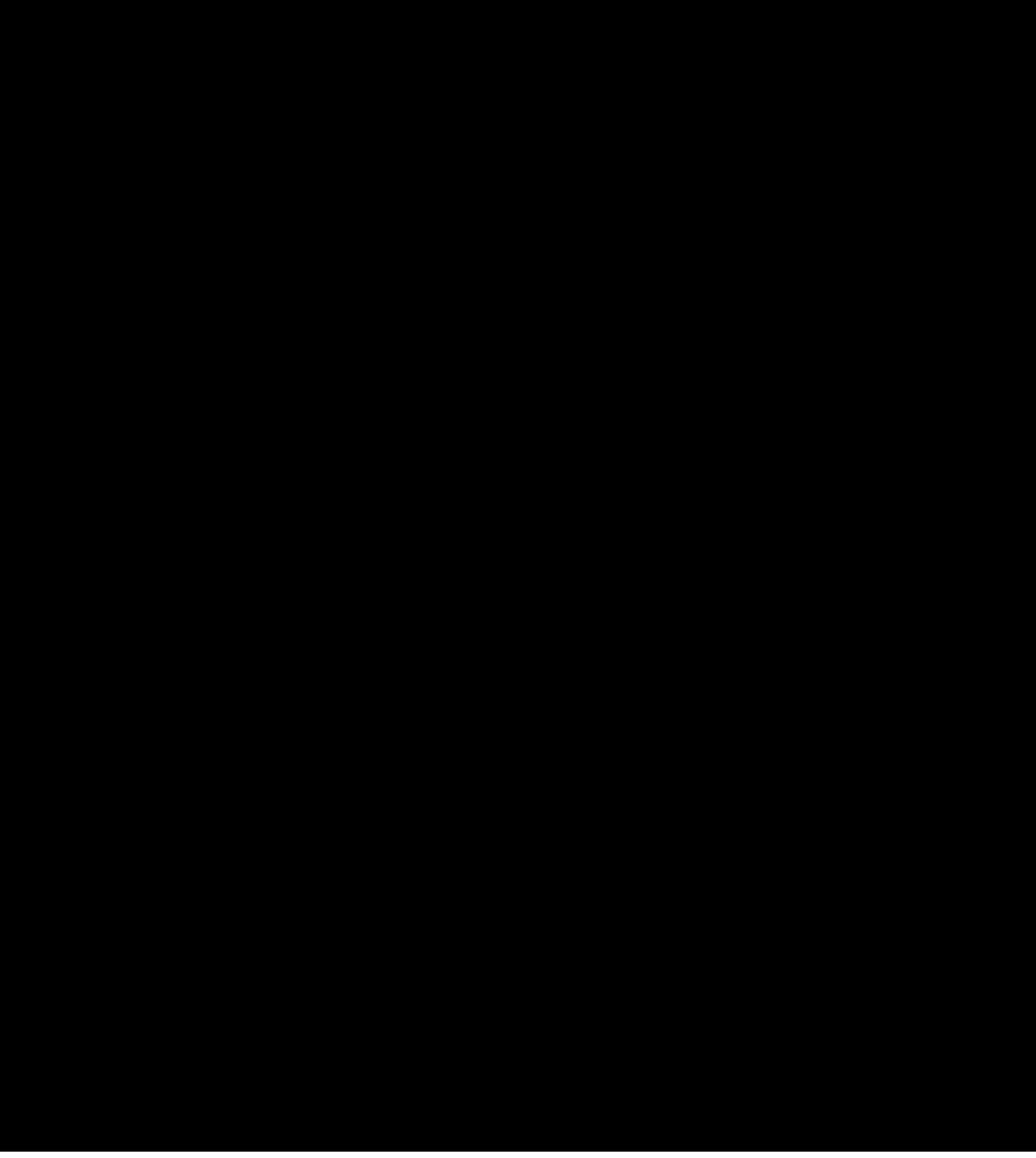
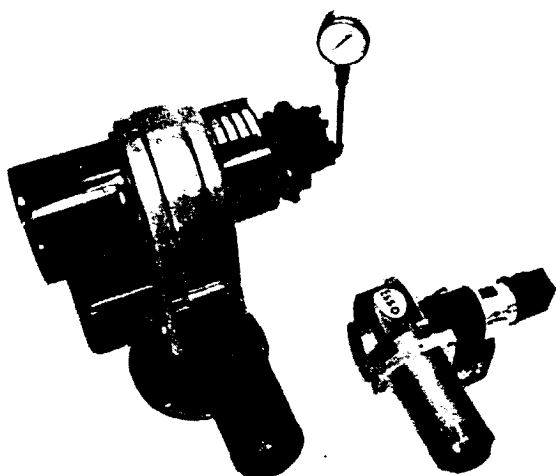




Ultrasonics at work ...

