long cables supporting the bridge. In April, 1974 the bridge was re-painted during a two-year program ending in September, 1976. A total of 8,000 gallons of spot coat and 34,000 gallons of finish coat was utilized.

Lead also used by Port Authority

Other bridges in the New York area are maintained by the Port Authority of New York and New Jersey. The Port Authority favors lead-based paints for the primary coating of steel structures for the four bridges under its jurisdiction. They are the George Washington, Goethals, Bayonne and Outer Bridge Crossing.

These bridges are prime coated with a pre-mixed red lead/iron oxide paint. The top coat is alkyd-aluminum. The painting operation consumes eight months of each year. Maintenance of the various areas of all bridges is performed on an individual cyclical basis.

TA likes lead protection too

Lead-based paints are also playing an important role in maintaining New York City's subway system. The City's 24 subway lines carry about 3,500,000 passengers per day on 230.64 miles of track that snake through four of the City's five boroughs—Manhattan, Bronx, Brooklyn and Queens. And in some areas the subway becomes elevated, emerging from beneath the ground to rise above the streets.

The 70.82 miles of elevated track, more commonly called the "el", are supported by a massive network of structural steel girders, beams and joists. Like the City's bridges, these structural members are exposed to dirt, grime, rain, snow, auto fumes and in some cases industrial pollutants.

New York City's Transit Authority (TA) has been specifying lead-based paints for these structures since they were first built in the early 1900's. A spokesman for the TA reports that the paints "provide an excellent rust inhibitive coating over the metal and that they can be applied with a minimum of surface preparation. Their value as an anti-corrosive covering lies in the fact that lead-based paints retain their corrosion resistance regardless of the surrounding environment."

According to the TA, the red oxide primer consists of 74 per cent red lead, and 23 per cent red oxide. The remaining paint system is synthetic resin solids, linseed oil, and dryers.

Painting the 70.82 miles of elevated structures is not a job that can be completed quickly. Considering the vast size and amount of structural steel involved and the number of times that paint crews must move ladders and scaffolding, it is not surprising that just about four miles of elevated structure are painted a year.

The TA estimates that about 3,180 gallons of lead paint are used for each mile of typical three-track structure. Before applying the lead-based paint, crews scrape badly rusted areas with wire brushes. Following application of the primer a tan alkyd aluminum finish or top coat is applied.

Blue-grey paint used to coat steel structure of Throggs Neck Bridge has lead silico chromate base to ward off corrosion.

Lead-based paint is applied to part of structural steel that supports subway's elevated system.

Wave soldered PC boards enhance process control reliability

Faced with increasingly complex quality problems and increased production rates, many high volume process industries are now using computerized production control. Computer reliability helps eliminate costly errors in the processing of food, beverages, chemicals and scores of other products whose composition must meet prescribed standards.

Introducing computerized process control can be expensive. So some companies are turning to special purpose analog computer techniques involving devices called function modules. A relatively inexpensive method of computing, involving current and voltage-regulating circuits, these devices are highly reliable and can be installed as needed, much like building blocks. Each module performs a specific function or group of functions while operating independently or in conjunction with others.

A key element in the high reliability of analog computers is the built-in quality, long life and virtually maintenance-free operation of the printed circuit (PC) boards that are the nerve centers of these units. The key factors in joining PC board components are speed, efficiency and economy. Often these factors can best be attained through the use of wave soldering.

For example, at Bell and Howell's Control Products Division, wave soldering is being successfully employed to mass produce high quality PC board assemblies for function modules used by the process industries. Initially, wave soldering at the Bridgeport, Conn. plant was limited to one bench-type machine which handled only one type of board. The rest of the boards were hand soldered. Now the company has a large machine made by Electrowrt, Inc., Mt. Vernon, N.Y., featuring a 15-in.-wide wave and the capacity for soldering a variety of boards.

Wave soldering proved beneficial

Roger Gemza, plant and manufacturing engineer, reports that the transition doubled production capacity without the need for plant expansion. "We also realized $10,000 a year in direct labor cost savings," he said. "And the ability to mass produce PC boards by wave soldering upped productivity 10 percent the very first year."

