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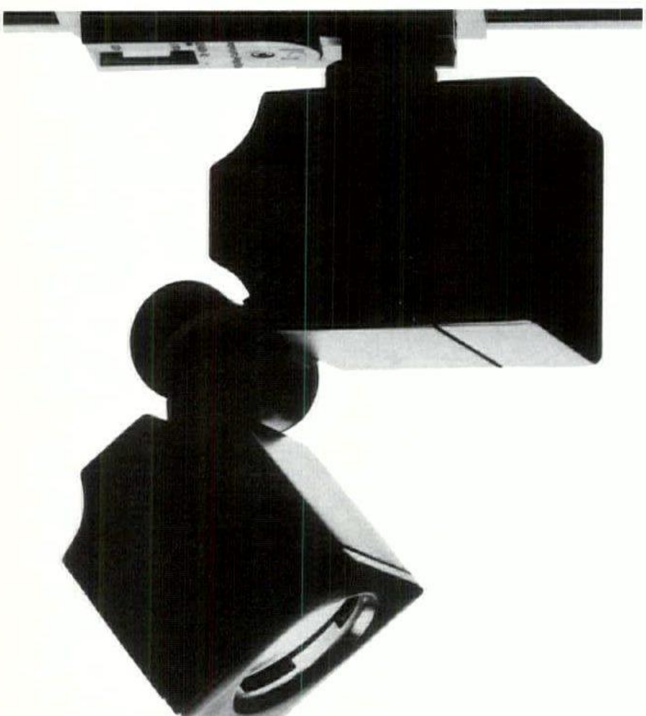

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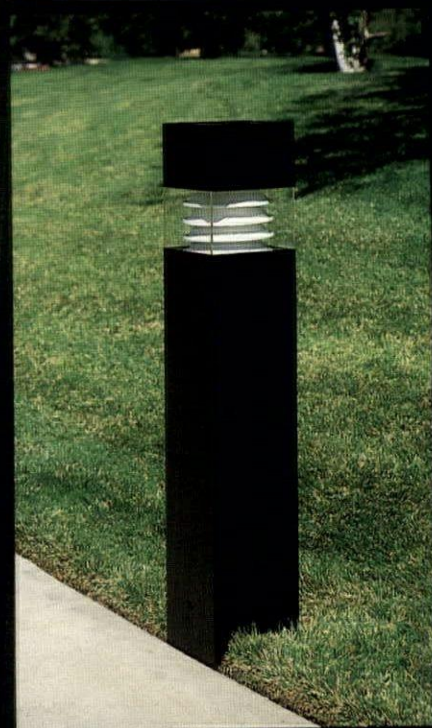

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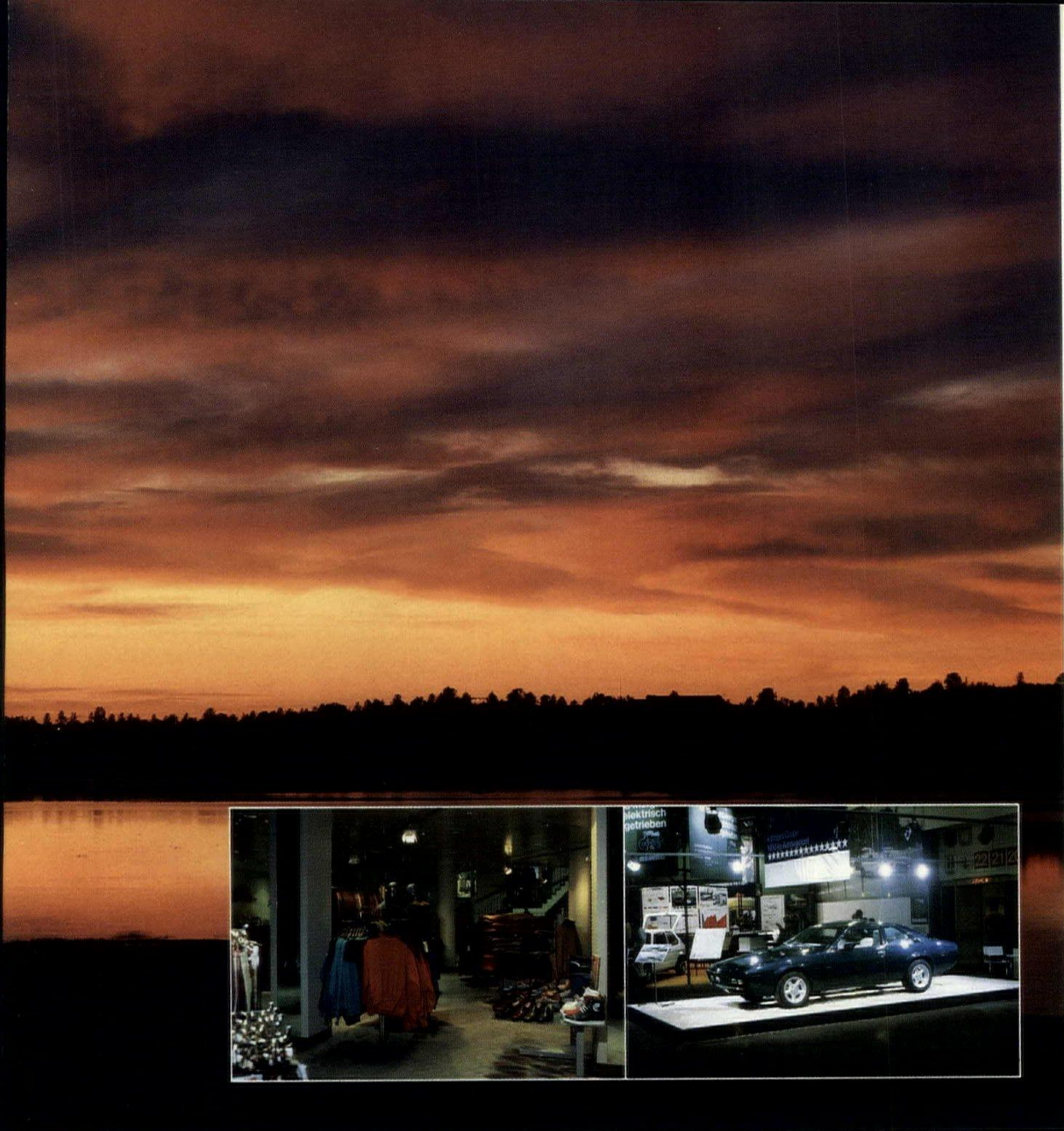

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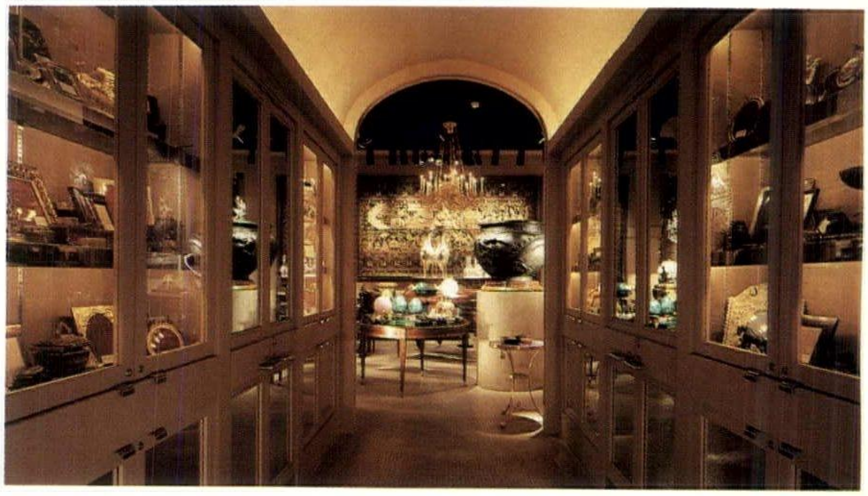
ARCHITECTURAL LIGHTING

November 1986
Volume 1 Number 0



From the Publisher

For a designer, I am sure there is no greater thrill than the completion of a new project, especially if you regard it as among the best you have ever done. As a publisher who has introduced six other successful trade magazines, I feel very much the same way about the introduction of this magazine, *Architectural Lighting*. I am proud to say it will be the best we have ever done.

Architectural Lighting represents not just another trade magazine, either to Cassandra Publishing or to our readers. It represents a strong commitment to publishing a magazine that will bridge the lighting information gap that has existed for many years between the lighting industry and the design professions, and between design professionals themselves.

We are committed to providing, every month, more pages of articles on projects and applications of day- and electric lighting technology and more new product information than any other lighting magazine. And we are committed to distributing this magazine to more than 50,000 architects, engineers, landscape architects, interior designers, and lighting designers — more than twice as many readers as those reached by any other lighting magazine.

But, does more mean better? In this case, absolutely. Our editorial commitment is to inform and educate and inspire. Designers who read *Architectural Lighting* can, of course, count on both the beautiful photography and high production values we know they demand of a design magazine. But they also can count on practical, timely, substantive coverage of the leading edge of new lighting technology — the newest applications and ideas. Practical coverage will provide information you can apply in practice to the design decisions you face every day. Every month we will present the hows and whys of a number of projects that represent some of the finest examples of lighting design today. We'll also give you technical columns, articles on controls, fixtures, and day- and electric lighting design methods.

But, I've saved the best news for last: *Architectural Lighting* is available to designers not on some "trial subscription" basis but absolutely free. You support *Architectural Lighting* simply by filling out and signing the postage-paid subscription card in the back of this magazine. Please reserve a subscription to the best new design magazine in decades by taking a minute of your time to fill out a subscription card now.

Edward D. Aster

From the Editor

It is my pleasure to welcome you to *Architectural Lighting*. There was a time in the past when most lighting design was reasonably straightforward; if we weren't already putting in lighting by rule of thumb, all we needed was a reflected ceiling plan and a favorite reference book to tell us how far apart to put the fixtures. Daylighting was merely a matter of "popping in" a few windows and skylights. Energy was cheap for lighting, heating, and cooling.

In recent years, lighting design has become a lot more complicated. As designers, we face tough demands for better lighting from clients and users who are well aware of lighting design issues, such as initial versus life-cycle costing and the health and behavioral effects of lighting. New energy codes and the uncertain future of energy costs require that we account for every kilowatt used in our designs.

Changes in the kinds of architectural elements we commonly specify in design have altered the way we think about lighting space. The architectural marketplace has experienced a flood of new electric and daylighting products: lamps, fixtures, controls, glasses, glazings, skylights, reflectors, shading devices, and so on, all with an accompanying array of manufacturers' claims and admonitions. And all of this has come at a time when professionals must be expert in more and more areas; the amount of time required to stay abreast of the changes in these fields is enormous. Reference books become obsolete, and accurate, useful information is often inaccessible.

Design professionals have long needed a regular source of practical information and ideas devoted solely to the subject of lighting for architecture, a fact confirmed by hundreds of responses to the user-input survey conducted during research for this magazine. Those responses have been the basis upon which *Architectural Lighting* was designed and have directly influenced the direction the magazine will take.

But that research was only the beginning. I invite reader response to ensure that *Architectural Lighting* will always deliver the information about new projects and developments that design professionals need to make appropriate design decisions in an area that will continue to change rapidly. It is my desire as editor and a practicing architect to continually provide design professionals with the best in *Architectural Lighting*.