A Vest-pocket Oil Burner



Conventional (left) and ultrasonic oil burner. (Courtesy Esso Research and Engineering Company.)

Today, an ultrasonic horn is making "sweet music" in the ears of engineers at the Esso Research and Engineering Co., Linden, N. J.¹ While the engineers cannot actually hear this "music," they like the tune, because it makes possible a remarkably compact little oil burner which may invade the domestic hot water heater market and other sizable markets.

Key to this new development is an ultrasonic atomizing horn activated by PZT, a lead zirconate-titanate ceramic which is currently finding extensive use in sonar and ultrasonic cleaners. When high-frequency voltage is applied across a crystal of PZT it expands and contracts in harmony with the pulsing current. These vibrations produce ultrasound (sound frequencies above the range of human hearing). Of the many transducer materials known which exhibit this ability to convert electrical energy into sound waves, lead zirconate-titanate is one of the most efficient.

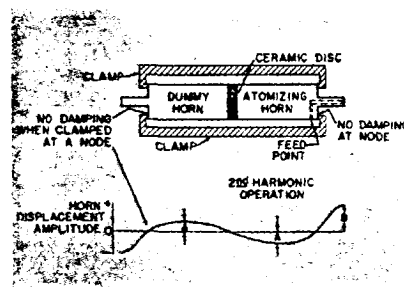
Faced with the results of a study showing that sizable new markets for fuel oil awaited such a development, Esso Research engineers set out to create a compact, low-firing-rate oil burner. Shooting for a rate of 0.2 gph (gallons per hour) — conventional burners are not reliable at rates below 0.6 gph — Esso researchers concluded that ultrasonic energy, produced by PZT, offered a practical solution to their problem.

Ultrasonic waves atomize the fuel and at the same time allow for a much lower rate of feed. This is because the

high-energy sound waves literally blast clean the feed tube — making the burner self-cleaning. Conventional burners tend to plug at these very low feed rates, as they do not have the advantage of this built-in purge.

To achieve sufficient sound amplitude to atomize the fuel it was found necessary to magnify vibrations of the PZT by means of a horn, in much the same manner as a cheerleader intensifies his voice with a megaphone. Much experimentation and a good knowledge of acoustics were required before the engineers settled on a satisfactory design.

Initially, horns were built with an epoxy resin cement used to bond the leaded ceramic disc to the metal walls.



Heart of the ultrasonic oil burner is the atomizing horn. Shown here in a cut away view, the horn contains a lead zirconate-titanate ceramic transducer which ultrasonically atomizes oil in the feed tube for better burning.

However, this was inadequate due to bond deterioration and the time-consuming care necessary to get good bond. On the other hand, mechanical clamping of the disc to the horn also

presented serious problems, not the least of which was damping, i.e., the clamp restricted vibration of the transducer.

The damping problem was ingeniously solved by the addition of a dummy horn (see drawing). Each horn is designed to produce a node plane at its shoulder, thus the damping effect of the clamps is negligible.

The horns are made of aluminum which has a high vibrational quality (Q) factor, and the unit is designed for service in the frequency range of 60,000 cycles per second. An electronic driver tube, or oscillator powers the transducer, and power outputs of up to 6 watts are common with single tube equipment.

A variety of life and field tests have been conducted with the new burner. One was in a center-flued hot water heater with #2 heating oil. It operated very well throughout the range of from 0.2 to 0.7 gph. The burner has also been run continuously for 5000 hours, whereupon the tests were voluntarily concluded.