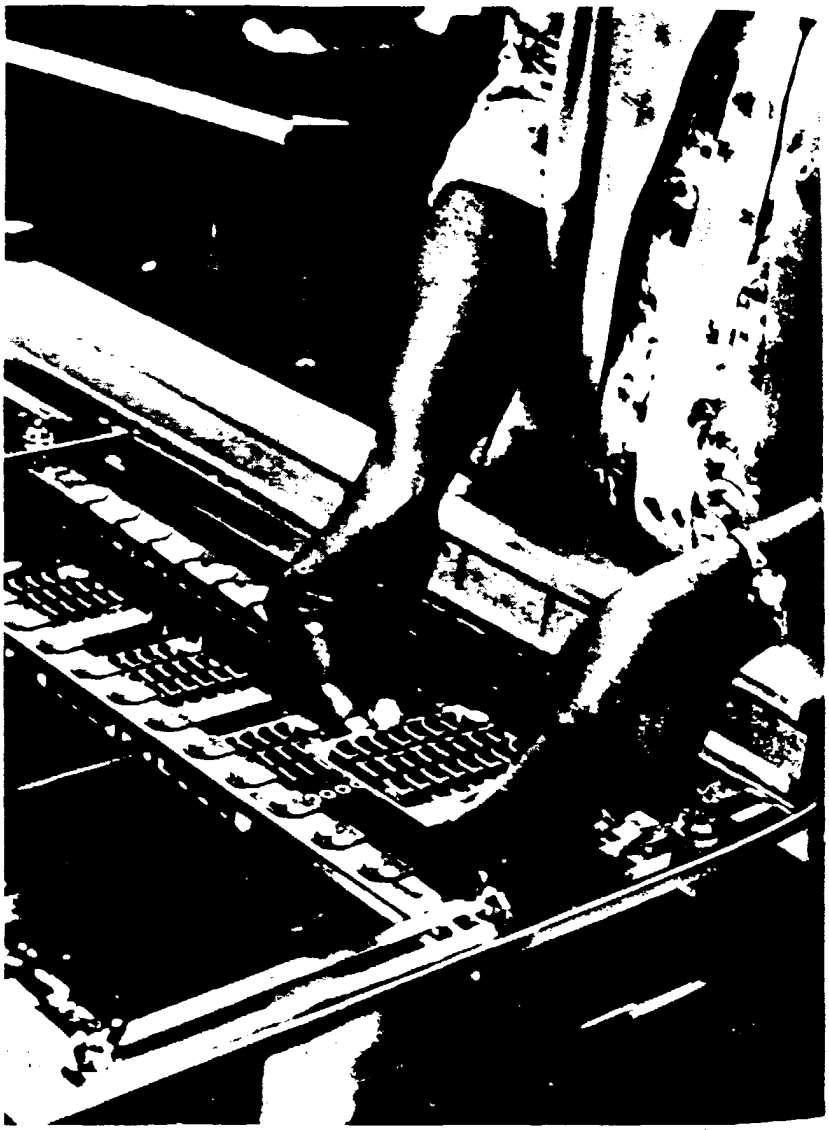
Over 220 different PC boards, ranging in size from ½-in. x 2-in., to 8-in. x 10-in., are joined and connected by wave soldering. On many of the boards the circuitry is incredibly dense and complex. A single board might contain up to 400 joints to be soldered. Each type of board is processed at a precise speed in order to achieve the correct preheat temperature and solder wave dwell time. The machine can accommodate up to six boards at once and up to 75 boards an hour can be soldered. The exact totals depend on board size and configuration.

Soldering is accomplished in a matter of seconds with one pass of the board over the solder wave. And the precise quality control attained has increased PC board reliability five-fold, according to Gemza.

System involves three steps

The company's wave soldering is a three-step integrated system. It consists of fluxing, pre-heating and the soldering. A 12-ft. long conveyor carries the pallet-mounted PC boards through the soldering process. The conveyor is inclined 3½ degrees with respect to the solder wave for optimum soldering efficiency.

Rosin-based "foam" fluxing employed in the initial step of the process gives a complete and uniform coating to the solder side of the PC boards and enhances the wetting action of the solder.