Charles Linn, AIA

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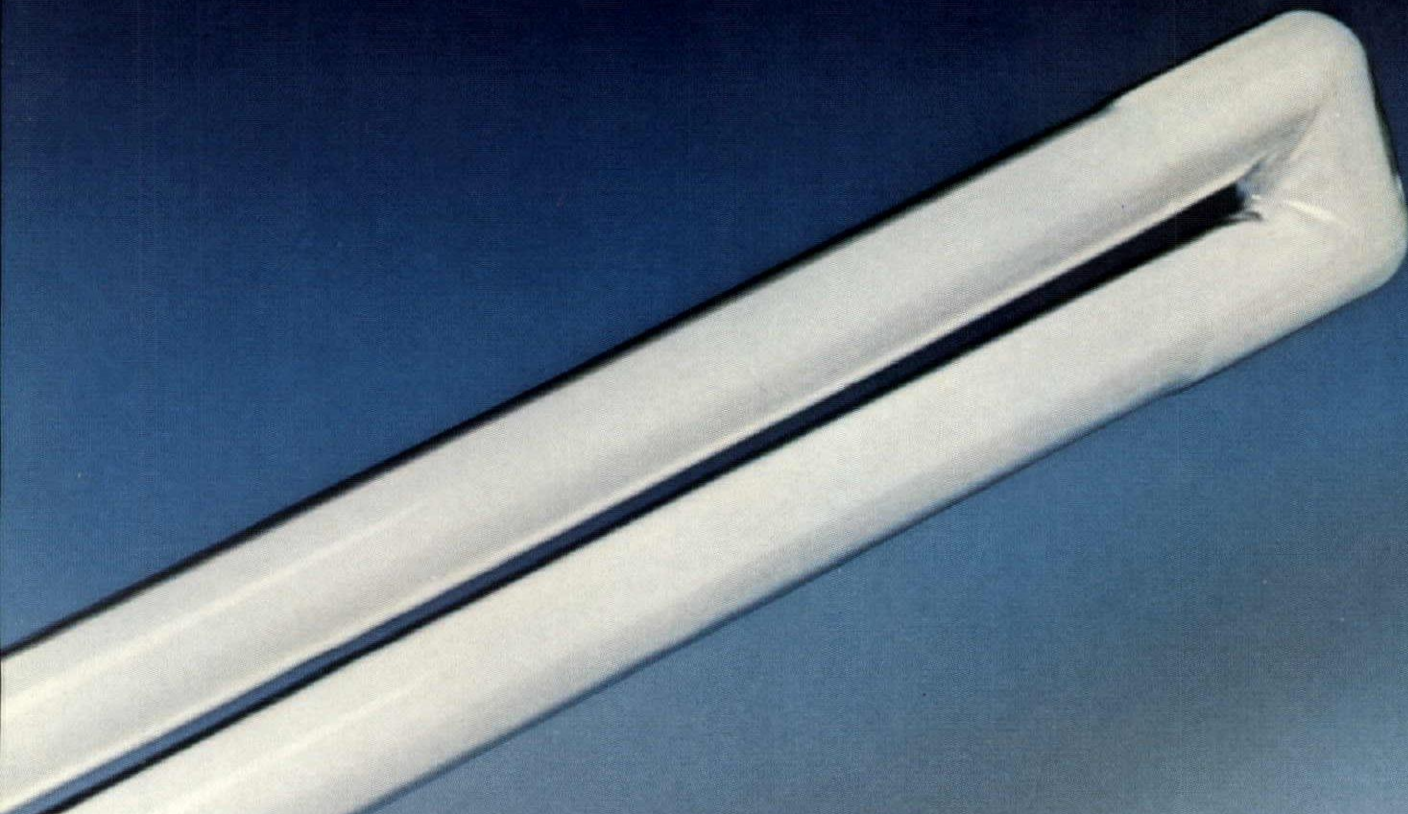

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Introducing Our Editorial Advisory Board

Architectural Lighting's Editorial Advisory Board represents various facets of the lighting professions, and members were chosen for their expertise. EAB members suggest article subjects, review manuscripts or projects, and answer questions as they arise.

■ Charles C. Benton

Cris Benton is an assistant professor of architecture at the University of California at Berkeley and a faculty research associate with the Lawrence Berkeley Laboratory, Berkeley, California. He received his bachelor's degree in architecture from Tulane University and his master's degree in architecture from Massachusetts Institute of Technology.

From 1980 to 1985 Benton was an assistant professor of architecture at Georgia Institute of Technology. From 1981 to 1985 he was a partner and then sole principal of E-Plus Consultants, Atlanta. In 1983 he was awarded a patent for the design of a heliodon.

A registered architect, Benton is the author of numerous publications and reports on daylighting and energy conservation. During the past year, his research projects have emphasized daylighting.

■ David L. DiLaura, FIES

David L. DiLaura is the founding officer and director of engineering with Lighting Technologies, Inc., Boulder, Colorado, and an associate professor of civil, environmental, and architectural engineering at the University of Colorado at Boulder. He received his bachelor's degree in physics from Wayne State University, Detroit, Michigan, in 1970. He immediately joined Hyde & Bobbio, Inc., as a junior engineer. In 1973 he joined Smith, Hinchman & Grylls Associates, Inc., as an illuminating engineer; he was later named an associate of the firm.

In 1981 DiLaura founded Lighting Technologies, Inc., a Boulder, Colorado, firm that specializes in applied mathematical research, lighting analysis software, and contract research. He was appointed to the faculty of the University of Colorado in 1982 and is currently in charge of the program in illuminating engineering there.

DiLaura is the author of 17 technical papers on lighting measurement and computations; he also holds a patent for a luminance and contrast measurement device. He is a Fellow of IES, a member of several of its committees, and sits on its board of directors; he is also a member of the Association of Energy Engineers.

■ M. David Egan, PE

M. David Egan is an associate professor of architecture at Clemson University, Anderson, South Carolina, and a lecturer at the University of North Carolina at Charlotte. He is also principal consultant of his own firm in Anderson.

Egan received his bachelor's degree from Lafayette College, Easton, Pennsylvania, and his master's degree from Massachusetts Institute of Technology. During the past 20 years, he has served on several university faculties and has offered lectures and workshops at schools of architecture and engineering in the United States and other countries.

Egan's work as a consultant in architectural technologies began at Bolt, Beranek and Newman in Cambridge, Massachusetts. In 1970 he founded his own consulting firm. He is the author of several books about architectural technologies, including *Concepts in Architectural Lighting*.

Egan is a member of the lighting education committee of IES, a fellow of the Acoustical Society of America, a former vice-president and director of the National Council of Acoustical Consultants, and a member of the adjunct faculty of the National Fire Academy.

■ Raymond Grenald, FAIA

Raymond Grenald is the founder and senior partner of Grenald Associates, Ltd., of Los Angeles. He is currently on the faculty of the University of Southern California School of Architecture. A registered architect, he earned his bachelor's degree in architectural engineering at Washington State University and was also educated at the University of Washington, the University of Cincinnati, and the University of Pennsylvania, where he was a Fels Fellow.

In 1968, following 14 years of general practice in architecture and engineering, Grenald established his own firm to specialize in architectural lighting. Since then the company has grown to include offices in three cities and has undertaken projects throughout the world.

Grenald has taught at many institutions and has served as visiting lecturer and design critic at Harvard University, Yale University, and the Lighting Institute at Nela Park, among others. He is a fellow of the AIA, a member of IES, and a member and past president of IALD.

■ David Lord, PhD

David Lord is a professor of architecture at California Polytechnic University, San Luis Obispo, California. He earned bachelor's and master's degrees at the University of Arizona in Tucson, the master of architecture degree at the University of California at Berkeley, and his doctorate at the Bartlett School of Architecture and Planning at the University of London.

Lord has been a member of the faculties of the University of Hawaii, the University of Maryland, Harvard University, Washington University in St. Louis, and UCLA. In 1982 he was a Fulbright lecturer with the Faculty of Architecture at Middle East Technical University, Ankara, Turkey. A variety of institutions have engaged his services as an energy consultant during the past 14 years.

Lord is the author of many publications in the areas of energy use and environmental control. He is a member of the Society of Building Science Educators, of the American Society of Heating, Refrigeration and Ventilating Engineers, and of the Daylighting Committee of IES.

■ Thomas R. Schneider, PhD

Tom Schneider is president of the Lighting Research Institute, Palo Alto, California. He was awarded his bachelor's degree in science by Stevens Institute of Technology, Hoboken, New Jersey, and his doctorate in physics by the University of Pennsylvania at Philadelphia. From 1971 to 1972, Schneider was a postdoctoral Fellow at the University of Pennsylvania's National Center for Energy Management and Power. He then worked in the research and development department of Public Service Electric and Gas in Newark, New Jersey.

In 1977, Schneider joined the Electric Power Research Institute in Palo Alto, where he advanced to the position of director of end-use technology, which included lighting and HVAC. In 1985, he became president of the Lighting Research Institute, a not-for-profit organization that sponsors basic and applied research in all forms of lighting.

Schneider is the author of numerous publications on energy and end-use technologies. He is a member of IEEE, IES, and the American Association for the Advancement of Science.

■ William I. Whiddon

William I. Whiddon is president and founder of W.I. Whiddon & Associates Inc., McLean, Virginia. He received a bachelor's degree in aerospace engineering from the University of Maryland and a professional architecture degree, magna cum laude, from Kansas State University.

Whiddon has worked for a nuclear engineering firm and an aircraft manufacturer and served five years with the United States Air Force. After earning his architecture degree, he joined a Kansas firm involved in the design of shopping facilities, home improvement centers, and condominiums.

After several years in Kansas, Whiddon accepted a position as senior associate with Booz•Allen & Hamilton's energy and environment division in Bethesda, Maryland. In 1981 he established W.I. Whiddon & Associates Inc., a firm that specializes in communicating building technology innovations to the building industry. He is the author of several books and manuals and currently serves on the board of directors of the Passive Solar Industries Council. ■

Letters to the Editor

Adverse impact

If possible, I would like to use the editorial section of your publication as a public forum. Your readership includes many professionals who are involved with landscape illumination. They need to be made aware of a change in the 1987 National Electrical Code (NEC).

According to Article 225-26, live vegetation, such as trees, shall not be used for support of overhead conductor spans or other electrical equipment. This addition to the NEC will effectively prohibit the installation of any lighting fixtures in trees. Downlighting or "moonlighting" will become a thing of the past. This will have an adverse impact on design professionals, contractors, owners, and manufacturers. A multimillion-dollar industry segment could be decimated.

Regulation of landscape illumination to insure safety is necessary. Prohibition is not. Concerned readers need to send their comments and reactions to one of the following individuals.

R.G. Bierman
Bierman-University Electric
2300 University
Des Moines, IA 50311

Peter Schram
National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

Thank you for your assistance in bringing this development to the attention of your readers.

Lloyd R. Reeder
Greenlee Landscape Lighting
Carrollton, Texas

Keep in touch

We want *Architectural Lighting* to be your forum for lighting issues of all kinds and invite your letters on subjects of interest to our readers.

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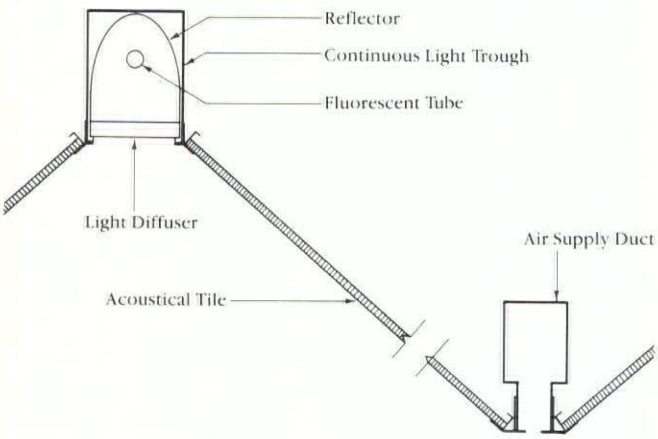
Circle 11

'Sawtooth' ceiling design protects computer screens from glare



Project: Trading floor
Location: Park Avenue Plaza, New York
Interior Designer: R.J. Burling, Total Concept/New York Incorporated
Lighting Designer: Alfred Scholze
Electrical Engineer: J.R. Loring & Associates
Client: The First Boston Corporation
Photo: Peter Paige

With 40,000 square feet of floor space, First Boston Corporation's trading floor at Park Avenue Plaza in New York was a warehouse-sized project. Illuminating so large an area evenly without the tremendous ceiling height normally encountered in such a space was only part of the challenge met by Robert Burling of Total Concept and lighting designer Alfred Scholze. They also had to find a way to do it economically without creating the eye-straining reflections that hundreds of lights could create on the hundreds of CRT screens used in the room — a situation often associated with normal open office lighting.

