VOL. 34 NO. 1 1971

Tin-Lead Alloy Speeds Printed Circuit Board Manufacture

Considering the millions of component leads which are soldered to circuit boards each day, it becomes obvious that any improvement in soldering or assembly processing can mean big savings to the volume manufacturer.

Camden Wire Company, Camden, New York, manufacturers of copper wire used as wire leads for capacitors, resistors, and other electronic components for printed circuit boards, are able to effect such processing improvements by electroplating the wire with a tin-lead alloy so that the actual manufacture of the boards will be easier and faster.

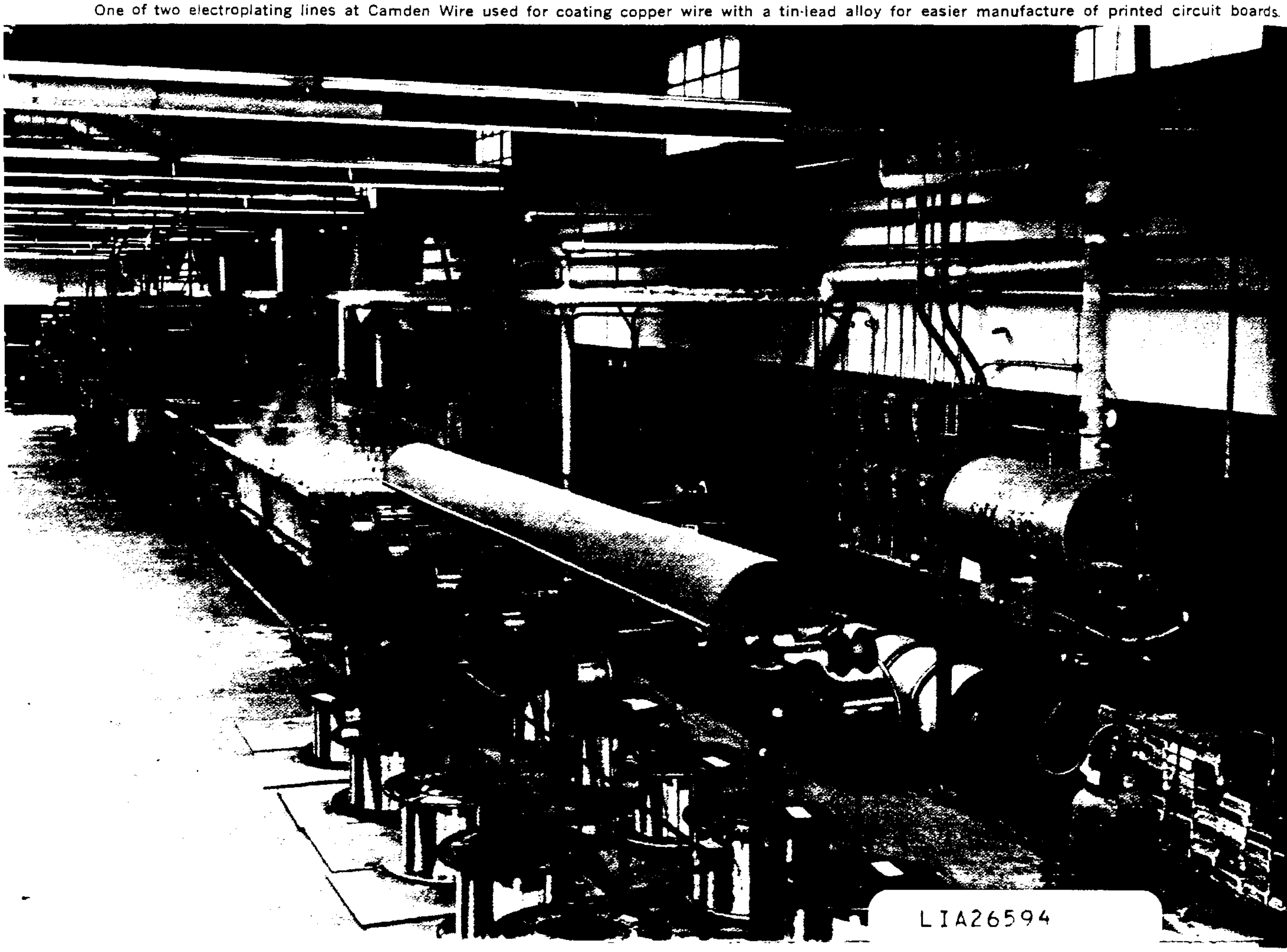
Plating of the wire with this alloy enables board manufacturers to more easily dip solder the already assembled board. This is a result of the improved concentricity and uniformity of coating thickness compared to other tinning methods.

Camden produces plated wires in sizes ranging from 16 to 26 AWG. Capacity ranges from 50 to 500 feet per minute dependent upon the thickness of the plate. Thickness of the coatings range from 300 to 500 millionths of an inch.

At Camden the procedure is automated as follows: From 5 to 20 reels of copper wire are fed into the entry end of the electroplating line at which point the wire is first electronically cleaned. The second step consists of an acid neutralizing bath to remove the cleaning salts. And finally the wire is fed into the electroplating solution.

The electrode used in the electroplating bath consists of a 20 to 35 pound tin-lead alloy anode. The anodes are made by Camden. These are melted and alloyed in an electric furnace and ladled into molds to form pigs of the desired size for the particular plating machine for which they are intended. Weight of the pig is dependent on which machine in which line is involved. A typical anode lasts approximately 10 days.

One of two electroplating lines at Camden Wire used for coating copper wire with a tin-lead alloy for easier manufacture of printed circuit boards.



Lead Fiber Glass Combination Silences Air Conditioning Noise

While modern air conditioning is unquestionably a comfort and often a necessity, it can also be annoyingly noisy. For this reason the architect made sound insulation an essential part of the construction plan for the new $40,000,000 Medical School complex at Case Western Reserve University in Cleveland. Several thousand feet of noisy, rattling air conditioning ducts would hardly have provided the ideal atmosphere for the teaching of medicine, dentistry and nursing.