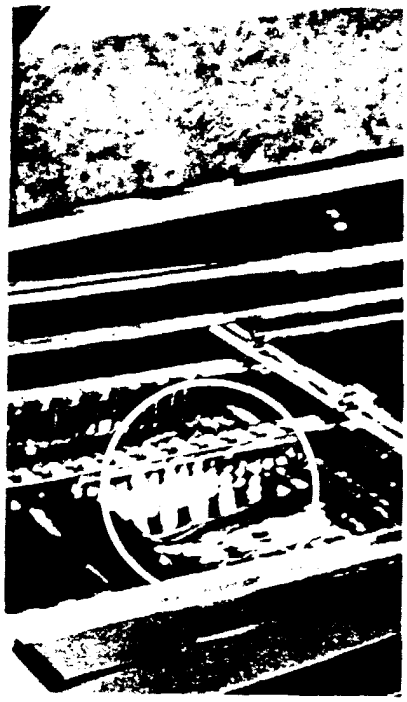
Bell and Howell worker places printed circuit board in pallet on inclined conveyor which will move it through various wave soldering steps. At right, electronic components of PC board are solder-joined in seconds with one pass over solder wave (circled area).

The pre-heating step brings the boards up to an average temperature of 160°F. This serves to evaporate excess solvent in the boards and to condition the assembly against thermal shock as the board touches the solder wave.

Use of 63/37 tin lead solder permits rapid joining of the board componentry at the lower practical temperature. The solder bath temperature is maintained at about 500°F and normally the wave height is ¼-in.

The bi-directional solder wave applies solder to the conductor surfaces and joint areas of the workpiece, promotes fast wetting and aids capillary penetration. The velocity of the solder flow is highest where the board enters the wave for the most efficient heat transfer, rapidly elevating the board to soldering temperature conditions. As the PC assembly moves up the wave incline, the flow velocity decreases, accompanied by increased wave pressure to provide good capillary rise and through-hole penetration. The board exits at a point where the relative velocity between board and solder approach zero to eliminate icicles, bridging and excess solder deposits.

The soldered PC boards are cleaned later with a fluorinated solvent, after which they are inspected and any necessary touch-up performed. Gemza reports that the high quality obtained through wave soldering has resulted in lower inspection levels and a 50 percent reduction in costly and time consuming touch-up.



Eye-catching bank lobby pool based with lead

Two-tiered decorative pool with fountain-sculpture in First Pennsylvania Bank lobby is lined with lead to preserve water-tight integrity.

A decorative pool with fountain-sculpture dominates the Centre Square Lobby of the First Pennsylvania Bank Building in Philadelphia. Although visitors are impressed with the futuristic freeform, many are somewhat mystified as to what the sculpture is supposed to represent.

According to Christopher Ray, the artist responsible for the work, the two wrought copper sculptures depict the Maine coastline. The larger of the two is called "Ebb Tide" (low tide). "This part of the sculpture suggests the calm mysteries of the intertidal world," Ray explained. "The smaller part, known as 'Neap Tide' (high tide), depicts vitality and strength," he added.

Most visitors also are unaware that lead plays an important though unseen role in keeping the pool water-tight. A total of 3,724 lbs of lead lines the pool to contain the constantly circulating water. The 5-ft wide by 25-ft long pool is really divided into two sections, since the lobby is on two levels, with a 2-ft elevation difference. Water from the upper level pool spills down into the first level section. Each pool, is 16 inches deep and faced in polished granite. The bottom consists of 4-in by 4-in square clay tile.

The pool lining was installed by two lead burners from Baltimore Lead Burning Corp., using lead supplied by Devine Bros., the contractor. For the exposed areas 8-lb lead was used, while 6-lb was employed under the granite. The lead, which contains 4¼ percent antimony and 0.08 percent arsenic, was installed in 8 strips. Sheets ranged in size from 3-ft by 14-ft, to 8-ft by 20-ft. About 125 lbs of lead burning bar was used to join the sheets.

Initially, the concrete base was thoroughly cleaned and covered with a cold-applied brush coat of bituminous coating. This was followed by asphalt-impregnated felt. After the sheet lead system was laid down, a 24-hour hydrostatic water test was conducted to check for leakage. Another layer of bituminous coating was then applied before the granite and clay tile were installed.