"You don't want lights to shine on computer screens," says Scholze. His solution was a combination of elements: widely spaced rows of fairly standard single fluorescent lamps, deeply recessed in parabolic reflectors and covered by custom one-inch baffles. The rows of lights were separated by shallow wedges of acoustical tile, as shown in the detail drawing at left, giving the overall ceiling a furrowed appearance.

The combination of the deep baffles, white reflective tile, and recessed parabolic reflectors provides extremely diffuse light. That combination also enables the rows of single 40-watt rapid-start deluxe warm white lamps on five-foot centers to produce an even 50 footcandles at the work surface. In addition, the small number of lamps and ballasts contributes less heat to the space than more conventional lighting solutions. "Tremendous amounts of heat were already being produced by CRTs, Trans-Lux machines, which display ticker tape information, and other types of projection equipment," says Burling.

In addition, the increased surface area of the furrowed ceiling helps reduce the chaotic reverberation of trading floor noise. It is an economical solution because it is constructed from stock acoustical tile components, according to Burling. The ceiling is the trading floor's most distinctive feature both because of its design and because it creates the illusion that light radiates from an invisible source.

The fire sprinkler system is concealed at the same level as the light fixture baffles, and ventilation for the space enters through continuous slots that run parallel to the length of the light fixtures between these inverted light troughs.

"The angle of the ceiling — the upside-down triangles — forms the cutoff angle for the whole assembly," Burling says. "You cannot actually see the rows of lights unless you are standing right under them. Then, the baffles conceal all but the part of the lamp that is directly overhead. There is just a sense of brightness above you."

"They've adjusted the computer equipment as well," says one of the trading floor workers, "and with the ceiling lighting, there is absolutely no glare." ■

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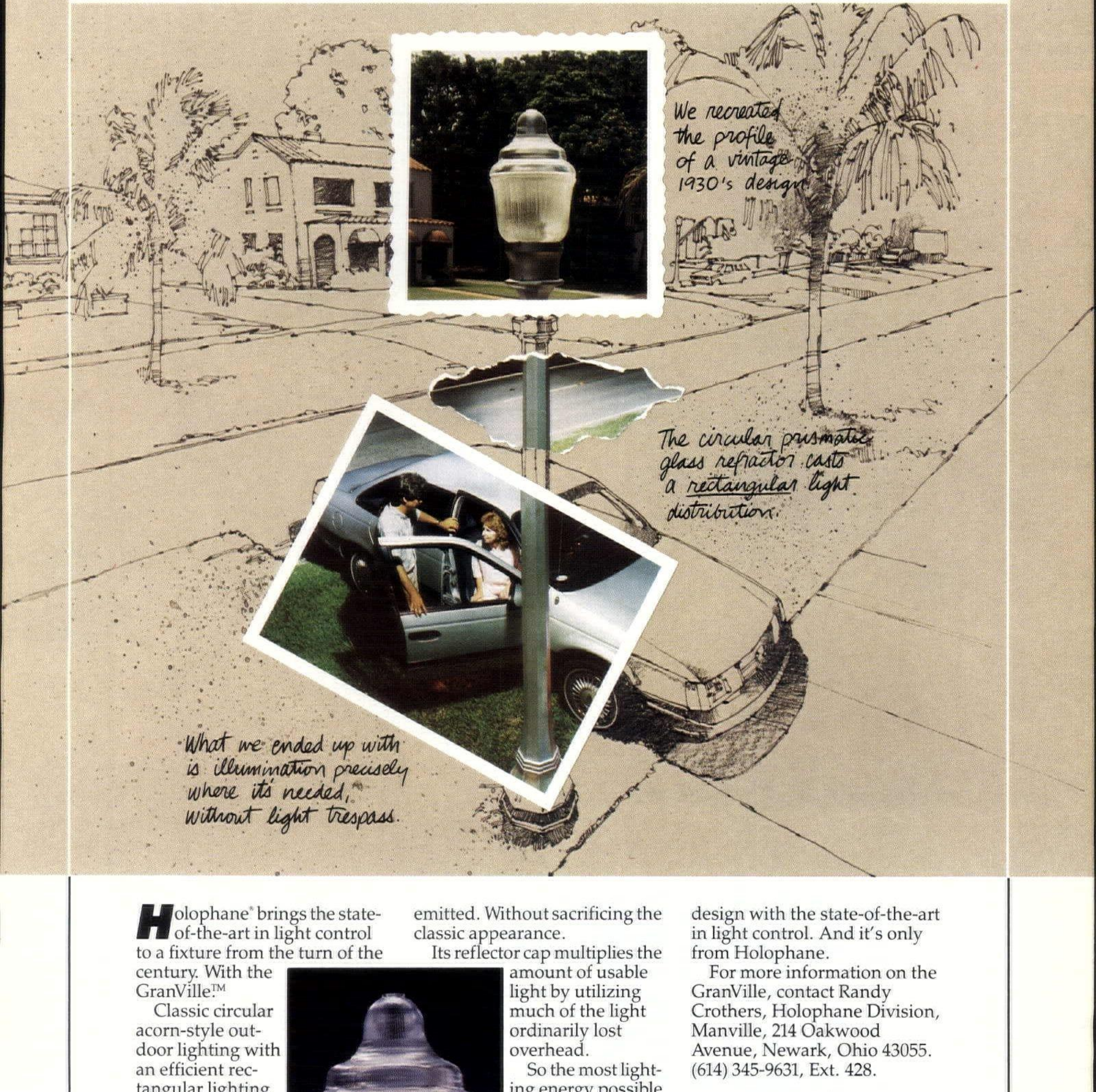

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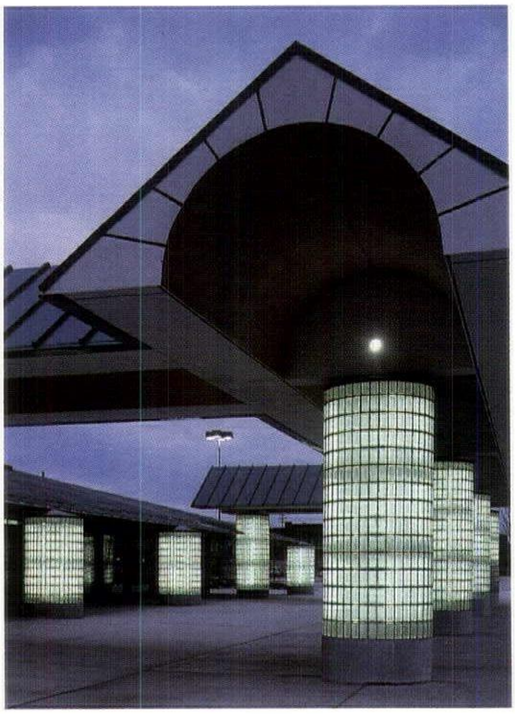
Circle 12

Lighted glass columns welcome railroad and bus passengers



Project: Battle Creek Transportation Center
Location: Battle Creek, Michigan
Designer: William Kessler and Associates, Inc., Architects
Client: City of Battle Creek
Photos: Balthazar Korab

One problem with railroad stations is that they all look a lot alike. They get that way because they have to have certain features in order to function as railroad stations. Architect Ed Francis, of William Kessler and Associates, found a way to give Battle Creek, Michigan, something special in a passenger facility by using glass-block columns.

Traveling from Chicago to Battle Creek — about 100 miles west of Detroit — "and passing through all those identical little stations in between," Francis says, "your railroading experience can start to get a little dull."

In addition, in this case, city planners have redeveloped the downtown area, consolidating railroad and motor coach traffic so that buses and trains no longer run through the middle of town. The station has become a primary entry to the city.

The designer's challenge was to preserve the identity and function of the railroad station. At the same time, it was necessary to do so in a way that created a good first impression on visitors.

Francis found a fresh approach with a traditional feel using columns constructed of glass blocks. Each column is about 14 feet high and slightly more than 4 feet, 6 inches in diameter. The columns are lighted from within by fluorescent fixtures, each hung on two 50-pound-test cables attached to unistrut mounting brackets.

The large columns under the train and bus canopies on opposite sides of the terminal are illuminated by nine fluorescent fixtures in each. Columns at the entries, bus and train freight areas, and crew lounge area are lit by three fixtures each.

Diffusion of the light through the blocks makes each column act as a large indirect luminaire at night. In addition to being attractive and distinctive, the block columns offer added benefits. They are washable and graffiti-resistant, providing protection against vandalism and many other kinds of damage, and they lend a solid identity to both the building and the area.

The canopies over the columns are rendered in a rusticated style. The rusticated style suggests historic tradition in the canopies.Their main purpose, of course, is utilitarian: shelter from the weather for bus, train, and taxi passengers. ■

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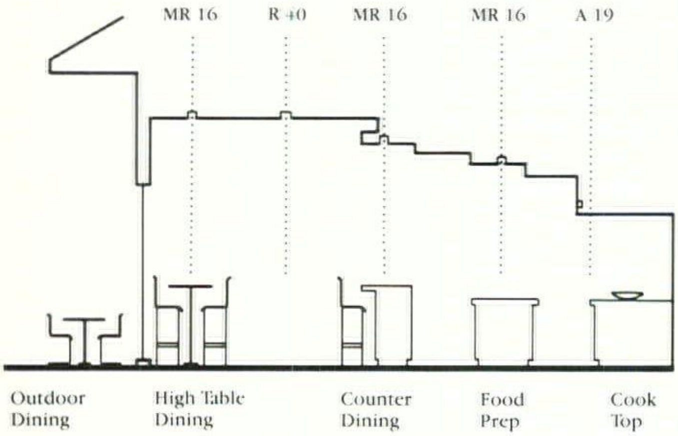
SYLVANIA GTE

Lighting presentation cooking for fast customer turnover



Project: ChinChin
Location: Brentwood, California
Interior Designer: Brent Saville, Swimmer Cole Martinez Curtis with Bob Mandler
Kitchen Consultant: Clevenger Associates
Client: Bob Mandler
Photo: Toshi Yoshimi

ChinChin is a restaurant that specializes in *dim sum,* a kind of Chinese appetizer or snack. For economic reasons and because of limited space (roughly 6000 square feet) the owner wanted a snack-bar design that would encourage a profitable customer turnover while appealing to Brentwood, California's young, suburban clientele.

At ChinChin, everything from *dim sum* dough making to wok cooking is done in front of the customer. This provides a lively, entertaining show as it merchandises the food. At the same time, it creates additional heat, smoke, and noise, all of which had to be controlled; but, as an essential part of the restaurant's ambience, they could not be eliminated altogether.

With display cooking at the heart of ChinChin's show, food was treated as an aesthetic factor in the lighting design. To give the food the same kind of emphasis required for merchandise in a retail store, to render better color for the completed dishes, and to provide lively lighting and controlled light intensity, 12-volt MR16 lamps were installed over tables and display areas. The low-voltage, 50-watt MR16 — a bright and narrow source — also introduces less heat into its surroundings than do other 50-watt lamps, a desirable quality in Southern California's warm climate.

Brighter incandescent lights are used over aisles to increase the restaurant's ambient light level. Canned 150-watt R40 lamps were chosen for the purpose.

Light from both sources is positioned to reflect off the stainless steel and chrome equipment in the display kitchen. This dramatizes the area and makes the restaurant brighter than it would be otherwise. The brightness and sparkle add to the stimulating atmosphere in which customers relax and enjoy themselves without settling in, so rapid customer turnover takes place comfortably.