The original specifications for the complex called for a duct wrapping of ½" thick fiber glass blanket covered with ¾" of plaster over metal lath. However, knowledge of other installations plus some on-scene research convinced Richard Wilson, foreman for the Parker-Fallis Insulation Company, Inc., Dallas, sub-contractors for the insulation phase, that a 1" fiber glass blanket and 1-lb. sheet lead (1/64" thick) would do the job with less labor and equal effectiveness.

In actual fact, the lead sheet-fiber glass material and installation cost proved to be one-third of what the originally specified plaster barrier would have cost. And the installation was relatively simple.

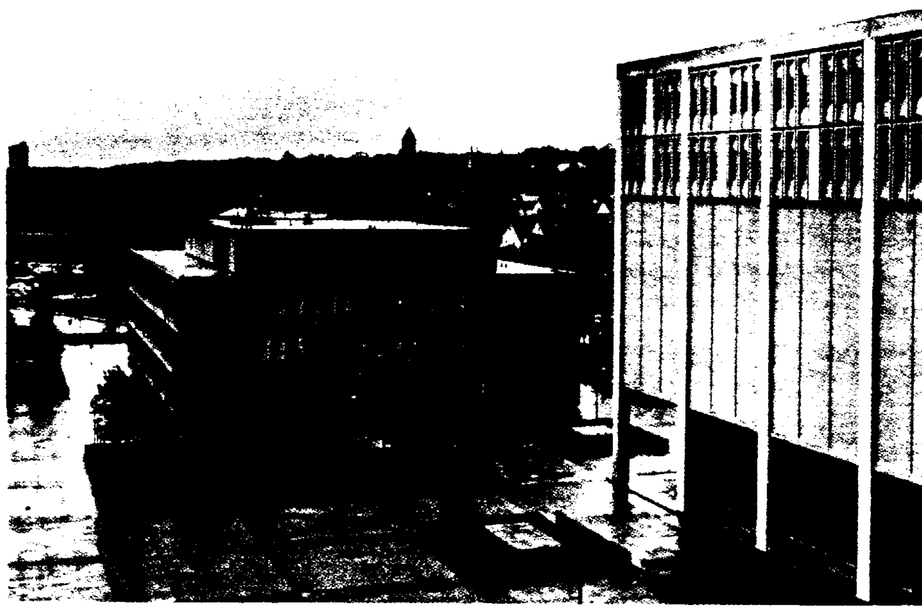
Cleveland Fabricating, Inc. laminated 1" fiber glass to a 1/64" thick lead sheeting in rolls 36" wide and 35' long. The rolls were delivered to the job on skids. The Parker-Fallis ten-man crew then completed the installation. The sheeting was installed on three sides of any duct when the fourth side abutted against a concrete ceiling or wall. Where the duct was completely in the clear, it was wrapped on all four sides.

Using a conventional installation method, the lead and fiber glass laminate was affixed to the duct by forcing it over projecting studs or stick clips. These had previously been fastened to the duct surface. The lead and fiber glass laminate was then held securely in place by means of lock nuts or speed washers slipped over the studs.

The sound attenuation system involved the use of 44,000 square feet of lead sheeting around the duct work used for air conditioning and ventilation. Twenty-one separate fan systems feed the three-building and garage complex. The three schools, Medicine, Dentistry and Nursing, all have total year-round air conditioning controlled from fourteen equipment rooms. Fan motors ranging from ¼ to 100 hp generate the noise and vibration that dictate the sound attenuation system.

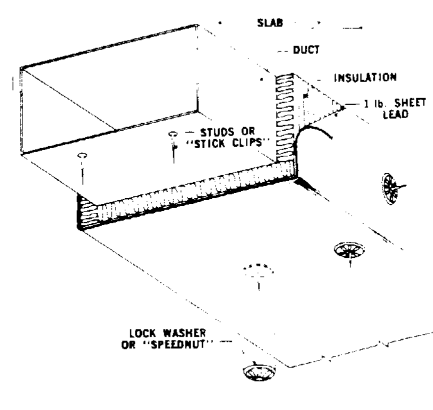
As for the effectiveness of the system, two views: Mr. E. H. Parker of Parker-Fallis estimated that the system cost thirty-four cents per square foot as opposed to an estimated one dollar for the plaster barrier—a saving of $30,000 to the school. Mr. Parker says, "The use of fiber glass-lead sheeting is the cheapest and easiest to install and it does the job best."

Mr. Ben De John, Director of Physical Planning for the University, reports that the system has proved highly effective in the reduction of what would have been a disturbing noise level. "To date, not one complaint has been registered about noise from the air conditioning system."



Exterior view of Medical School complex. Seven-story School of Medicine at right. Garage roof promenade between buildings.

Closeup view of an installation showing the speed washers holding the sheeting to the stick clips. Also shown is the use of outward clinching staples to hold two pieces of sheeting together.



Credits: Architect: John Williams & Associates, Cleveland • Consulting Engineers: Byers, Urban, Klug & Pittenger, Cleveland • Dallas • Builder: Turner Construction Co., New York • Lead Work: Cleveland Fabricating, Inc., Cleveland

LIA26595

Inc.,

Power and Passengers Tra[...]irst

Over 130 miles of lead-sheath cable contribute to efficiency of new subway system.

As with all large cities everywhere, Mexico City was faced with an increasing problem of mass transportation. Utilizing all the experience acquired by operating subway systems in other cities, the Mexican Federal District Department devised an electric transportation "METRO" that easily classifies as one of the fastest, high capacity and efficient systems in the world.

When totally finished, the subway will consist of three separate but interrelated lines totalling over 26 miles in length with 50 stations. The basic unit for the subway is a 9-car train accommodating 1500 passengers. The cars themselves are naturally of the latest available subway car design. Stations are singular in their carefully-planned attention to eye-appealing esthetics as well as the most modern construction and layout. The stations were very carefully planned since it is the intention of the system's designers that these terminals project an acceptable image of the system to the riding public.