First Pennsylvania Bank officials are confident that the pool, which was designed by Brown & Goldfarb of Philadelphia, will maintain its water-tight integrity, thanks to lead.

Leaded products combat noise on several fronts

There is a rising concern among industrial hygienists that occupational or work-related noise may be a serious general health hazard, creating diverse physical ailments in addition to hearing damage. A number of these experts feel that noise can be the basis for various psychological problems as well. More and more this form of pollution is being considered as an insidious danger, often unrecognized by its victims.

Faced with growing evidence of noise hazard, labor unions are pushing hard for stricter compliance to the 90dB noise exposure level established in 1970 under the Occupational Safety and Health Act (OSHA). In many cases lead, in combination with other materials, has proven to be an effective means of reducing noise to within the permissible OSHA limit. Here are some wide-ranging examples.

Remote control room at Dow Jones' Orlando, Fla. plant has lead laminated panels and double-glazed glass to shield operators from press noise outside.

Hush the presses

At Orlando, Fla., Dow Jones & Co. is printing Wall Street Journals for day of publication distribution in the Southeast by means of a satellite communications system. Facsimiles of full-size Journal pages are transmitted to Orlando via satellite from another Dow Jones plant in Chicopee, Mass., where the newspaper is set in type.

The Orlando plant, which is said to be the first of its kind in the world to produce newspapers by this "facsimile via satellite" system, also features a remote control room for the printing press. Shielded from outside noise by laminated lead panels and double-glazed glass, operators work in a substantially quieter environment. Press speed and flow of ink and water are regulated from a specially-designed console in the room.

The noise level outside of the control room averages 107dB, compared with an average of 87dB inside. This salutary change is effected by a 1/16-in. thick lead sheet sandwiched between two sheets of dry-wall board on three sides of the room. Sound attenuation is achieved on the windowed front wall through double-glazing, with thicker acoustical glass on the outside backed by conventional safety glass. The reduced noise level keeps press operators healthier and happier.

Pipe forming machine noise curtained off

At Interspace Corp., Wharton, N.H., a 50-ft. long lead-vinyl barrier curtain helps protect employees from the noise of four concrete pipe forming machines. The installation has reduced noise at these machines to the permissible 90dB level from a previous 105dB reading.

The problem presented by this particular application was complicated by two factors. Any noise control installation would have to allow the machines to be fully exposed for the entry and positioning of concrete forms by an overhead crane and exiting of the finished reinforced pipe. In addition, the machine operators had to view the placement of the concrete poured into the rotating form.

The customized noise control system, jointly designed by New Jersey Safety Equipment Co., and Singer Partitions, consists of six 3/4-lb. per sq. ft. acoustically engineered leaded vinyl curtains. The 10-ft. high curtains are suspended from an overhead track-and-roller system, attached to a steel framework. When closed, the curtain barrier covers the 50-ft. length of the machinery area.

At left, open view of leaded-vinyl noise barrier curtain shows swing-away overhead track which permits easy access by crane. Closed view of curtain (right) shows safety window which enables machine operator to monitor manufacturing process.

For machine access, a hydraulic system swings the overhead track sections out of the way to permit entry and exit of the crane. When closed, the operators view the manufacturing process through safety windows installed at set intervals along the curtain wall. The 15dB noise reduction achieved has considerably lowered physical risk to employees.

Ship engine noise reduced up to 15db

When ships are at sea, engine room noise is often considered something that must be endured since you can't walk away from it. On small-class vessels, the noise level can be relatively high at any point, including living quarters and on the bridge.

On two U.S. Navy Weapon Retriever boats in use by the Pacific Missile Range Facility, Port Allen, Kauai, Hawaii, noise levels from the engine rooms were in excess of the 90dB limit. OSHA exposure criteria for noise levels of 95dB measured on the bridge of both ships should have permitted the crews only four hours of exposure per day. Actually, they often remained at those duty stations for much longer time periods.

After General Acoustics made an in-depth sound survey on each boat, a three-step approach was taken to solve the problem.