A strong exhaust fan was installed to deal with the extra smoke, and extra air conditioning was added to beef up the restaurant's capacity to deal with the heat. To avoid adding the noise from this added equipment to the work and equipment noises already inside the restaurant, the air conditioner and exhaust fan were installed on the roof, as far away from the dining area as possible. A 20-foot cooking vent connected the fan to the cooking and dining area. ■

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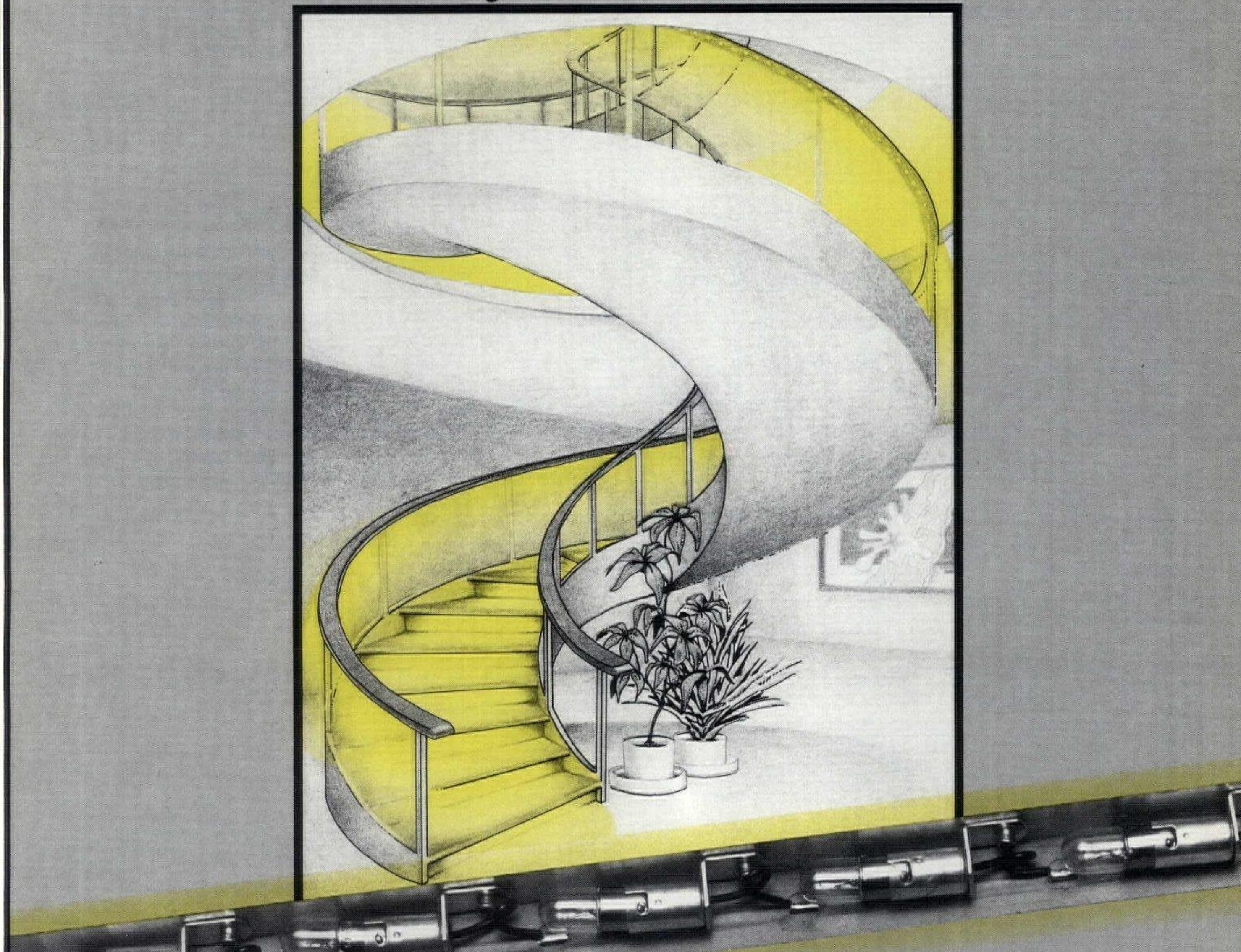

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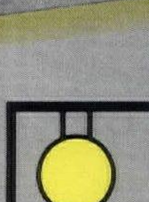

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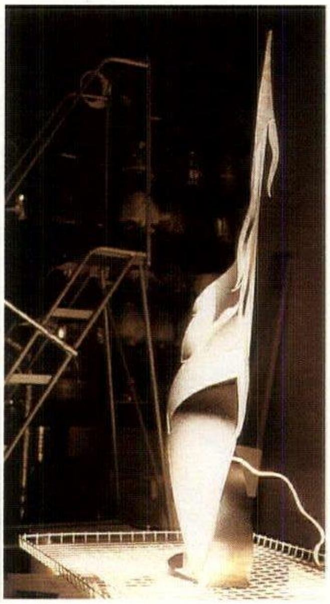
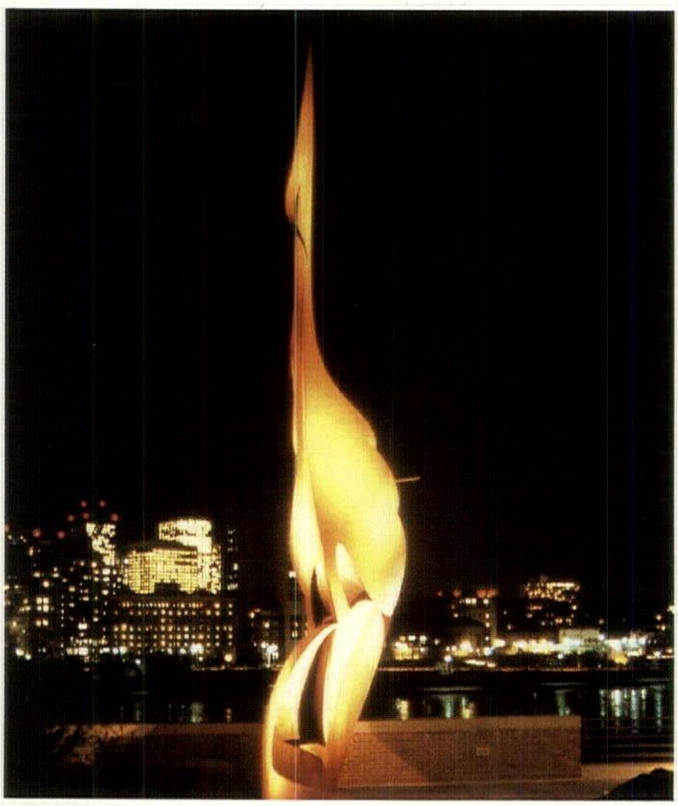
Circle 14

Illuminated sculpture a standout on Charles River skyline

Project: Lupus Sculpture
Location: Cambridge, Massachusetts
Lighting Designer: Horton-Lees Lighting Design, Inc.
Client: Lotus Development Corporation





JAMES E. BEYER

The *Lupus* is a 40-foot steel sculpture by John Raimondi and is on an outdoor plaza overlooking the Charles River at Lotus Development Corporation headquarters in Cambridge, Massachusetts. A frozen flame effect is heightened by the rusty characteristic of Cor-Ten steel and by dramatic lighting. Karen Langendorff, of Horton-Lees Lighting Design, Inc., credits the extraordinary overall effect, in part, to the opportunity to "rehearse" the lighting concept and to consult with the artist personally.

Because he uses the same type of lighting for sculptures displayed in his own home, artist Raimondi readily agreed to Langendorff's idea for low-voltage incandescent PAR 56 lamps around the *Lupus*. They discovered physical restrictions, however, as they tried to find suitable locations for lighting fixtures on the architectural plan drawings.

"Originally, we considered recessing the fixture housings in the plaza floor," Langendorff says. They abandoned that plan when they were told that "digging holes in the plaza floor would delay the tenant from moving in below it."

They avoided a major setback when the artist provided them with a 4-foot model of the *Lupus*. With proportionately smaller lamps, they determined the final placement and angle of the fixtures. By sacrificing some degree of brightness control, they were able to locate the fixtures in raised planters and avoid digging holes in the plaza.

In spite of the low aiming angles required to light the bottom of the *Lupus*, strategically located narrow- and medium-beam PAR 56 lamps, in combination, dramatically render the form of the sculpture. The PAR 56 is a directional spot beam that can be used either horizontally or vertically depending upon the installation. The tight beam pattern allows the kind of precision aiming necessary for rendering three-dimensional forms.

The reddish curves are highly illuminated at the projections and allowed to fade as the form recedes. Because of special attention to illuminating the wing tips of the *Lupus* on the side and top, the sculpture stands out distinctly above the Charles River and the Cambridge skyline. ■

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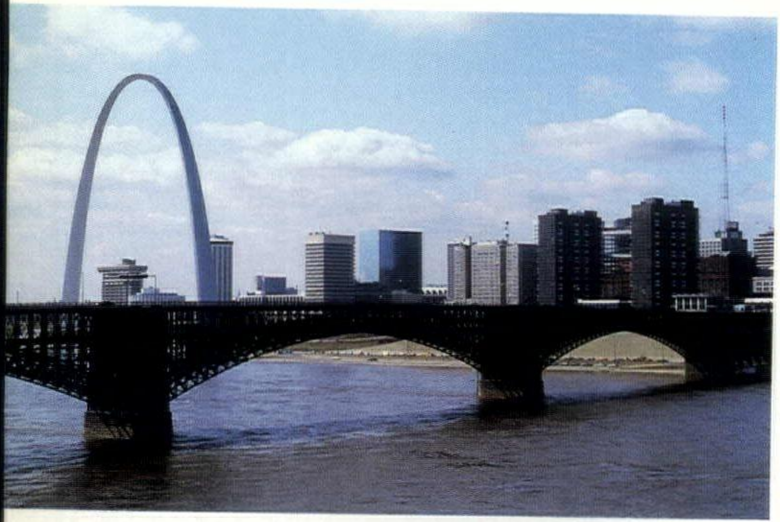
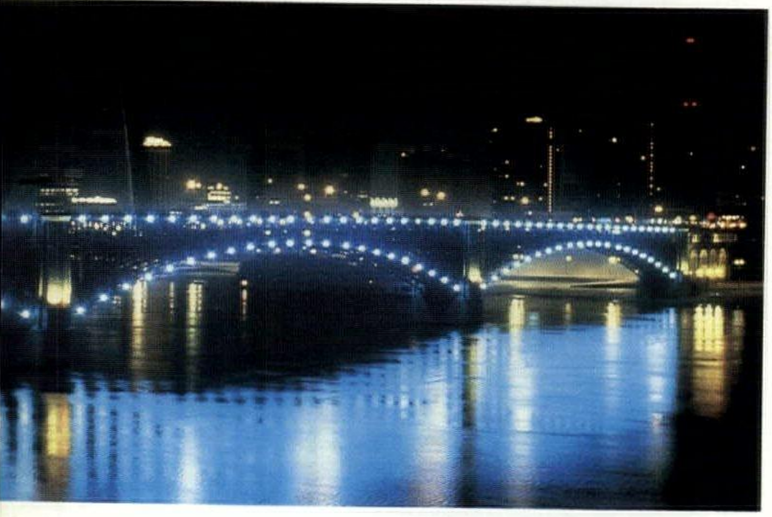
Bridge lighting concealed by day, controlled from river by night





Project: Decorative Lighting, Eads Bridge
Location: St. Louis, Missouri
Designer: Sverdrup Corporation, St. Louis
Client: The Veiled Prophet Organization

Lighting the Eads Bridge is an example of the challenge involved in trying to improve something that has stood the test of time. It was, after all, the first bridge in the world to use arched trusses and the first major span across the Mississippi River. The 112-year-old bridge still carries traffic, much of it tourists visiting the nearby Jefferson National Expansion Memorial, a riverfront park that surrounds the Gateway Arch.

A group of St. Louis civic and business leaders challenged the Sverdrup Corporation to retrofit decorative lighting to the bridge as one of its annual gifts to the city's riverfront beautification program. Sverdrup donated its lighting design services.