Sub-soil conditions in the Mexico City area presented construction problems of unusual complexity. The soil generally is a soft, high-plasticity, sensitive, highly-compressible and expansive clay. Ground levels, of course, vary considerably from locale to locale. The area is historically subject to earthquakes so that compensations had to be built into the system to accommodate such possibilities. And finally, soil conditions include a degree of moisture which had to be taken into consideration in planning the all-important electric power system.

Underground tunnel construction for the Mexico City subway was rejected as economically unfeasible because of the unusual characteristics of the sub-soil. As an alternate, underground structures are actually reinforced concrete structures built in open excavations of minimum depth and width to meet design specifications.

The overall control center for the system is located in a seven story building in central Mexico City. In addition to containing the centralized control equipment for operation of the system, it also contains the necessary controls for distribution of the electric power on which the system is run. Totally computerized, the control system is capable of virtually instantaneous decisions.

Sub-soil conditions and the imperative need for flexibility were major determining factors in selecting lead-sheathed cable for the entire system. Lead's characteristic imperviousness to moisture or corrosion, its flexibility

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The "Metro's" trains are accessible from the clean, well designed station platfor

Much of the lead sheathed cable used on the "Metro" is carried in cable trays
to the walls of the subway system.

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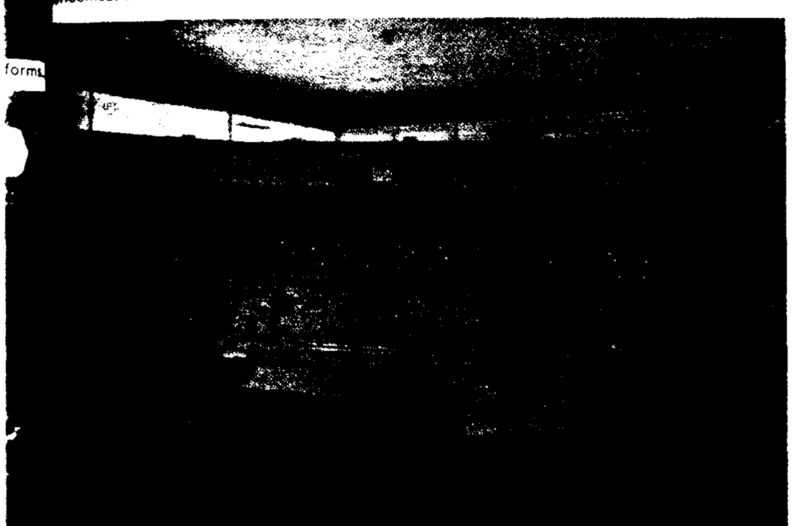
avFirst Class in Mexico City Subway

...en unskilled workers can quickly learn to make splices in the lead sheathed cable with ...modification of the electrical wipe system.



...s mo...ontrollers can see at a glance the position of every train and switch of the system from the console located in the central control building.

and its long life when exposed to acids and salts in soil water filled the bill for the system's specific requirements.

The cable selected was a 3-core, sector conductor, 300 Mcm, cross-section type, with a rating of 15Kv grounded neutral and 160 amps. Altogether, over 130 miles of cable were supplied in shipping lengths of over 1200 feet. Outside diameter of the cable is about 2½ inches.

All cables for the system emanate from the central control building and, following the three routes of the subway system, feed the rectifying stations and the passenger stations (for lighting). The longest cable route in the system is just over 6 miles long and although it contains cable splices, it is not sectionalized.

At the cable exit of the central control building all the cables are installed in the main cable gallery. From there they branch off along the different routes and are installed in one of various ways. Depending on the special construction requirement of any given locale, the cables are installed:

1. On cable trays on the side walls of the train tunnels.
2. In a concrete trench filled with sand, in-between the two track lines where tracks run above ground.
3. In underground duct banks running parallel to the subway lines.

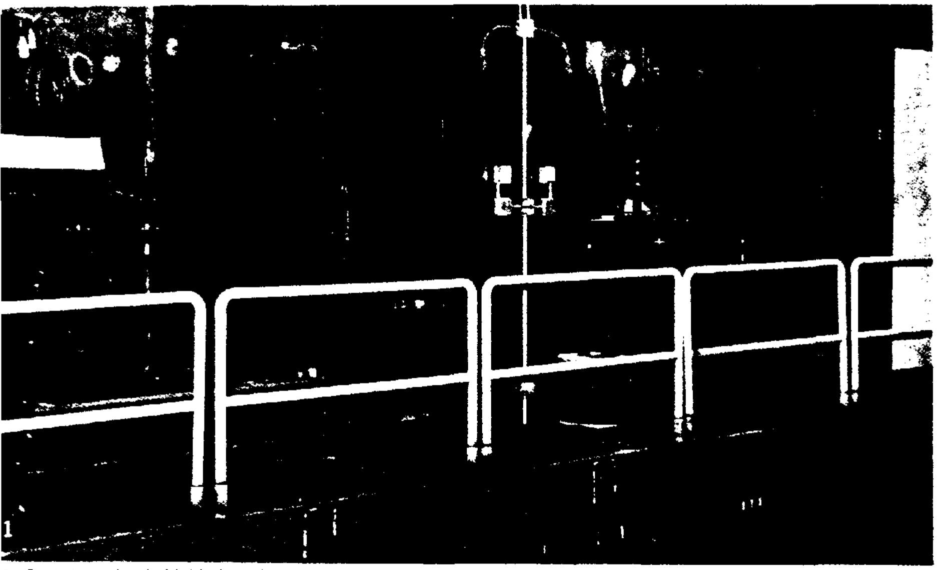
The cable joining method used throughout the system is the electrical resistance wipe joint. Four solder-sealed joints are used to seal the splice sleeve to the cable sheath. The sheath area to be soldered is first tinned with a torch and solder stick. A loose-fitting lead reducer is then slipped over the sheath and tightened to induce capillary flow of the solder. A heater wire wrapped around the lapped joint raises the temperature evenly to the melt point of the solder. Solder is then fed into the hot joint to capacity. While the joint is cooling excess solder is wiped away.