1. Existing mufflers and exhaust piping were replaced.

2. Exhaust piping from the engine manifold to the exhaust exit was insulated.

3. The engine room bulkheads, hatch covers and interior hull surfaces were lined with sound attenuating material.

When the new muffler sections and exhaust pipe were installed, vibration isolation was provided between the pipe hangers and clamps used to secure the piping to the interior structure. General Acoustics then covered the piping with a 2-in. thick layer of 8-lb. per cu ft high temperature insulation material, combined with a sheet lead barrier. The outer covering consisted of light gauge aluminum sheets secured with stainless steel straps.

Sound attenuation in the engine room was achieved by the use of a lamination of fibrous acoustical material and sheet lead. This material, which was made up in sections called "sandwiches," was bonded to the engine room interior surfaces between the bulkhead stringers. A perforated sheet metal shield was placed over the acoustical material and riveted to the stringers.

Sound surveys were again made on the bridge of each boat with both engines at full load. The noise level on one boat was 82dB, compared to the previous 95dB reading. The noise on the other vessel was reduced from 96dB to 81dB. In addition, an 8dB noise reduction was achieved inside both engine rooms.

Lead helps provide fast curing for painted products

Companies that produce painted products cannot tolerate long drying times. Production lines would become backlogged and distribution would be delayed, both costly situations to be avoided.

To solve the paint drying problem, a system called thermal curing was developed. The system is also used to cure ink and other industrial coating materials such as adhesives. However, thermal drying facilities are becoming increasingly expensive to operate in view of the high price of natural gas, crude oil and electricity. They also occupy an inordinate amount of space. So industry has turned to more sophisticated techniques to achieve quicker, more economical curing cycles.

One of the newer curing techniques is the electron-beam (EB) method, which often involves the use of lead radiation shielding. In the process, low energy electron beams are directed onto the surface to be cured. This effects a near instantaneous cure over the entire width of the product, providing its width is within the capabilities of the system. EB lines are generally faster—up to 2,000 feet per minute (ft./min.) than another recently developed system of radiation curing involving ultraviolet rays (UV). In addition coatings for EB may cost as much as 15 percent less than those for UV curing.

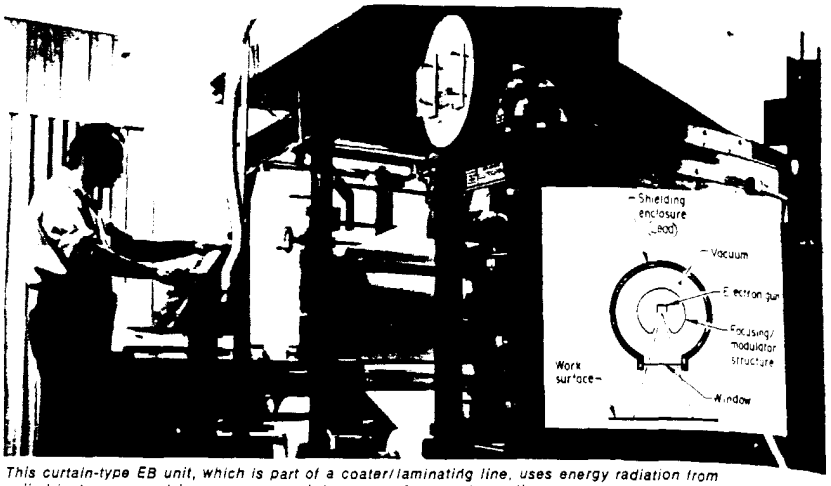
EB also has a distinct energy advantage over thermal curing. To illustrate, an EB curing unit now on the market reportedly consumes only 68,000 Btu per hour for a 48-in. wide line operating at 500 to 600 ft./min. On the other hand, a thermal curing station operating under the same conditions consumes 1.5 million Btu per hour.

Lead supplies radiation shield

While EB curing units consume less energy and increase production curing cycles, the high-velocity electrons emit radiation. For this reason, manufacturers of EB units, must provide sufficient shielding to protect workers. In most cases this protection is achieved through the use of lead.