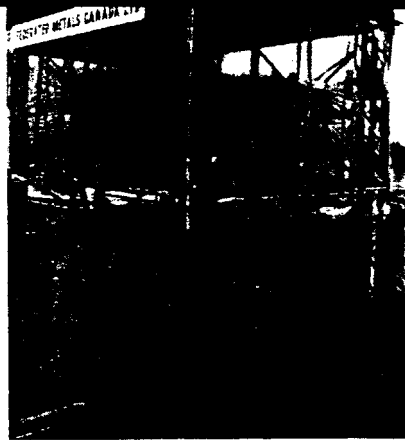
Esso Research estimates that its ultrasonic burner can be manufactured at about the same cost as a conventional oil burner unit, and it offers many advantages over the latter: compactness, no high-pressure oil supply requirements, self-cleaning passages and good performance at low firing rates.

At the present time Esso is offering interested manufacturers a license to make and sell ultrasonic burners in the U.S. and Canada.

1. "An Ultrasonic Oil Burner" by J. C. Young, J. A. Wilson and R. J. Lang.
A report of the Esso Research & Engineering Co., Linden, N. J. (1962).

They go the twist!

Rig containing aluminum mandrel and self-propelled crane straddles a row of concrete cells while lead burners inside the rig horizontally weld two sheets of lead to form the cell lining. Cell on left has received finished wall lining.



600 TANK LININGS— NO VERTICAL SEAMS

Construction time on the largest lead construction project ever undertaken in Canada has been halved by the development of a method that avoids burning vertical welds.

Installing sheet lead linings in 600 large zinc reduction cells at Canadian Electrolytic Company's new reduction plant at Valleyfield, Quebec would normally require a long, tedious and difficult weld up each vertical edge. The new method cuts the time and number of men required for the project in half.

Key to the new process is a hollow aluminum mandrel corresponding to the shape and size of the interior of a cell. The mandrel is carried by a self-propelled crane that straddles a row of cells and moves the work from cell to cell. The entire rig is enclosed so work can continue through the winter.

In fabricating the liner, two sheets of chemical lead are fitted around the mandrel to form the four walls of the cell so that only two weld seams are required where the sheets join at diagonally opposite corners. The sheets are welded together by a team of operators inside the mandrel which is lying on its side so that the seams are horizontal.

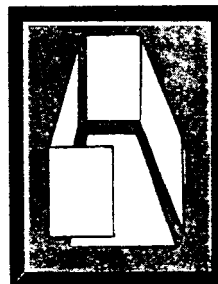
When the first two sheets are welded together to form all four cell walls, the mandrel is removed, the liner is upended and lowered into the cell. Another team of lead burners then welds a third sheet of lead at the cell bottom, while the first team moves on and repeats the process at the next cell.

When the plant is completed the 600

cells, lined with more than 500 tons of lead will be used for the electrolyzing of a zinc bearing solution to obtain zinc cathodes. Lead linings are used because of the metal's resistance to corrosion by the strong acid used in the process. As an additional precaution against corrosion, each concrete shell is sized with sodium silicate before the lead lining is installed. More sheet lead covers the concrete columns supporting the cells to protect them against acid spillage.

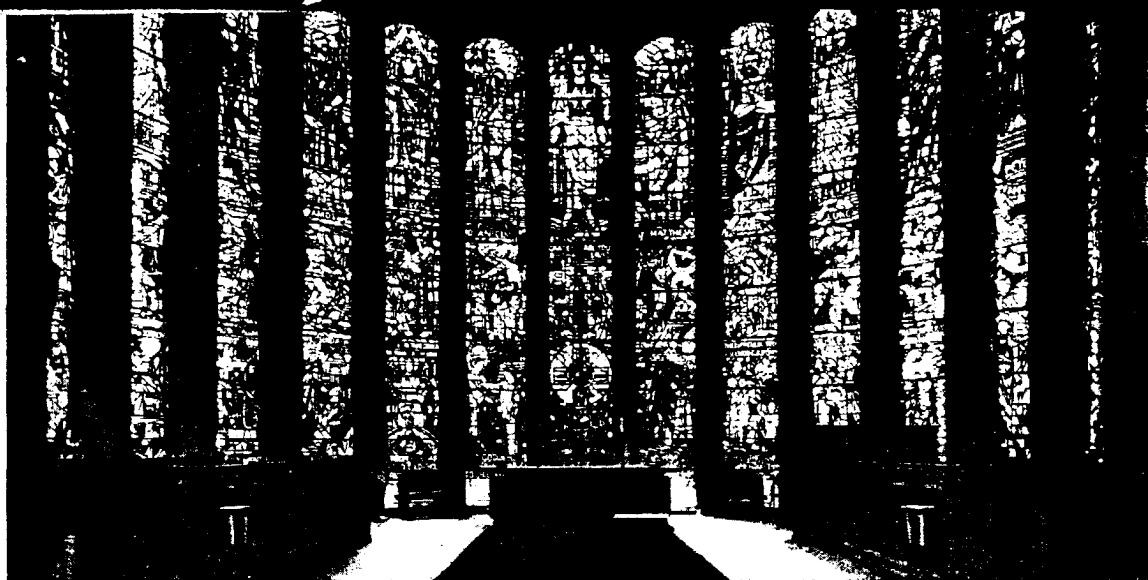
The new plant, jointly owned by five mining companies, will cost \$20 million. When it goes into production in the fall of 1963 it is expected to produce 200 tons of zinc per day. The new method was developed by Armand Piche of Federated Metals Canada Ltd., a subsidiary of American Smelting and Refining Co.