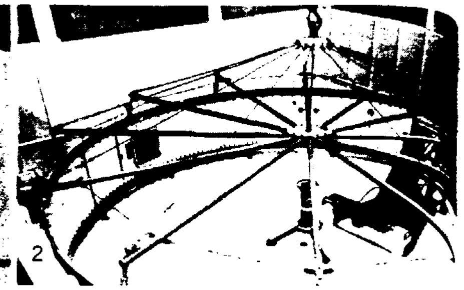
Perhaps the most significant aspect of the extensive cable joining installation was that it was performed by unskilled personnel who were trained specially to perform this job.

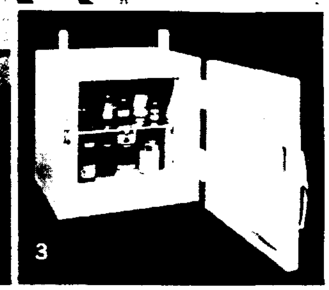
Assured of a highly reliable electrical system, Mexico City's subway trains travel their modern, quiet way on a combination of pneumatic tires and flanged wheels. Guide wheels keep the trains on the tracks. With this new system Mexico joins Paris and Montreal in having (in operation) one of the quietest, most efficient underground mass transportation systems in the world. And lead is there!

LIA26597

Personnel Protected Against Radiation Hazard by Lead Shielding







1. Prototype lead-shielded curing rooms have been developed for the automotive industry. They are 10′ x 6′ x 6′ with sheet lead shielding (¼″ thick).

2. This lead-lined inspection unit enables hardware manufacturers for America's space program to accomplish X-ray inspections for flaws in complete safety and in 85% less time.

3. This 19″ x 18″ x 17″ safe has a lead door and 2″ thick wall liner for the storage of radioactive isotopes.

4. The special materials that have been developed for radiation protection include this combinaion of V-shaped lead bricks with an intermediate layer boron-impregnated laminate.

Advances in medical diagnostic and treatment techniques, involving the increased use of X-rays, cobalt and other radioactive materials, have brought with them the increased need for protecting operating personnel from exposure to dangerous levels of radiation.

Industrial use of radioactive isotopes, X-ray machines, accelerators and electron beam welders have necessitated, as well, elaborate precautions to reduce overall body burdens.

Even though other materials can be adapted for this use, lead continues to be the most efficient protective shield for most of these applications. Among lead's advantages are its greater density (hence, less volume for a given shielding ability) and its imperviousness to contamination even from continuous exposure to radiation.

How lead is most effectively used for radiation shielding depends entirely on the given situation. Lead alone, as sheet or bricks, or in combination with other materials as a laminate are all now available to accommodate given needs.

Lead and Boron Mixtures

A high-flux radiation room used for the study of the biological effects of neutron radiation, as an example, is lined with an inner layer of lead for protection against gamma rays, and an intermediate layer of a boron-impregnated laminate that shields against neutrons.

The lead is in the special form of V-shaped bricks that overlap to offer complete protection from the potential escape of "straight ray" radiation through the joints. This lead shielding captures the decaying gamma rays and provides the necessary reduction in the dose rate—in this instance 1/200th of the level that would exist without the use of lead.

Another material consists of a lead powder, boron and polyethylene mixture in a basic rectangular brick form that provides a neutron/gamma shield. Among its numerous special advantages are its availability in many special configurations and its ready machinability. When temporary shields offer the solution to the protection problem, this material provides an easy answer, as do the lead bricks previously mentioned.

Quality Control for Space Exploration

When part of the hardware used in America's space program posed a critical quality control problem, X-ray blocking sheet lead helped solve the dilemma. A special 8-foot high lead-lined enclosure was designed within which instrument units can be X-ray inspected for possible flaws without any potential danger to inspectors and other participating workers. The new inspection unit also provided a time boon in that it cut radiographic time of individual inspections from 30 to 4 hours.

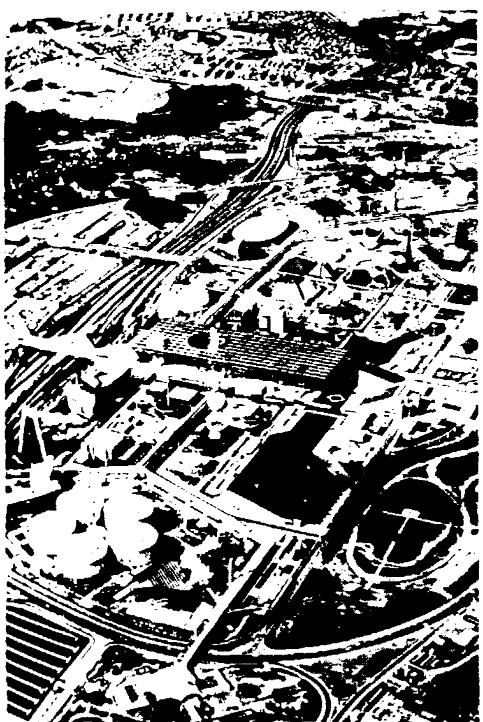
Protection for Commercial Radiation

Curing process materials engineering experts predict that by 1975, 10 to 20% of the industrial finishing done in the United States will rely on some form of radiation processing. Clearly, lead will play an important part in the development of safe equipment that will fulfill this prediction.

Various radiation curing devices already exist, including an electron gun mounted in a lead-shielded chamber that has vast potential for the automotive industry.

The lead-shielded area replaces the conventional curing oven. In the room is a 300 kv electron gun which scans the painted material. Curing takes place literally in seconds and the heat generated in oven curing is eliminated altogether. Meanwhile, personnel are protected from the radiation by the shielding.

Open-to-the-view pavillion cars capable of handling 6 passengers traversed the fair grounds at speeds of up to 9 miles-per-hour. Seen here is the Switzerland Pavillion.