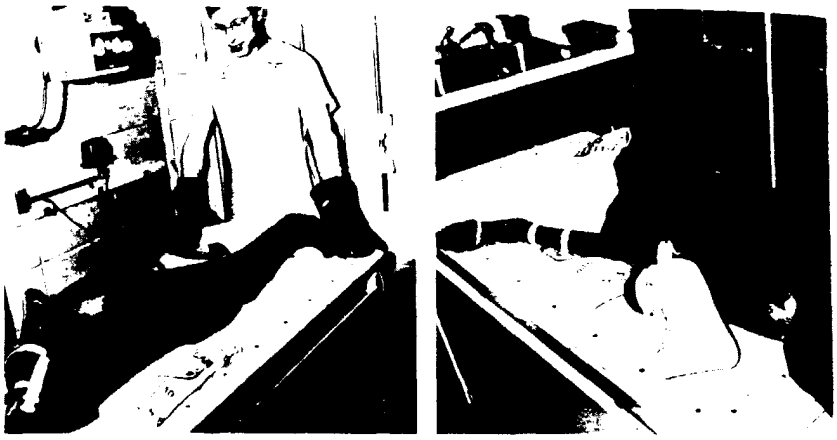
For example, Energy Sciences of Bedford, Mass., uses two layers of ⅛-in.-thick sheet lead for radiation shielding for one of its new 54-in.-wide EB processors. Total weight of the lead shielding on the unit is about 1,300 lbs. According to Energy Science engineers, sheet lead is the most effective radiation material available for such equipment.

EB is still not generally used for curing finishes on metal and plastic parts, although Ford Motor Co. is using it for interior plastic applications. However, the process is finding increased use, particularly in plastic, paper and foil web applications. Its production speed, low energy requirements and reduced generation of air pollution are attractive user benefits.



This curtain-type EB unit, which is part of a coater/laminating line, uses energy radiation from cylindrical component in upper center of the photo. Cylinder is totally encased in lead. Inset drawing shows greater detail. (Drawing courtesy of Machine Design.)

Lead shot solves veterinary problems



At left, Dr. Thomas P. Nytch positions Doberman Pinscher prior to radiographing her injured leg. Photo at right shows how 25-lb bags of lead shot effectively immobilize animal during X-ray procedure.

The remarkable growth in pet ownership in recent years has put increasing demand on veterinary services. These doctors must rely heavily on the use of radiographic equipment to determine the extent of animal injuries, and this can create problems.

For one, veterinarians often have difficulty positioning their patients. Unlike humans, animals will not hold still in specific positions during X-ray exposure. Therefore, they must be anesthetized and made as immobile as possible. This can require the animal to be held, which exposes the doctor or his assistant to the dangers of radiation. Or some heavy object must be used to immobilize the patient in certain body or limb positions.

Many veterinarians purchase specially-prepared, leather-covered bags of sand for this purpose, or resort to other homemade devices. One sports-minded physician in Vestal, N.Y. discovered that 25-lb bags of lead shot provided a practical solution to the problem. The bags not only offer advantages over alternate methods, but the lead shot can later be recycled to reload 12-gauge shells for skeet shooting and hunting.

Dr. Thomas P. Nytch of Vestal Veterinary Hospital found that the lead shot bags are heavier but smaller and more flexible than the sand-filled type used

for the same purpose. This differential provides greater holding force in a smaller space. For a large dog the added weight is especially important to hold head, leg and body positions. For a smaller animal, the bags offer more freedom for positioning a particular part, and make it possible to use more than one bag in a closed-in area.

The lead shot also prevents unwanted X-ray exposure on the film and the animal by proper positioning of the bags on the table and the patient. In addition, it aids in post-operative and post-accident therapy. Since many four-legged animals tend to favor a bandaged or hurt leg, veterinarians often weight the foot to encourage normal use of the limb. The use of lead shot around the contour of the foot enables a smaller, neater bandage to be used. Dr. Nytch finds the package to be less bothersome, so animals are not inclined to attempt to remove it.

Veterinarians who do not reload shotshells for sports activities can merely recycle the lead shot into new cloth bags whenever necessary. Either way, lead shot bags offer radiation protection and concentrated weight in a soft, flexible form for more efficient animal diagnosis.

Who says a lead balloon can't fly?

That old phrase "It went over like a lead balloon" has been put to rest by the research and development firm of Arthur D. Little, Inc. (ADL). Three teams of designers from the firm's Acorn Park headquarters in Cambridge, Mass., recently undertook the unique task of constructing lead balloons. And, believe it or not, they flew . . . just like real balloons!