Designers used 256 high-intensity mercury vapor luminaires with concealed ballasts to delineate the upper and lower chords of the trusses with dots of light. For maximum energy efficiency and maintainability, these fixtures were fitted with 100-watt, 24,000-hour lamps. All fixtures and conduit are secured by clamps to avoid any structural compromise of the steel truss members. The lights are installed below the surface of the roadway, out of drivers' line of vision.

The limestone masonry piers and approaches to the bridge were illuminated by 400-watt high-pressure sodium lighting fixtures. They were chosen for both energy efficiency and color output. The reddish lamps effectively render the stone and contrast with the bluish mercury vapor lights.

Sverdrup designers also considered the safety of river barge traffic. They devised a dimming system that tugboat operators can activate from the water. Pilots may dim the bridge lighting by focusing a searchlight on a series of photocells installed on the riverbanks. They may, instead, choose to radio a nearby river traffic control center and ask a controller to activate the dimming device by telephone. In either case, the lighting is dimmed for 15 minutes, after which the system's timer automatically restores the lights to full brightness.

The success of this project can be measured on a number of levels. It is energy efficient, and it was engineered for the safety of boat traffic on the river and auto traffic on the bridge. Above all, however, the lighting makes night viewing of this historic structure a memorable experience and adds drama to the St. Louis cityscape. ■

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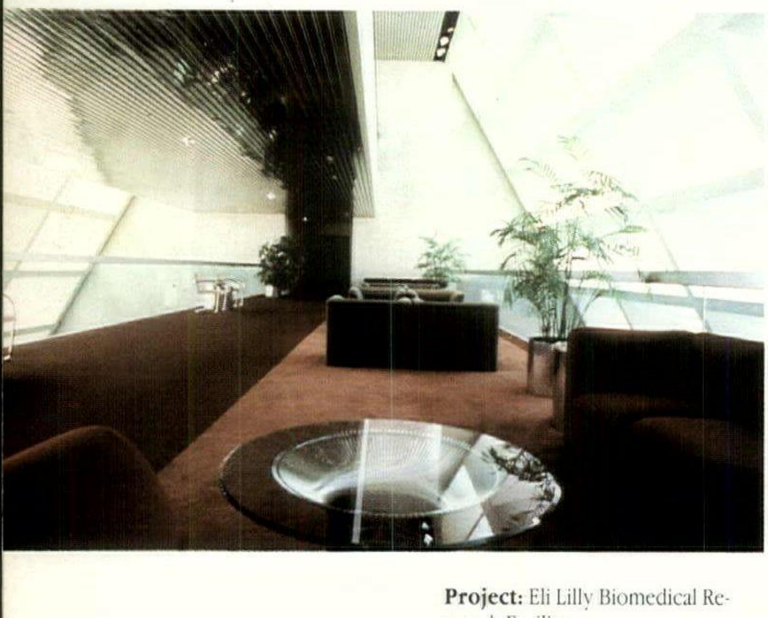
Circle 16

Flexible lighting matches the needs of Eli Lilly's multipurpose atrium



Project: Eli Lilly Biomedical Research Facility
Location: Indianapolis, Indiana
Lighting Designer: Smith, Hinchman & Grylls Associates
Photos: Paul Bednarski

The Eli Lilly Biomedical Research Facility in Indianapolis includes a central atrium, which is the building's most striking feature and the main entrance for visitors on the ground level. Space on the upper levels serves as an employee lounge and meeting area. In addition, the atrium has room for special events, such as seminars or dinner dances, on the ground floor.

Lilly approached Smith, Hinchman and Grylls Associates with a request for a lighting system that would make the best use of high levels of daylight in the atrium. An important aspect of the atrium, in fact, was the exterior curtain wall system with light shelves to diffuse daylight and use it for interior lighting.

Lilly officials wanted a lighting system that would integrate daylight and electric light without overheating the atrium. At the same time, they said, they wanted an efficient system: one that would meet their requirements for adequate light levels during both normal and event use of the space and one that would do so with the least amount of electric lighting possible.

The lighting designer found a solution by combining daylight and electric light sources into a balanced, even illumination. This supplied necessary light levels with the least amount of electricity. Because the area serves a variety of purposes, however, more than one level of light is needed. Special events such as seminars require high levels of light; less light is needed for normal use of the reception area and lounge; so the system needed some flexibility.

This was provided by controllable ballasts with a wide dimming range. Because the ballasts used make virtually no noise when they operate, they were ideal for the atrium. Rapid-start fluorescent fixtures provided additional indirect light, reflecting off the underside of the light shelves in the roof portions of the walls. At night, the lighting is completely concealed and indirect.

To read atrium daylight levels for the automatic system and monitor the amount of incoming daylight from the light shelves, 12 photosensors (barely visible in the linear metal ceiling) were mounted strategically throughout the atrium. The data they gather are averaged and that average reading is used to control the electronic ballasts that regulate the fluorescent lights. In this way, even lighting is provided throughout the atrium regardless of outside light, and the problems that could arise because a column casts a shadow on any one sensor are avoided.

For further flexibility, lighting controls were located at key areas on the ground floor, so the automatic system can be overridden and preset lighting levels can be selected. An analysis of the new system at Lilly projected yearly energy consumption of 67,400 kilowatt-hours using a traditional multilevel relay switching system. The study predicted that the new controllable ballast system would use approximately 32,900 kilowatt-hours during the same period. The study supported installation of the new system, projecting annual energy savings of 32,900 kilowatt-hours, or about 52 percent. ■

MARTA shop lighting meets utility and safety requirements

Project: MARTA Major Maintenance Facility
Location: Atlanta, Georgia
Lighting Designer: Marlene Lee, PE
Client: Metropolitan Atlanta Rapid Transit Authority

During any eight-hour shift, as many as 50 railcars can rumble into the MARTA car shop for routine repairs, regularly scheduled preventive maintenance, or inspection. The Metropolitan Atlanta Transit Authority inspects each of its railcars every 45 days with progressively increasing detail. A 45-day inspection takes about four hours, says Dan Estep, chief of vehicle maintenance at MARTA. Ninety-day and semiannual inspections take longer. Annual inspections take from 8 to 10 hours, Estep says.

The railcar maintenance area is a compound of warehouselike buildings, each with a maintenance pit for working on the underside of the cars. Each pit is approximately six feet deep, with supported track over it long enough to accommodate one "married" pair of railcars — an "A" car and a "B" car.

"A" cars carry a battery charger, battery, and the automatic train control equipment; "B" cars carry an air compressor for the air brakes. "B" cars also carry the train's radio equipment. Each crew inspects an average of two pairs of cars each shift.

The electric railcars get power through a special shoe designed to make contact with a third rail. The rail carries a lethal 750 volts DC. For safety, the third rail does not extend into the car shops. A "stinger" is a wandlike device attached to a cable power source. Maintenance workers touch the wand to the rail to supply the power to move cars in and out of shops.

The MARTA lighting system satisfied requirements for both utility and safety. The garage area is illuminated by metal halide lamps. In addition, a series of red flashing incandescent lamps are activated when the stinger is charged and cars are powered.

Cars over the pits virtually black out the work areas. For that reason, specially made fluorescent pit lights mounted on brackets in the work area are carefully angled up to illuminate the underside of the cars. Workers under the cars at the MARTA car shop are rarely dazzled by the lights during either day or night shifts, says Estep. To ensure longer life in a working environment that includes exposure to dirt and chemical damage as well as to rust-promoting humidity, these fixtures are resistant to grease, impact, and solvents.

"It can get very black under there, even in the daytime, with a car over the pit," says Estep. "When you're working on a car, you're usually looking up and the lights are also angled up. So you'd have to be on top, looking down into the pit, to get the light in your eyes." ■

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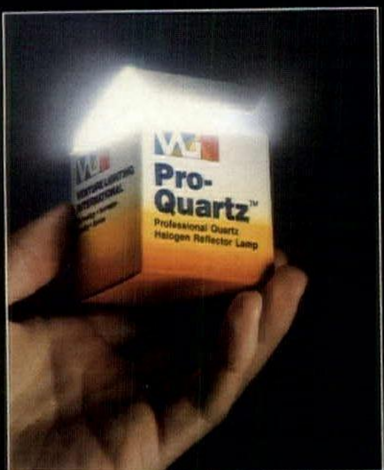

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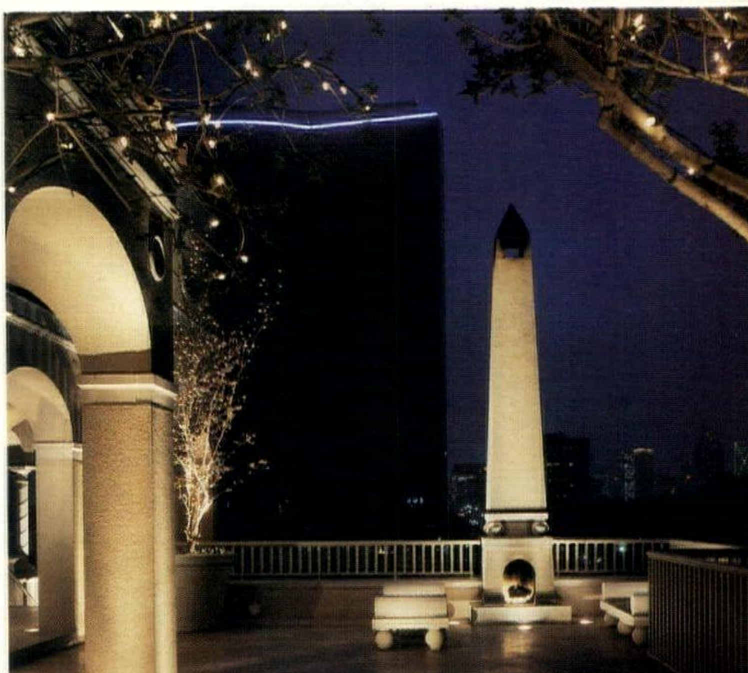
Circle 18


ME THE SERENITY TO ACCEPT

Loyd-Paxton Galleries: Optimum lighting for peerless antiques

ARTICLE BY
CHARLES LINN, AIA

PHOTOGRAPHS BY
ROBERT AMES COOK



"We want you to design the optimum lighting system." That was the directive given to lighting designer Craig Roeder by Charles Paxton Gremillion, designer and co-owner of the Loyd-Paxton Galleries in Dallas, which was completed in July 1985. One might think Roeder's challenge would have been simplified by the fact that Paxton and his partner, Loyd Ray Taylor, already had a supreme understanding of the major role lighting could play in making successful the building that would house their residence and showroom for art and antiques. That understanding, however, only made the level of complexity of lighting this building as high as any lighting designer might ever face.

The program required lighting rooms filled with some of the finest examples of antique English, French, and Continental furnishings and art objects available for sale anywhere — rooms in which the lighting must be changed at a moment's notice after the sale of major pieces — as well as designing distinctive exterior lighting, and the lighting of Loyd and Paxton's personal residence and collections. In addition, the owners wanted a wide variety of light levels available for the different activities that occur in their building: for showing antiques; for cocktail parties, special events and entertaining friends; for nighttime security; and for lamp longevity and energy savings.

Loyd and Paxton discovered this 1946 Italianate building some 25 years ago when they established their first antique shop in the same neighborhood. When the building became available a few years ago, they decided to remodel it for their new galleries. They gutted the structure entirely, leaving only the two facades that faced the streets bordering the corner site. Rebuilding the structure allowed the addition of massive amounts of conduit and wiring and the addition of outlets, control panels, light track, and recessed- and burial-type fixtures. Those installations would have been extraordinarily difficult under normal retrofit conditions.

"The first thing we established is that the building would be exactly the same color inside and out. All of the walls, floors, doors, trim, everything is a taupe color — a shade it took 16 tries to perfect," noted Roeder. "So the building works as a backdrop for all of these marvelous works of art. The color rendering index of the light is all the same as well, so that the outside reaches inside, upstairs reaches downstairs. A person going through the space never goes through any color transitions."