Sitting inside the cell, workman welds walls to floor. Only three sheets are required to fabricate the lining. Exploded view (inset) shows position of the three original sheets.



These 12 foot high concrete columns will support the completed cells. The columns will be lead sheathed to protect them from acid spillage.





THE MAGIC OF STAINED GLASS

Definition of "window": "An opening in the wall of a building for admission of light and air, usually closed by . . . glass . . ."

—*Webster's New Collegiate Dictionary, 1961 by G. & C. Merriam Company*
Another definition (by a seven-year-old boy on his first visit to Notre Dame Cathedral in Paris): The lad entered the cathedral just as the organ started to play. His eye caught the rose window and he exclaimed, "It sings, the window is singing!" The boy was Viollet le Duc and his revelation of the effects of stained glass did much to revive the art in the last century.

Great stained glass windows do more than admit light. They actually vibrate to it. Any good window functions architecturally to keep out rough weather. Great stained glass windows function spiritually as well.

Today craftsmen and designers combine pure art and modern science to produce superb creations that mark a mastery of light and pure color, controlled by lead lines and painted patterns which lose nothing in comparison with their illustrious medieval prototypes. In this country today craftsmen work in much the same fashion as their predecessors did seven or eight hundred years ago. Probably the reason is that the real beauty and aesthetic-architectural appeal of stained glass can be accomplished in no other way.

One of the foremost practitioners of this philosophy is the Jacoby Studios in St. Louis, Missouri. A fine example of their art illustrates this article:—the first Presbyterian Church of Kirkwood, Missouri. Fischer & Campbell Assoc. of Clayton, Missouri were the architects with whom the designers worked almost from the first sketches for the church.

In fact, this was a collaborative effort in the truest and finest sense of the word. The church committee, early in the development of the designs, was brought in for counsel and advice. The minister provided guidance in choice of biblical texts to be portrayed. The chief designer, whose work in this instance was

a culmination of a lifetime spent in designing stained glass windows, had the able and often inspired assistance of a happy mixture of apprentices and timers."

The thirteen windows in the apse, as shown in illustration, are each 4'-0" wide by 27'-0" high, divided into nine sections supported by lead coated irons anchored into the masonry openings. Size lead comes vary from 3/8" to 1" flanges and over two tons of them were used.

Many parts of the window were "plated," that is, two pieces were laminated or combined to achieve a color not obtainable with a single piece. Nonetheless the glass was coated with paint and the designer actually personally selected each piece of glass in a total glass area of 1,400 square feet. Other than the windows in the apse, there are about 100 small windows including 75 geometric "symbol" windows on the East wall and 10 on the West.

"These are exciting times," says Mr. William Oppliger of Jacoby Studios and though they are keeping abreast of them and are doing some work in the newer epoxy resins, etc., "nothing will replace the beauty and effects achieved through the use of stained glass. Over the centuries, lead has proven to be the ideal material with which to bind the designs of all sizes and shapes in colored stained glass."

A real view from this picture window overlooking San Francisco Bay. The lead-covered plant boxes form a neat, tasteful border to the picture.