The company was founded on the premise of accomplishing the "impossible on impossible time schedules" and, more often than not, does it. Therefore, the staff has an ingrained distaste for shibboleths about what can't be done. So they set out to prove that "going over like a lead balloon" is really an outdated phrase.

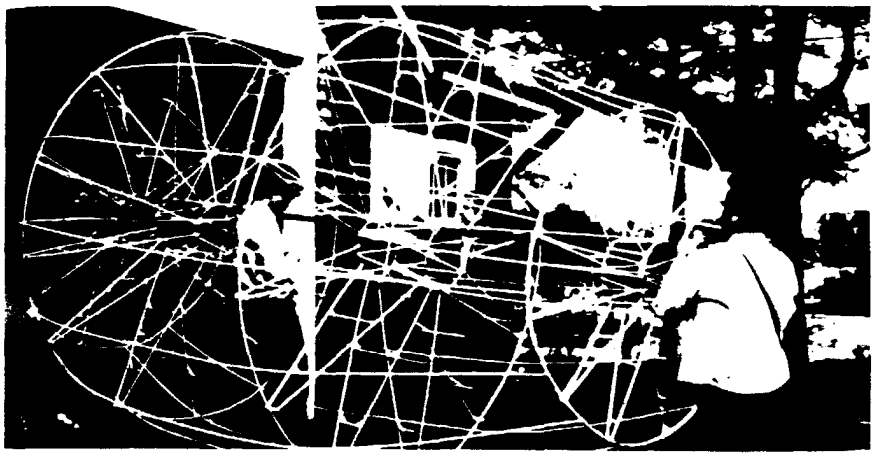
Three different types of lead balloons were constructed. One was a traditional limp sphere, another an endoskeletal sphere shaped much like a watermelon, and the third a cubistic unfolding square, resembling a giant pillow.

All three ADL balloons featured a lead foil exterior. To disprove the point that lead's so heavy it can't "fly," the round balloon weighed 12.9 lb. (5.8 kg.), the elongated balloon weighed 27 lb. (12.3 kg.) and the cube, 30 lb. (13.6 kg.).

Filled with helium and launched from the ADL parking lot, the balloons actually flew! The cube balloon rose about 10 feet in the air, developed a rip in the seam and fell back to earth. The traditional sphere ascended, slipped its mooring and sailed across the highway into neighboring Arlington.

The 14-foot-long endoskeletal balloon, which was filled with 463 cu. ft. of helium, also broke tether. It was last seen heading out to sea, the uncontested "winner."

So the next time you spot a silvery looking object in the sky, look closely, it could be a helium-filled lead-balloon on its way to the moon.



At left, Arthur D. Little designers construct balsa wood skeleton for 14-ft. long endoskeletal lead balloon shown at right. This balloon, one of three constructed by the firm, was successfully launched.

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

Soldering of Electronic Products

Booklet covers the use of tin lead solder as a highly reliable joining method in the electronics industry. It includes information on the control of electronic assembly components for solderability, fluxes and flux residue removal, solder alloys and soldering methods. I-8

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 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

Electric Vehicles: State-of-the-Art 1978

New 28-page booklet contains latest data on electric trucks, buses and passenger cars around the world. Case histories describe EV's in a variety of work applications. Other sections cover energy crisis and poillution problems and their effect on EV's; and the role of lead batteries in EV development. L-24

GENERAL

"Lead Abstracts" and "Yearly Indices"

Bi-monthly abstract of all current world literature on lead and its products and published research. A general index is published annually. Must be requested on company letterhead. M-2

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

The U.S. Lead Industry

An annual review of activity within the industry that contains a general summary for the year and a series of charts and tables giving current statistics on lead production and consumption. M-14

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

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

Lead and Your Health

Brochure contains advice on occupational protection against over exposure to lead. A checklist of good health practices is included. M-35

Old Paints and Rural Lead Poisoning

Booklet discusses the incidence of lead poisoning among children in small towns and rural areas, a problem usually associated with big cities. The need for lead screening programs to detect and correct the problem is emphasized. M-36

Directory of Lead Casters

Booklet lists 58 companies throughout the U.S. that produce lead products for industry. Data on each firm includes type of casting method, products produced and auxiliary services offered. A contact name at each company is provided. M-37

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, 15 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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