The second thing they agreed on was finishing nearly all of the interior ceilings in matte black. "We weren't using the ceilings to reflect light into the rooms as in most situations, because nearly all of the light is being painted onto the objects shown in those spaces." Furthermore, all of the lighting track and fixtures and the recessed fixtures have been painted to match, diminishing their importance. "Everything just disappears, which is good. We want only the furnishings and art to be noticed, not the hardware that's illuminating them."

Three Projects

"We really looked at the building as three different types of projects —

Project: Loyd-Paxton Galleries
Location: Dallas, Texas
Designer: Charles Paxton Gremillion
Lighting Designer: Craig A. Roeder Associates Inc.
Architect: Hendricks and Wall
Clients: Loyd Ray Taylor and Charles Paxton Gremillion

there are numerous things occurring simultaneously on this job: an exterior project, the galleries, and the residence upstairs." The exterior illumination presented some formidable challenges. The clients wanted strong lighting for retail identification, drama, and excitement, and flexibility for "special occasion" lighting. City ordinance prohibited any kind of pole lighting, and the building stood 0 to 10 feet from the city property line. The owners requested incandescent fixtures to keep the color rendering of the interior and exterior of the building the same.

At ground level, Roeder used custom-designed flush burial uplights with 3-inch-deep matte black internal louvers. "The louver is important because the light tends to glare into the eyes of pedestrians. We're using the louver to direct the light away from their eyes and onto the building. We worked with the manufacturer of the burial unit to get the louver on the inside because I always find that if you put it on the outside of the fixture, it fills up with debris in about a week or somebody runs over it with a lawn mower. The top of these fixtures is totally flush and allows for maximum ease when cleaning."

On top of the louver is an assembly that allows the installation of colored glass gels for special occasions. At Christmas, the building is bathed in red and green; for a Mexican fiesta, in yellow and red. "Loyd and Paxton are entertaining a level of clientele that has come to expect something special. Needless

to say, they are never disappointed. And the people love it."

Because the exterior lighting fixtures at the ground level had to be located so close to the building, Roeder had them lamped with 250-watt quartz PAR 38 flood lamps for their superior beam spread and light intensity; 150-watt quartz PAR 38 spot lamps are used on the second floor terrace to soften the light for residential use, but still complement the building facade.

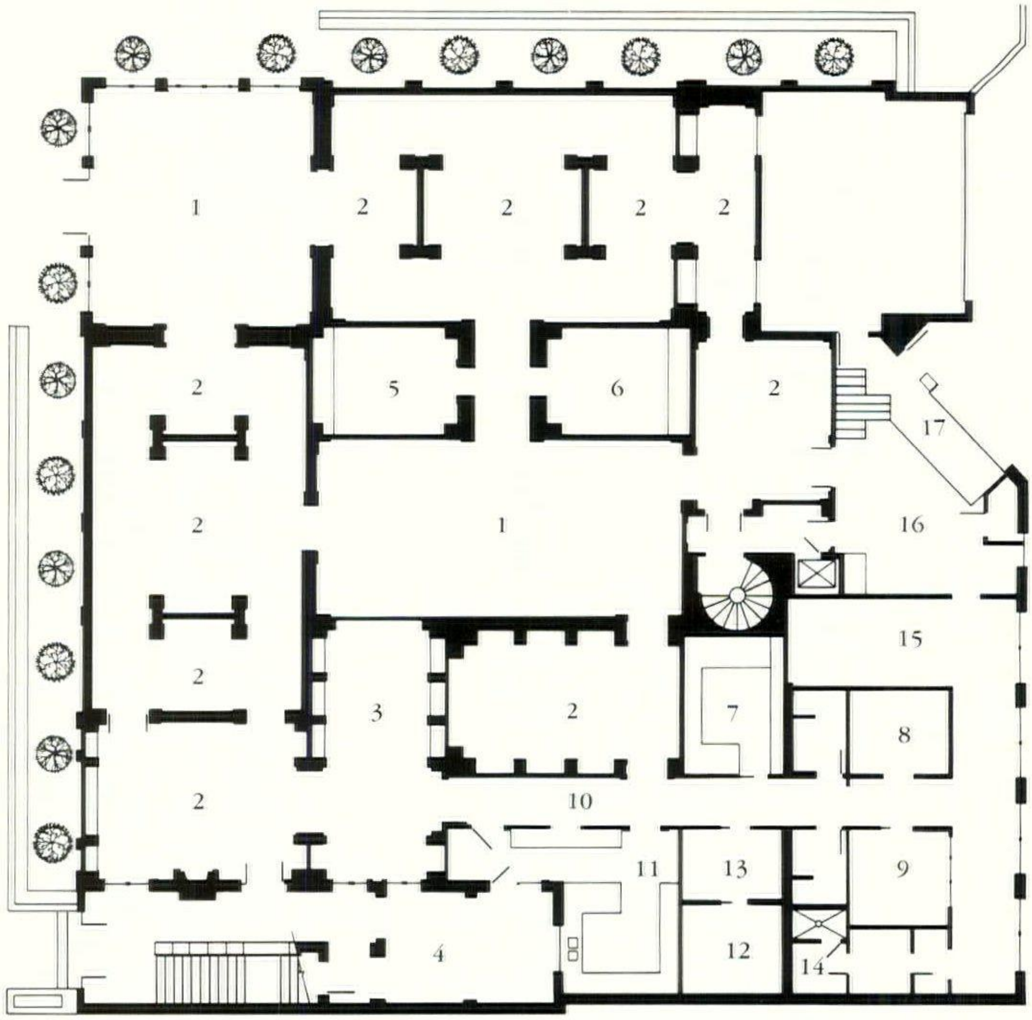
Although the exterior lighting is time-clock controlled through the dimming computer, it is activated automatically by a photocell. From dusk until 10:00 p.m., the lights run at their brightest setting, a mere 50 percent. From 10 p.m. until 2:00 a.m., the lights go through percentage setbacks at two-hour intervals. By 2:00 a.m., the lights have been dimmed to about 15 percent, and they are left at that level until dawn, bathing the entire building in about 1200 watts of light. "It's just the softest glow," says Roeder. For about two hours once a month, the lamps are run at 85 percent to permit activation of their cleaning cycle. These lamps are experiencing 10,000 to 14,000 hours of life.

The Galleries and Operations Area

The Loyd-Paxton Galleries retail art and antiques of such rarity and quality that they would be at home in any museum. They are, as Roeder says, "the best of the best."

Loyd and Paxton felt that the quality of light in the galleries should be the same as it would be in the fine residences of the clientele that purchases such art and antiques. One remains unaware of the light or the architecture in these galleries; one notices the ornate and deeply polished gilt and wooden surfaces of the eighteenth and nineteenth century European furniture, shelves of crystal stemware and decanters, porcelain vases filled with orchids, and glistening sculptures of marble, amethyst, lapis lazuli, brass, and bronze. Nearly every room is graced by at least one antique chandelier; most are executed in rare quartz and amethyst rather than the crystal commonly used today. And everything displayed in these rooms is for sale.

Due to limited depth in the ceilings for recessed fixtures and the frequent need to change the lighting — sometimes daily — as items are sold, high-grade track lighting was chosen to illuminate the galleries. Establishing some common denominators for the average depth of the furniture allowed Roeder to place track lighting on the ceilings in locations that would consistently work well



1: Entry gallery
2: Gallery
3: Conference room
4: First floor courtyard
5: Loyd's office
6: Paxton's office
7: Administration office
8: Operations director
9: Executive director
10: Hallway to operations
11: Kitchen
12: Accounting
13: Ancillary room, copier
14: Staff bath, shower, and dressing room
15: Operations
16: Loading dock
17: Shipping and receiving

in a variety of display situations.

Two rows of track run parallel to each of the four walls of each gallery. Supplemental tracks are mounted in the center of each room or in front of island partitions as required. A two-circuit track is mounted two feet from the wall for 12-volt, 50-watt, very narrow pin spots. Lights on one circuit of this close-in track are used to graze the fronts of ornately carved furniture; lights on the other track are focused on the smaller art objects displayed. These low-voltage lights have self-contained transformers so that 120-volt fixtures can be used on this track if desired.

The second two-circuit track is located four feet from the wall and is used for a combination of 150-watt PAR 38 spot and flood lamps that directly illuminate the horizontal and vertical planes of the objects on display. All of the track lights have been equipped with deep hoods and internal louvers, so that lamps are not visible unless viewed from straight on. With all of the gallery lighting connected to the dimming computer, the lights are rarely brighter than 80 percent of full power.

Part of the first floor area has been dedicated to the day-to-day operation of the galleries: offices, kitchen, shipping and receiving, and operations. These areas have been lit with 2-foot by 2-foot parabolic fluorescent fixtures, fitted with 2900 Kelvin fluorescent lamps that closely resemble the color of the incandescent lamps used throughout the rest of the building. The loading dock has been equipped with a swiveling, long-reach industrial-grade loading dock fixture with a quartz lamp to illuminate the interior of vehicles being unloaded.

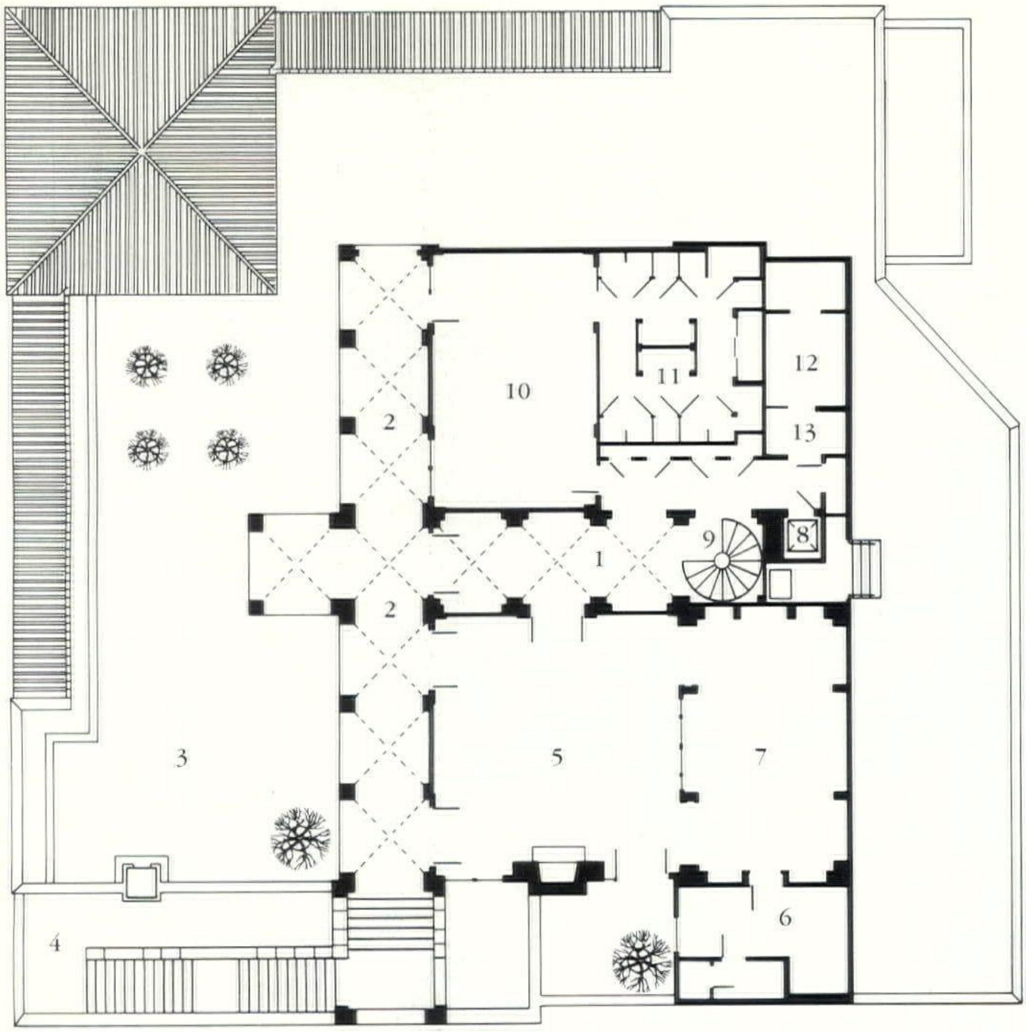
The Residence

Loyd and Paxton express a certain respect for the merging of craft and aesthetics by their selection of only the finest wares for their shop. That expression is grandly reiterated by the furnishings in their private residence, where the influence of the architecture on the rooms has again been minimized.