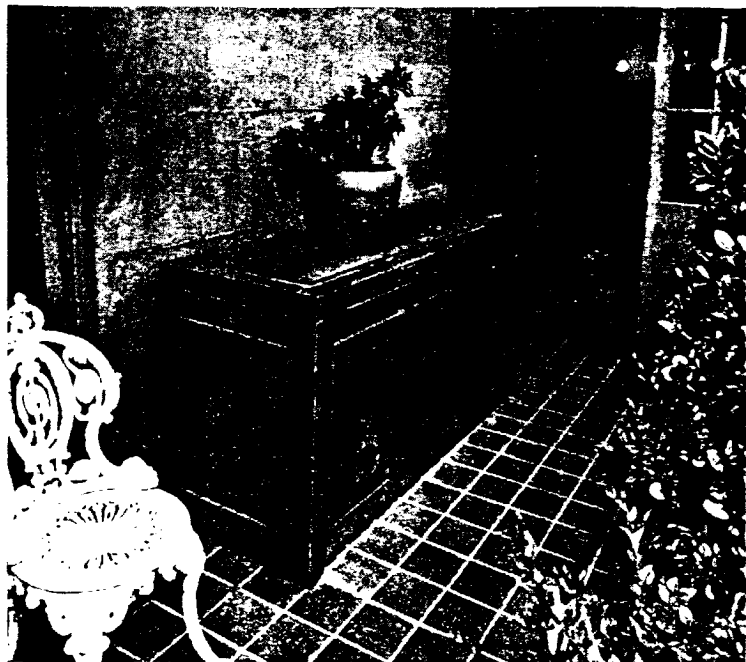


Exterior Lead and Interior Decoration

Take an urban balcony or terrace, add plants in plant boxes, provide the proper furnishings, and you have a pleasant spot for a twilight chat or a breather through the day. But too often you also have an insufferable problem of protecting those furnishings from the weather — or, as an alternative, an unintended rustic air as sunlight, rain, and airborne dust destroy them.

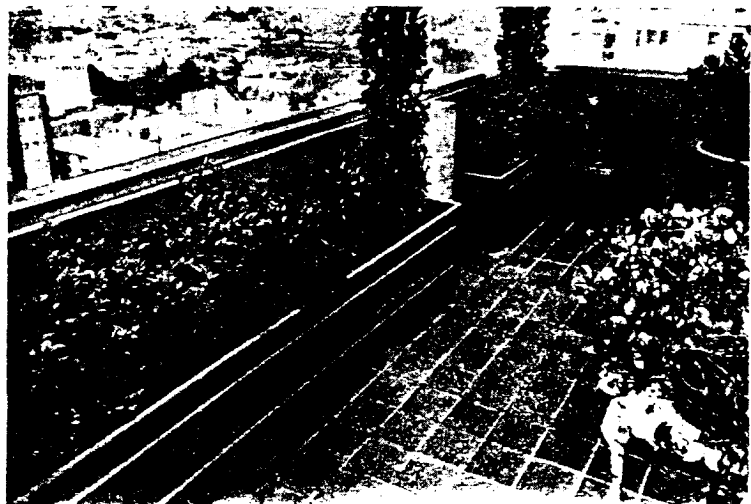
A solution to this "exterior decorating" problem in one San Francisco apartment has been the use of 2½-pound (just over 1.32") sheet lead. Plant boxes and cabinets were made up in inexpensive redwood 1 x 6 planks and finished with the easily worked sheet. By lapping it over top and bottom edges by about 2½ inches, the major fastenings for the sheet all fall in hidden areas. Then, to break up the flat expanses, ½ inch diameter half round extruded lead rod was fastened to the sheet to form rectangular panels.

The result is elegant and unobtrusive. The terrace is urban, comfortable and above all practical. In the year and a half since the lead was first put out it has required no maintenance of any kind. The surfaces have developed the soft gray patina which pleases the eye without diverting attention from the plants or the unrivalled beauty of the Bay Area skyline.



The storage cabinet is waterproof, weatherproof, and worryproof thanks to a sheathing of 2½-pound sheet lead.

Redwood and lead sheet form the plant boxes, too.