This aerial view of the fair grounds at EXPO '70, Osaka, Japan, indicates the vast ground to be covered by visitors. Leg weary sightseers were aided by a fleet of lead acid battery-powered electric vehicles.

Clustered around the Pavillion of the Commonwealth of Australia are lead acid battery-powered staff cars and (directly behind the light pole) an electric patrol car.

Electrics go to the Fair

Latest, and by all accounts one of the most successful of the world fairs to have dominated the world's entertainment scene during the 20th Century, was Japan's brilliant EXPO '70. Held in Osaka, EXPO '70 was distinguished by a number of features, among them its huge size and record attendance from all over the world. Unnoticed but prominent in attendance was lead.

To help insure a quiet, clean, maximum-comfort atmosphere at the fair, all vehicles were lead acid battery-powered . . . almost 300 units in all.

For that matter, lead was almost certainly instrumental in getting all visitors to the fair. Foreign visitors most likely flew to Japan in jetliners insulated against engine noise with lead loaded vinyl. Anyone driving to Osaka did so in an automobile that starts with a lead acid battery. Visitors traveling from Tokyo to Osaka aboard the 130 mile-per-hour Tokaido Super Express rode under slider bars made of Bishiralloy®, a lead infiltrated iron alloy designed specifically to meet the friction problems presented in electrifying the world's fastest surface transit system.

The lead acid battery-powered electric vehicles in operation at EXPO '70 included a variety of types to meet a variety of demands. Reserved for rental service were 120 open-view pavillion vehicles, each of which accommodated 6 passengers. An alternate transportation system for the sprawling fair grounds was provided by a fleet of 70 electric taxi cabs. Security patrols policed the fair grounds in 44 electric vehicles, 28 of which were equipped with radios. The Nippon Telephone and Telegraph Company operated a fleet of 10 electric service vehicles. The remaining electrics were used for such diverse purposes as press and publicity coverage, deliveries, lunch wagons and even a tiny fleet to handle the inevitable lost children.

From start to finish, the millions of visitors to Japan's EXPO '70 saw more, in greater comfort, with more pleasure, because lead was there.

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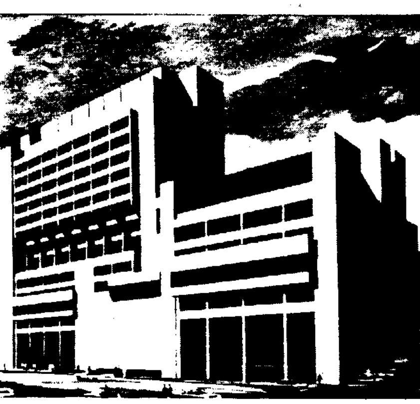

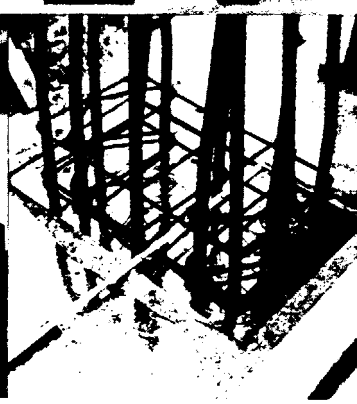

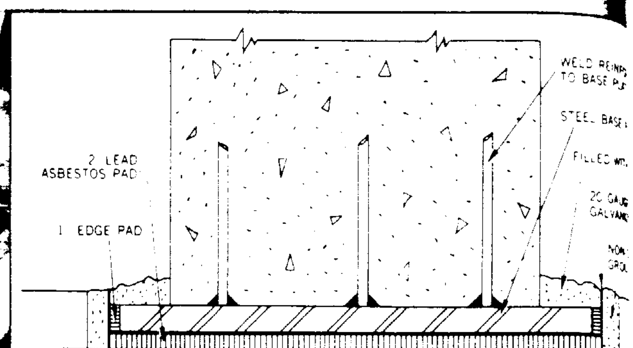

Lead Pads Quiet Vibration in a Modern Hospital

Nine years of painstaking research have gone into the planning of Boston's Tufts-New England Medical Center. All needs were considered: the community, hospital itself and patient. Advanced concepts of patient care dictated horizontal rather than tower layouts. This in turn made it necessary in this complex urban location to secure the air rights over Boston's busy Washington Street and underground transit system. As have designers of other buildings confronted with the same problem of potentially annoying vibration, the designers of the Center specified lead asbestos anti-vibration pads.

Design for the Center is the work of The Architects Collaborative of Cambridge, Massachusetts, in close association with the medical center's own planning office. The overall architectural concept consists of continuous layers of activity covering most of the 13-acre site. A key factor in selecting a horizontal rather than a tower layout for the complex was experience showing that the former allowed for greater flexibility in assignment of space and encourages informal contact among specialties—a special advantage for a teaching hospital.

Another design "first" was a rejection of the usual layout of patient rooms along a lengthy corridor in favor of a "cluster" arrangement. Nurses' stations, examination rooms, supplies, etc. are centralized with patient rooms surrounding them. The nurse can now enter a patient's room directly from this center core as opposed to the usual time-consuming and largely wasteful walk down corridors.

To isolate the hospital from the inevitable noise and vibration generated by heavy traffic on Washington Street and the underground transit system, it was designed to rest on lead asbestos anti-vibration pads similar to those used in such important buildings as those in Lincoln Center in New York and the Kennedy Center for the Performing Arts in Washington.

The pads themselves as designed for this installation, are 6½" wide, nominally 2" thick, 4' long—bituminous-coated to protect them from the free lime in the uncured cement.

The pads consist of a sandwich enclosed in 8-lb. (⅛"-thick) sheet lead envelope. The filling has a layer of ½" asbestos roll fire felt, 12-ga. steel stiffening sheet, ½" felt, 12-ga. steel and a third felt layer.

The illustrated drawing of the actual pad and steel base construction shows clearly the engineering detail of this particular installation.