All of the private interior areas, which include a conference–dining room and the library downstairs and all of the second floor, have been outfitted with recessed low-voltage equipment using a variety of PAR 36 lamps and very narrow spot lamps. "There's a tremendous energy savings in that, and it's also an area where things are not getting moved about that much," commented Roeder, "and I really don't like to do track lighting in any truly fine residence."

Track lighting, however, is much more easily adjusted than recessed lighting. Although recessed lighting is adjustable to about 45 degrees, its position in the room is fixed. There is little room for error in lighting a collection of antiques and art it took two connoisseurs 25 years to assemble; so, Loyd and Paxton spent days planning the placement of each object in these rooms to help Roeder put the lighting exactly where it would be needed. There is no stray light in these rooms; every fixture has been precisely located and aimed to show the art at its best. The lighting system in the residential areas is also controlled through the primary dimming computer.

"Residential lighting requires fewer footcandles than retail or commercial installations. With the use of low voltage, you gain the option of isolating singular objects through carefully defined placement of the lighting," says Roeder.



1: Entry hall
2: Mirador
3: Terrace
4: First floor courtyard
5: Drawing room
6: Guest bath, dressing room
7: Library–guest room
8: Elevator
9: Staircase
10: Principal bedroom
11: Master bath, dressing room
12: Kitchen
13: Wet bar

The Dimming Computer

At the heart of this lighting system is an immense dimming computer. Located in a mechanical room in the rear of the building, it is about the size of four vertical four-drawer filing cabinets and looks like a mainframe computer when its cover is removed. Inside are racks of dimming card controls; 147 in all, each card controls one circuit of eight preset scenes.

Each card is edged with two rows of dimmers, one fitted with eight tiny white variable set-screws and one containing eight tiny red LED displays that vary in intensity with the dimming ratio. Numerous circuit breakers are housed in the same cabinet and are located adjacent to the dimming card racks.

A few rooms and some exterior lighting have no need for the eight-level, preset dimming capabilities, but all of the lighting is controlled by the system, which includes even basic off-on commands. A typical gallery might have 10 circuits on the dimming computer, allowing all of the lights in the room to be dimmed uniformly even though they perform specific, individual functions. Pin spots, for example, provide highlights on a display of crystal.

Although the lights perform separate functions, they are grouped together on a single circuit to ensure uniform dimming. This circuit has been set to eight different levels of light intensity. At the touch of a control panel located in each room, all of the lighting circuits in that room may dim to different levels for each setting, depending on the function of the lights carried by that circuit. In the galleries, two-circuit track was used in many cases to minimize the amount of track required.

In addition, Roeder worked with the manufacturer of the dimming computer to make sure it would provide simultaneous dimming of every circuit in the residential lighting, the gallery lighting, or the exterior lighting from any control station on the premises. Each room also may be dimmed independently by use of its own control panel.

Setting the Light Levels

With such a tremendous range of light levels available, Loyd and Paxton took a close look at the various moods they wanted to establish through manipulating the lighting. They worked with Roeder for weeks setting the light levels for the job. "We used walkie-talkies, one of us monitoring the light levels in the room, the other setting the dimmers. In the gallery we have a daytime setting that is basically 80 percent up and an energy-saving setting that is dimmed to about 70 percent of full power; these are the scenes used most of the time," says Roeder. "They have what we call a 'cocktail party' setting because they entertain clients a great deal in the evening, around four or five o'clock." At that setting, most of the PARs that provide the frontal illumination for displays are dimmed to about 50 percent, and the pin spots that provide highlights are dimmed to about 70 percent.

A night setting pushes the frontal illumination a little lower and the pin spots a little higher, "and the space becomes a little more glamorous and romantic," notes Roeder. "The last setting is called 'good night.' Almost all of the lights are dimmed to 15 percent or 'off,' except for paths of light for the patrolling security guards."

Other dimming circuits in the galleries are used for special occasions and are activated by 12 motion detectors; lights set on certain display "vignettes" rise to

predetermined levels automatically when people walk up to them.

Roeder and his clients worked together for about six weeks setting the eight levels for each of the 147 circuits, so that differences in light levels from room to room are virtually imperceptible to a person casually browsing through the galleries. This also reinforces the concept they established when they decided to paint all of the rooms the same color and to maintain a consistent lamp Kelvin temperature.

"Again, setting the light levels so that you never go through any transitions when you are walking through the space is very important to making this design work — you never want the fact that customers are viewing the antiques and art in an extremely well-calculated atmosphere to be apparent. You don't want them saying, 'Gee, look at this light.' And the more complicated the lighting system is, the more time you're going to have to spend on the job setting the light level, getting it right."

Details

The lighting coves are done with two rows of 24-volt strip lights fitted with incandescent "peanut" lamps. The rows are immediately adjacent to each other and staggered so the lamps are 1 inch on center. Roeder doesn't like to use fluorescent lamps in coves because light fall-off at the ends of the lamps is reflected on the ceiling and because of the cost of the kind of ballasts required to achieve good dimming at the very lowest light levels. The color temperature of the incandescents also better matches the other lamp sources used throughout the building.

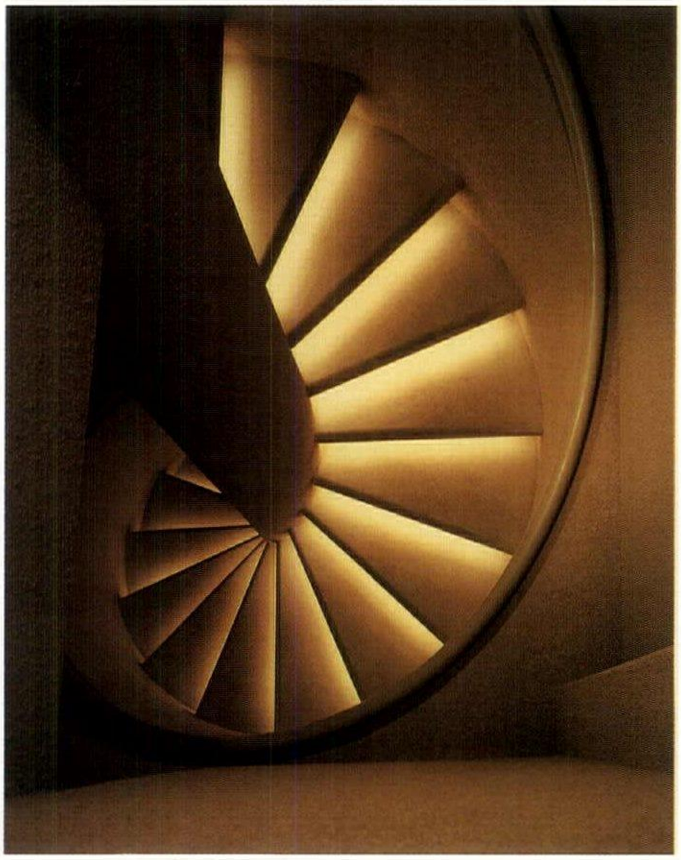
Lighting of the spiral staircase steps is accomplished in a similar manner, with only one row of 24-volt lamps per step. The recess for the light strip is formed by a 1-inch by 1-inch slot cut in the underside of each cast-stone tread immediately in front of each riser. Concealed inside the stair's center column at the top is a theatrical projector that projects a pattern onto the domed ceiling over the stair shaft.

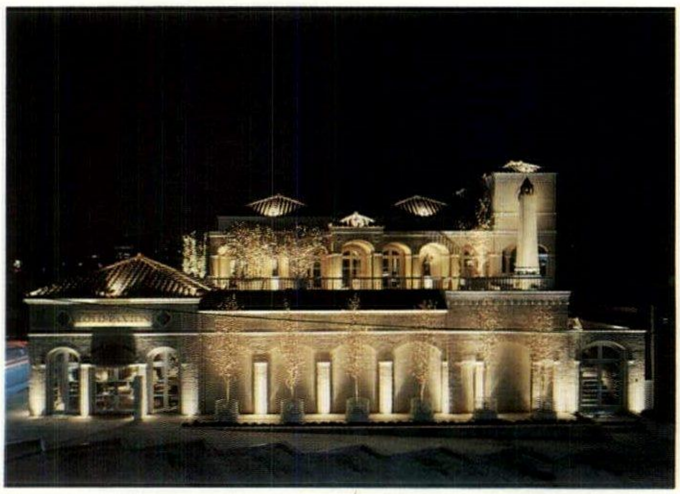
Lighting for the 1/2-inch glass display shelves was accomplished using this same 24-volt light strip, incorporated in a custom 2-inch chrome strip that runs along the front of the shelves. These light strips draw power through the shelf standards at the sides of each display case, so that there is no exposed wiring; they are also controlled through the dimming computer.

In all applications of this 24-volt light strip, the lamp sockets have been designed to swivel for easy lamp removal and replacement. As the strips are dimmed most of the time, lamp life has been greatly extended, and, according to Paxton, fewer than a dozen of the lamps have been replaced in the last year and a half. "That makes it a very successful detail when you consider


QUALITY TO

there are something like 2500 of those lamps on this job," says Roeder.





Lamp, Aim, and Tune

"In order to pick the right combination of lamps, we really did some extensive lab work," says Roeder. "We started lamping with some of the new energy-saving PARs, but we found that they didn't have the beam spread we were looking for. The claims that these lamps generate footcandles equivalent to their predecessors are true, but they have a narrower beam spread. We basically tried out every lamp on the market — but when you get a three-foot circle of light on the wall instead of the five-foot circle you're expecting, and that's how you're saving the watts, it means if you're going to light up a tapestry that's 20 feet long and 10 feet high, you've got to put in more fixtures. Not only that, but the lamps may alter the photometrics you're expecting out of a given fixture."

Roeder wound up using fairly traditional lamps, 150-watt PAR 38 floods and spots. "We're saving the energy on this job and extending the lamp life tremendously through the dimming computer. There are over 5500 lamps in the building. They're only changing two or three a week."

Choosing the right lamp for a given purpose, adjusting the dimming computer, and directing and focusing a fixture on an object — a process Roeder calls "aim and tune" — never ends in an environment that changes as often as the galleries do. Recognizing the importance of this process, Loyd and Paxton have a member of Roeder's staff visit the galleries about twice a month to aim and tune any fixtures that are not directed appropriately.

Lamps that have gone out are noted by Loyd-Paxton's staff on work sheets that Roeder has provided; this eases the job of locating them for replacement. "Maintaining a project of this complexity is so important. Otherwise a lot of the work is wasted."

In the end it appears that Craig Roeder has quite nearly accomplished Charles Paxton Gremillion's original directive — to design the optimum lighting system, at least for this application. Examination of the design process and the final product makes it clear that this was accomplished through a remarkable collaboration between client and lighting designer.