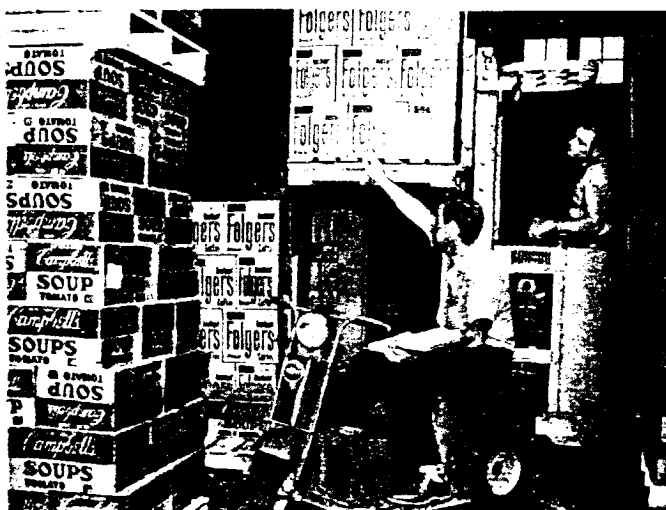




▲ PATROLLING the parking lot of a large shopping center on a two-passenger Cushman Truckster has virtually eliminated vandalism and car break-ins. The silent battery powered motor enables the patrolman to be on top of a trouble spot before he can be heard. The small, three wheeled vehicle can dart into traffic tieups and other tight spots. Use of ten similar one-passenger vehicles by the guard force at Westinghouse Electric Corp.'s huge East Pittsburgh, Pa. plant (cover picture) provides greater protection against pilferage, storage and fire hazards.



▲ RUSHING HOT MEALS to handicapped children in a cottage-type school is the job of this food train pulled by a battery powered vehicle. The train not only gets the food to the decentralized homes of the famous Arkansas Children's Colony quickly but it does so silently.



BATTERIES ON WHEELS

Small vehicles powered by rechargeable lead acid storage batteries are excelling in a wide variety of jobs in school, industrial and commercial plants, airports and resorts around the country. Here are five representative examples of the versatility of the quiet, speedy and economical vehicles.

TRAFFIC CONTROL and operational maintenance on Philadelphia's Tacony-Palmyra bridge is made more efficient and safer for operating personnel by use of two battery powered Cushman Trucksters. The small vehicles, manufactured by Cushman Motors, subsidiary of Outboard Marine Corp., Lincoln, Nebraska carry maintenance personnel, such as this paint crew, along the span's narrow walkways. The vehicles also stay out of traffic lanes while speeding such operations as bridge openings for ships, lane switching and coping with traffic accidents.



GUESTS and their luggage are carried comfortably to their rooms at a popular Scottsdale, Ariz. hotel in this fringe-topped, battery-powered "surrey." Other battery powered vehicles are used to deliver food, ice, mix, and messages to guests. The hotel says it averages 50 miles on a charge.



Look Ahead with Lead

WAREHOUSE TRAFFIC control in a wholesale grocer's large warehouse has been speeded since the warehouse supervisor took to a small Cushman Truckster. His job, directing the movement of 2½ million tons of dry groceries and frozen food within the warehouse each week, demands rapid travel between many locations. The battery powered vehicle is fast, small enough to move down the aisles without tying up other traffic, and ideally suited to indoor use because it emits no fumes or odors.



Torture test. Lead-cured Hypalon (black) and conventional wires have been subjected to a temperature of hundreds of degrees in the tip of this soldering gun. This overload would never occur in normal service, but duplicates a typical short-circuit condition.



When wire has to be **Tough** lead-stabilized plastic is the answer

The president of a large electric utility once said, "Nobody even realizes we exist until the meter reader steps in the tulip bed or the lights go out." Electric power is certainly one of the things we take for granted. Without ever knowing how much or what kind of wiring we have in our homes, appliances, cars, and offices, we expect the lights to go on when we flip the switch. And we are hardly ever disappointed.

But consider the really rough operating conditions wire encounters, say,

in a mine, and you can see that reliable operation is a minor miracle in its own right. Rapid changes of work site requires mine cable to be dragged over sharp edges of freshly broken rock. The wire may sit for days or months in water. Moisture and constant temperature are just the right conditions for fungus attack to the insulation. And heavy equipment and roughshod miners don't treat the wire like a lace napkin at a Sunday tea.