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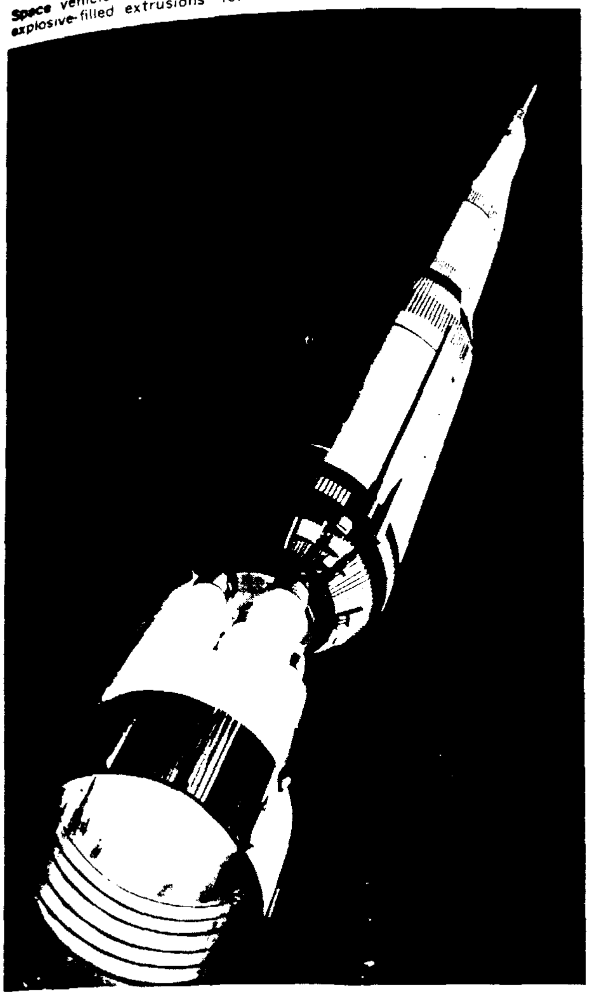
Space vehicles similar to the one drawn here depend on lead-clad explosive-filled extrusions for the all important stage separation.



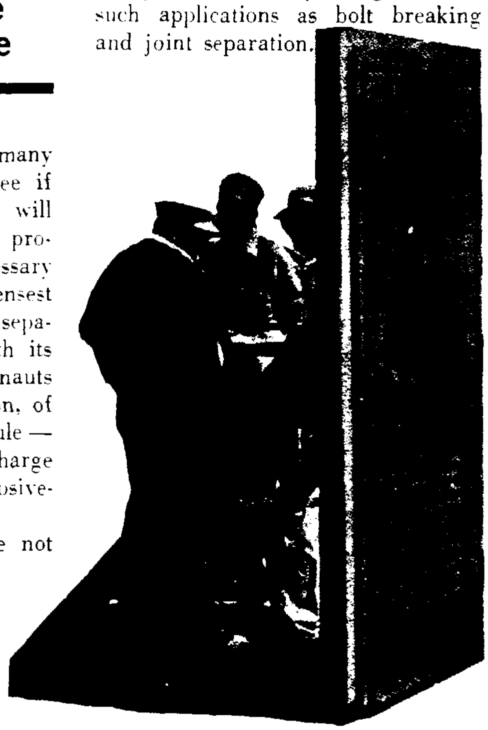
In space . . . on the ground lead-clad explosive strips play vital role

By now everyone has spent many anxious moments waiting to see if America's manned spacecrafts will successfully separate at the programmed stages for the necessary "go" situation. Probably the tensest moment of all was the first stage separation of the APOLLO 11 with its precious cargo of three astronauts headed for the moon. Separation, of course, went right on schedule — thanks to a linear explosive charge consisting of V-shaped explosive-filled lead extrusion.

But flights to the moon are not everyday occurrences. Demolition and fire fighting are. And variations of the lead-clad explosive strips used on APOLLO 11 are used daily for these purposes.

Demolitions such as that of an existing bridge over the Snake River near Spokane, Washington, was accomplished by three men in three days using 25 pounds of Jetcord at a cost of $5,000. Original estimates of the demolition requirement for the bridge called for 1,800 pounds of explosives.

Industry has turned to these new devices for special uses of its own. One unique clamp-like device has been developed to cut cast iron pipe with almost machine tool precision. Other configurations of the lead-clad shaped charges are currently being used for such applications as bolt breaking and joint separation.



Fire fighting organizations, faced daily with the need to make safe forced entries into burning buildings for ventilating purposes, rescue operations or simply to fight the fire itself, are making particular use of this "tool".

A new device called "Jet Axe", by its manufacturer, Explosive Technology, a subsidiary of Duncommun, Inc., is as completely safe to operate as a power tool. Its ease of use makes it a valuable adjunct in the hands of the professional fireman. Detonation can be made by means of a 30 foot firing line from an insurably safe distance. The line actuates a spring loaded firing pin which strikes a primer similar to that contained in a shotgun shell. The firing pin is in the handle of the device and is not attached to the firing line until the unit is prepared for use. Several sizes of the "Jet Axe" are available with lead sheathing filled with different explosive coreloads. This availability makes these units suitable for gaining entry or making ventilating openings in various combinations of steel, wood and masonry constructions. They are used successfully on roll-up steel doors, roof structures, concrete block, steel grill work and sheet steel up to 3/8-inch thick.

In the hands of trained firefighters or police, these space age lead-clad explosive extrusions have become a valuable asset in saving both life and property.

The forced entry device works equally well on steel gratings, steel fire doors, and corrugated steel roll-up doors.