In really demanding situations like this, litharge stabilized Hypalon syn-

thetic rubber is winning plaudits for month after month reliability. Hypalon is well known for its resistance to aging and breakdown through oxidation. Lead — in the form of litharge used for curing and stabilizing the synthetic—contributes to its top rated moisture resistance and electrical performance. About 13.3 per cent litharge is used in the manufacture of the Hypalon insulation of Western Insulated Wire Company's mine cable. In addition to its vulcanizing-stabilizing role in this formulation, the litharge contributes reinforcement.

Besides these prime characteristics, litharge-cured material has a good many secondary benefits to offer. Its electrical and physical properties are so good that a cable of paired #6 wires is no larger than conventionally insulated #8 wire pair cable. Since Hypalon is light in color and retains tints extremely well, bright yellow is used for maximum safety. The insulation is easy to strip. It is flame resistant and stands temperature so well that operation at temperatures up to 90°C is recommended — allowing a 17 per cent bonus flow current (76 instead of 65 amp for #6 wire).

Performance of Hypalon Mine Cable

(Branco P-116BM Parallel Mining Machine Cable
by Western Insulated Wire Co., 2425 E. 30th St., Los Angeles 58, Calif.)

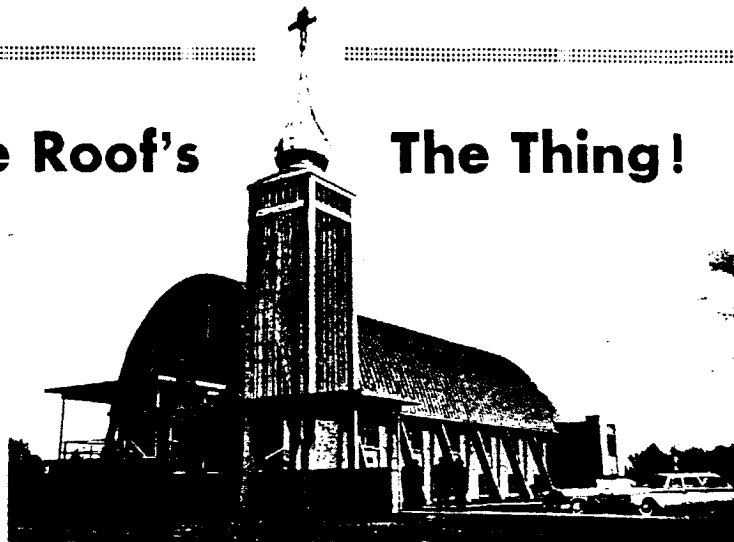


Size and construction.....	integral insulation & jacket of litharge-cured Hypalon, #6/2 cable
	0.51 x 0.84 inch
Allowable temperature ..	90°C cont.
Current capacity.....	76 amp
Insulation	
tensile strength	1750 psi
elongation	240 per cent
resistance	53 megohm/1000 ft
power factor	3.2 per cent

The Roof's

The Thing!

This Russian Orthodox Church, recently completed in Campbell, Ohio has attracted attention as far away as Moscow in the USSR. Architect C. R. Johnson has achieved all the desirable features of contemporary architecture without deserting tradition. The typical onion-shaped dome and the parabolic roof of the main structure blend interestingly. Terme roofing—lead-fin alloy coated steel — made possible the clean design.





ACTION AND COLOR CAPTURED ON METAL!

These bowls, panels and vases were designed and executed by Cleveland artists Ed and Thelma Winter. Pictured are only a few of the 82 pieces they have on display now through

January 28, 1963, at the Suffolk Museum, Stony Brook, Long Island. Leaded "jewelers" enamels are used by the Winters to depict lively horses, birds, flowers and other subjects with

skill, warmth and charm. The Winters create their own designs which are then fused permanently to metal substrates in the enameling furnace. Featured in more than 125 museums and galleries throughout the world, Mr. Winter's enamels have been fired on such diverse metals as copper, silver, steel, aluminum and stainless steel. Mr. Winter has recently published the second in a series of books on enameling. "Enamelling for the Beginner," (Watson-Guptill, N.Y.), in which he points out the many advantages found in using lead-bearing enamels.

lead



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