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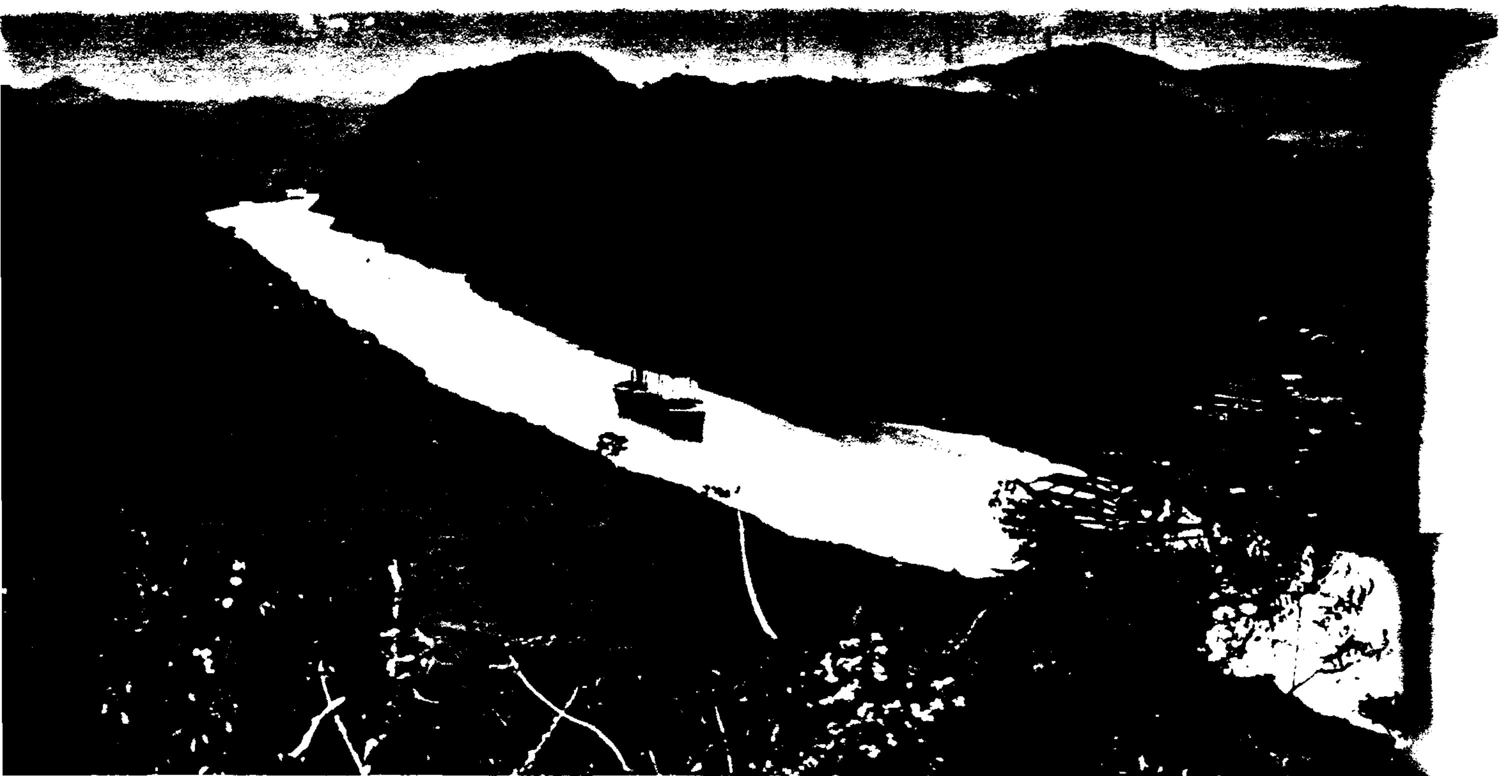


Red Lead "Takes the Heat" in Canal Zone Kitchen

The protection of ferrous metal structures in the Panama Canal Zone has historically been both costly and difficult. The intense ultraviolet radiation, high humidity and salt-laden air present hazards to ferrous metals that not even the best of the traditional organic type coatings could combat.

Seeking solutions to an old problem, the Panama Canal Company instituted a painting systems exposure program designed to isolate the best system(s) for that type of rugged exposure. After two-and-a-half years, tests show conclusively that for deck and other splash zone service, epoxy red lead, epoxy-enamel, and vinyl red lead epoxy enamel systems are standouts among the many paint systems tested.

Forty buoys or cans, located in varying exposures, were selected to undergo the test. Exposures included atmospheric, splash zone and underwater; locations included heavy sea conditions, brackish water, and fresh water.

The buoys were inspected at the end of one year, one and one-half years, and two and one-half years. The first two inspections entailed an examination of the deck and superstructure from a 4 to 6 foot distance while standing in a boat. A large section of the bottom of each buoy was then exposed for examination by tying a rope to the top and using a second boat to pull it over.

The final inspection was twofold: once each buoy was loaded on the removal ship and again two weeks later at the repair site. This final inspection was very thorough, and very revealing, since the two week exterior storage made all corroded or corroding areas highly visible. Inspection standards were exacting. They included both an extensive review of particular conditions noted at each site as well as an over-all rating from excellent to poor. On each buoy, three areas were rated separately: bottoms (subject to underwater); decks (subject to splashing); and superstructures (subject to atmospheric and salt spray corrosion).

The net result of this elaborate experiment proved that there were existing paint systems which offer a minimum of two and one-half years protection and probably three or more years protection with very little maintenance repair work required. Higher initial costs of such systems were scrutinized carefully and shown to result in basically lower annual costs as a result of the much longer life of the protective system.

The significant results of the test for red lead based paint systems were:

1. *Buoy bottoms* primed with vinyl red lead, expoxy red lead or phenolic red lead in numerous instances showed no rust whatsoever.
2. *Decks* painted with epoxy-red lead epoxy enamel and with vinyl red lead/epoxy enamel were rated excellent.
3. *Superstructures* painted with vinyl red lead/epoxy enamel, vinyl red lead/phenolic enamel, or epoxy red lead/epoxy enamel, were all rated excellent.

   Several epoxy red lead phenolic enamel systems were rated good.

Odds "n" ends about Lead

Photo courtesy of Science Digest

THE 60 FOOT LEAD FACIAL

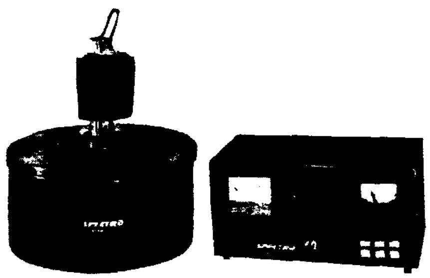
There is hardly an American who isn't aware of world-famous Gutzon Borglum's colossal sculpture at Mount Rushmore in South Dakota. The faces of four American Presidents, George Washington, Thomas Jefferson, Abraham Lincoln and Theodore Roosevelt, each 60 feet long, stand out as a genuinely huge testimonial to American folk heros.

Probably no one knows, however, that the National Park Service each spring gives the four faces their annual "facial." To preserve the monument for posterity, cracks in the stone and solid quartz veins are uncovered and sealed with a special mixture of linseed oil, granite dust and white lead—the solution originally specified by the sculptor when he completed the project in 1941.

HIGH SPEED BENCH TOP SOLDERING

Acccurate positioning and precise heating are major characteristics of the INFRA-DEX soldering system manufactured by Spectra Instruments, Inc., Trenton, New Jersey.

The INFRA-DEX is a combination infra-red spot heater and a specially designed index table, making it ideally suited for high speed production. The system can repeatedly reach temperatures in excess of 2300°F within dwell times of 8-10 seconds.



Work parts are loaded into the appropriate fixtures along with the solder (preforms or paste solder). The table is indexed either automatically or by a hand or foot switch which positions the work and triggers the infrared heat.

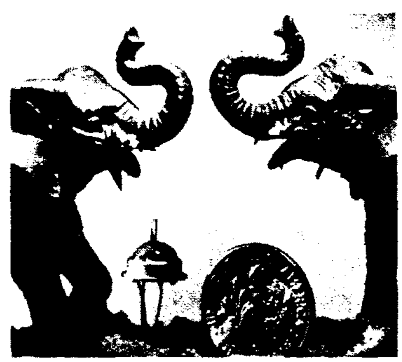
Since the heat cycle time and temperature are controlled by the power supply which functions independently of the index table, molten solder is able to solidify before the table indexes, thus avoiding cold joints.

CERAMIC REMOTE CONTROL DEVICE

Recently developed by RCA is a new solid-state ceramic element with electric properties that can be adjusted to turn on, turn off, or smoothly vary current flow in any circuit in which it is installed.

The device uses wafers made of ceramic lead zirconate/lead titanate. RCA reports that the device has long life and high reliability. Because it is made of relatively common materials, its fabrication is inexpensive and the associated circuitry can be quite simple. In addition, the device will retain its last setting indefinitely even if power to the circuit is shut off.

Potential uses for the control device are both numerous and intriguing: remote control of lights, kitchen appliances, television, furnace thermostat. A sophisticated model could even be used to turn on the heat or air-conditioning in an unoccupied vacation cottage by means of a telephone call from the owner.



The new RCA control element is the tiny rectangular "tab" projecting from the transistor header.

CHANGE OF ADDRESS OR NEW READER

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City, state, zip code

PLEASE CHECK INTEREST

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- ☐ Health & Safety
- ☐ Architectural & Building
- ☐ Design & Radiation Engineers
- ☐ Ceramics
- ☐ Chemical Engrs.
- ☐ Battery Power
- ☐ Miscellaneous (please specify)

LIA26603

NEW LISTINGS

The new lead belt

Reprint of article details operations at the new lead belt in Missouri. Booklet describes activities at four mines, four concentrators and three smelters. Twelve pages. **M-16.**

ARCHITECTURAL

Waterproofing with sheet lead

A description of the use of lead as a membrane waterproofing material for lining pools, planters, fountains, shower stalls and floors where positive waterproofing is required. Architectural details and specifications are included. Eight pages. **A-2**

Lead applications for building and construction

Reprint of article from Progressive Architecture reviewing the latest developments in the use of lead in architecture and construction. Twelve pages. **A-10**

PAINTS

Red lead based paint systems

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

PLUMBING

Lead plumbing catalog and specifications

Specifications and details for the use of lead in plumbing. Waste connections, shower and safe pans and chemical laboratory drains are covered. Four pages. **D-2**

ANODES FOR CATHODIC PROTECTION

Cathodic protection for an off-shore structure

A description of a lead anode protective system for a large offshore mining complex. Lead alloy anodes were so suspended from the structure that they could be pulled up during bad weather. Four pages, tables and illustrations. **E-2**

CHEMICAL CONSTRUCTION & CORROSION PROTECTION

Corrosion resistance of lead in chemical applications

A chart presentation of the corrosion resistance of lead and its alloys against 188 common chemicals from 0° to 300°F. Six pages. **H-3**

Lead in modern chemical construction

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

Cladding steel with lead by powder rolling

A description of the roll compacting process under investigation by the International Lead Zinc Research Organization. Four pages. **H-4**

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**

Industrial truck cost calculator

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

CERAMICS

Classification of inorganic enamels

Description of glass enamels, where they are used, and their composition. Application and firing is also discussed. Six pages. **B-3**

SOLDERING AND WELDING

Soldering alloys

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

SOUND BARRIERS

Practical designs for noise barriers based on lead

Seven case histories describing how sheet lead and soft leaded plastic materials make excellent sound barriers. Eight pages, charts, tables and illustrations. **J-2**

Plenum barriers and sound rated doors with sheet lead

A detailed description of the use of sheet lead as a sound attenuation barrier for both wall plenums and sound rated doors. Bulletin includes installation details, attenuation statistics and suggested specifications. Four pages. **J-7**

ANTI-VIBRATION PADS

Lead to control sound and vibration

A summary of lead's use as a sound barrier and vibration damping material. Sample specifications for an anti-vibration pad installation are given. Curves showing isolation achieved through use of such pads as well as sound attenuation curves for one pound lead are given. Four pages. **J-6**

Ways to reduce press vibration

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

GENERAL

The U.S. Lead Industry—1969

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**

Publications and films

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

Primary lead production areas in the U.S.

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

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