Loyd and Paxton were well-informed clients. They engaged Roeder early on in the project, solicited his input on an enormous range of design decisions, welcomed the use of state-of-the-art technology, and took responsibility for planning spaces so that placement of lighting would not be arbitrary. As in all "optimum" design, client involvement made this project a success. ■

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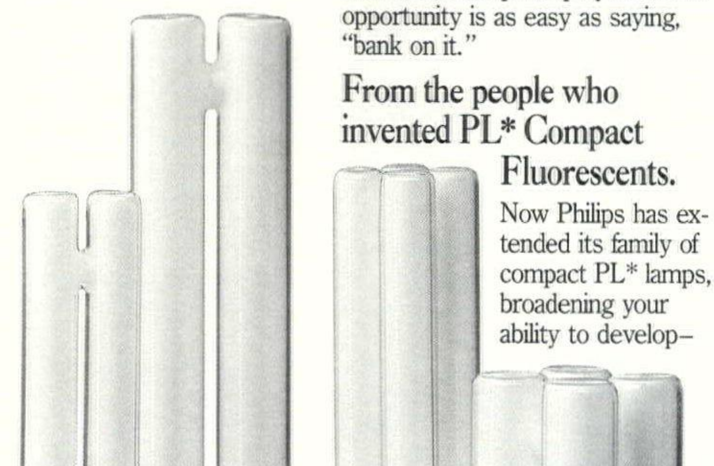

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The glow of a neon 'sky' lights a Seattle banking hall

Jeffrey I.L. Miller, IALD

Jeff Miller is vice president of Lightsource Inc., Seattle, Washington.

The midrise headquarters building of a major regional financial institution is located on a highly visible downtown corner in Seattle's central business district. Many of the neighboring structures are long-established citywide favorites; others are new or refurbished. The architectural intent for the building was to use elements and materials seen in the surrounding facades to weave the new structure into the surrounding cityscape. The curved glass corner reflects the shape of a historic theatre diagonally across the street. The three types of marble used in the facade were chosen to echo those found on adjacent buildings. The theme continues inside the banking hall and lobby, where the grid pattern used is reminiscent of downtown Seattle.

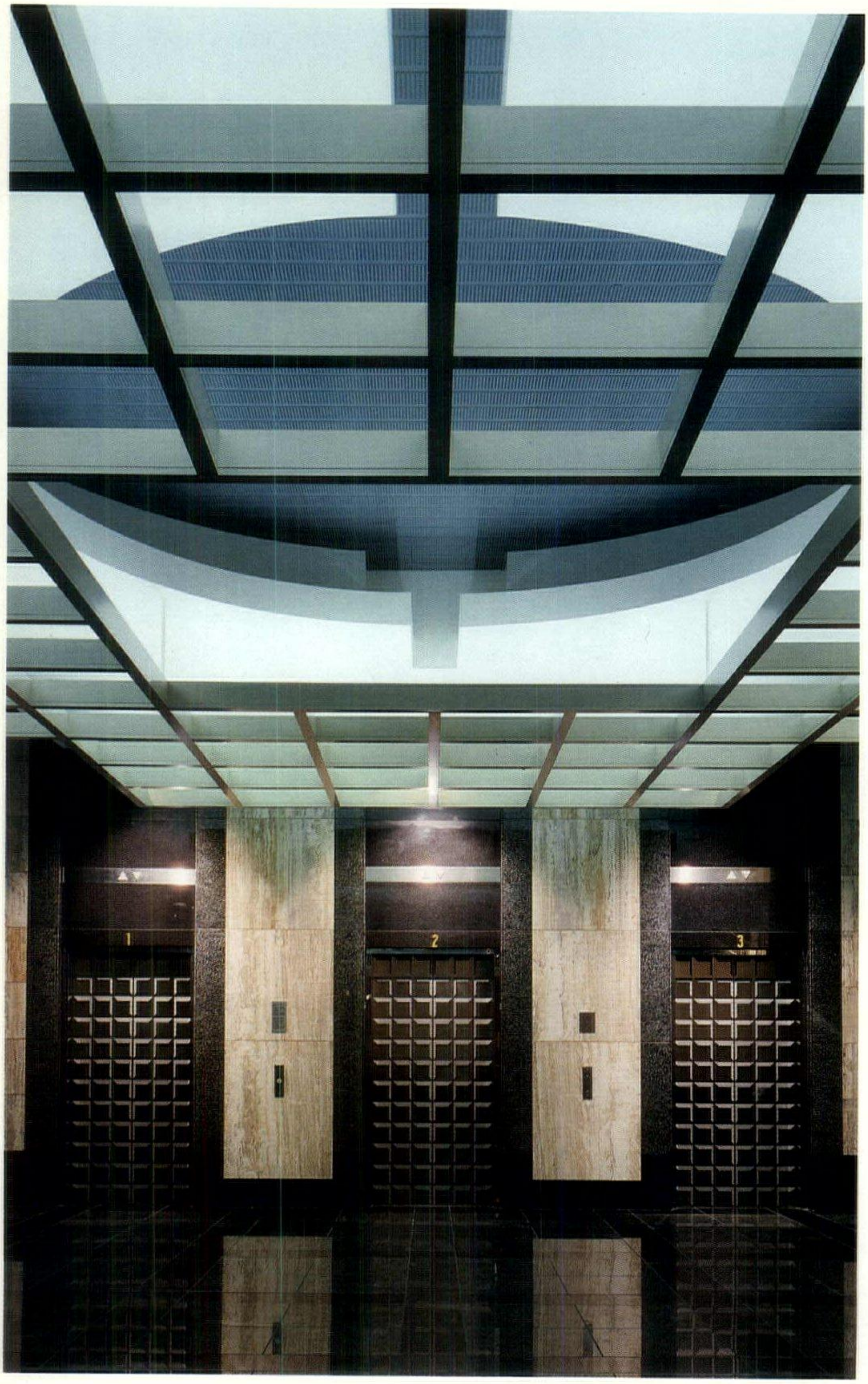
Design discussions for the banking hall took into account themes and patterns already established for the building as well as the natural lighting contributions of the local microclimate. Neon lamps for the grid were selected to maintain reasonable visual scale of each member and to guarantee a uniform light pattern on the ceiling "cloud." Indirect lighting was recommended in the form of a suspended ceiling grid positioned to provide indirect illumination to the space.

Computer analysis validated the design team's recommendation to use neon rather than fluorescent tubing as the light source. Because the design team believed that any tubular light source would yield much the same light dispersion pattern as any other, the initial calculations used photometrics established for an extrusion-type fluorescent fixture. To produce an accurate simulation, the team applied a reduction factor to these calculations based on the known light output of the selected neon. The computer analysis clearly showed that the light provided by the neon tubing would be more than adequate.

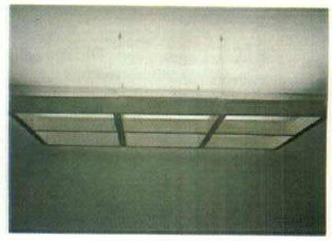
This approach allowed the use of a small-scale extrusion and, because neon tubing can be bent, produced continuous light with no dark spots. Unlike fluorescent sources, with fixed dimensions, neon can be bent to eliminate shadowing problems in corners or at the intersections in a grid arrangement.

Once satisfied with the computer analysis and the resulting refinement of the luminaire design, the

Project: Banking Hall
Location: Seattle, Washington
Client: Washington Federal Savings and Loan
Lighting Designer: Lightsource, Inc., Seattle; Jeffrey I.L. Miller, principal; Mary Claire Frazier, project manager
Architect: TRA, Seattle
Electrical Engineer: TRA, Seattle
Photos: Chris Eden



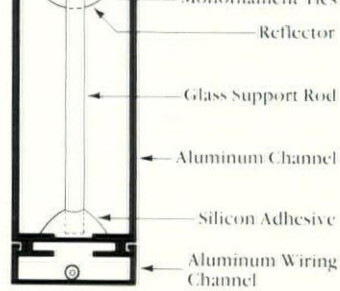
team constructed a plywood mock-up to test the theory. A gridlike housing structure was fitted with neon and suspended below a reflecting plane. As anticipated, the mock-up verified the validity of the conclusions based on the computer analysis and satisfied the clients that the unconventional approach would work.



LIGHTSOURCE

Mock-up of the gridlike housing structure.

The actual 2-foot, 6-inch square grid was formed from an aluminum extrusion especially designed for shape and minimal scale. The extrusion was carefully detailed; each branch was designed to accommodate a single neon tube along with the necessary connectors and wiring. The neon tubes were exactingly engineered to work within the tight confines of the custom extrusion, with precise bends at corners and intersections to eliminate dark spots. Hollow tube structural supports suspend the grid assembly and create a unified look. At the same time, they provide a readily available means of feeding power to the neon tubes



Section through grid.

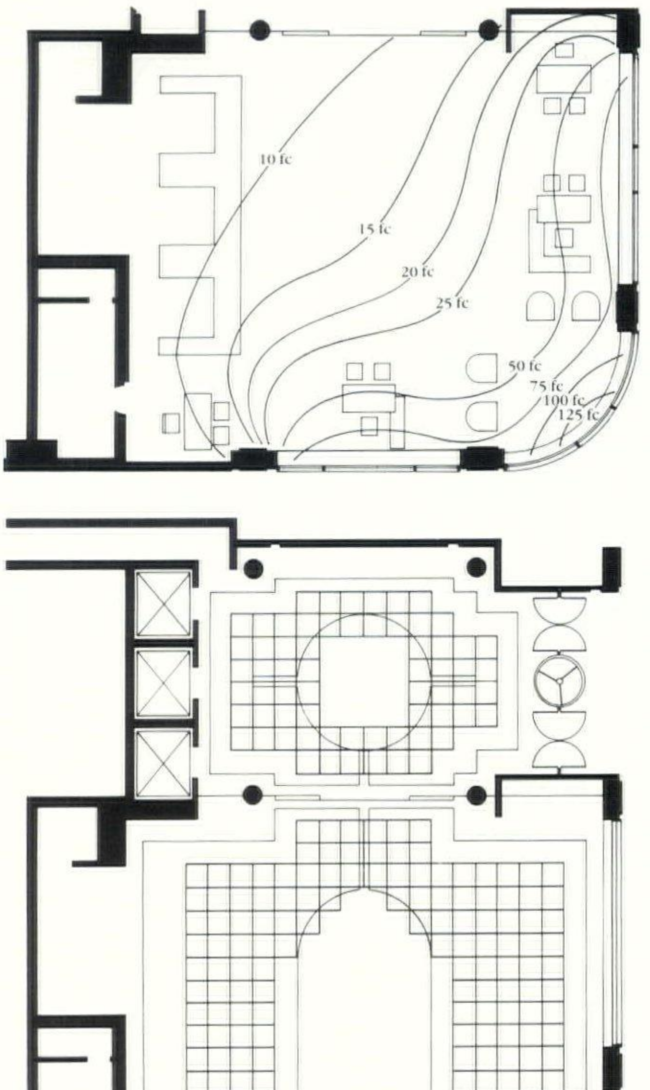
from the hidden remote transformers. The same type of lighting structure has been adapted to light other public areas, such as elevator lobbies, throughout the building.

Once assembled, the lighting grid was suspended from a smooth, white reflecting plane, or "cloud," hung below the darker textured ceiling. The 4500-degree white, 15-millimeter, 60-milliampere tubing, filled with argon, produces a soft, uniform, cool light. Its high color temperature mates well with incoming daylight.

The reflecting "cloud" both mimics the famed overcast Northwest sky and provides a pleasant background to incandescent task and accent lighting along the perimeter of the hall. Playing strong directional light against the diffuse ambient lighting also creates contrasts in texture. These contrasts in the lighting plan echo the variety of interior finishes, which include warm wood paneling and wall-hung canvas sculpture as well as dark, cool marble and stainless steel.

Design studies showed substantial daylight entering the space through the continuous full-height window wall that wraps the curved north corner and northeast and northwest sides of the banking hall. Although the typical Northwest sky tends to be overcast much of the time, computer analysis and model study demonstrated significant sky brightness contribution throughout the operating hours. With this in mind, the design team developed a complementary electric lighting system that provides comfortable, balanced, glare-free lighting throughout the space while avoiding wasteful light levels and redundant lighting.

Because it is judiciously placed, the extensive grid-mounted neon lighting system extends its cool ambient light evenly throughout the space; its power consumption falls well within the lighting power allotment prescribed by the Seattle Energy Code. Thus, good lighting is accomplished with minimal energy usage. Careful analysis combined with innovative uses of available lighting technology produced a lighting system that is both energy efficient and sympathetic to the architecture. ■



Isofootcandle contours show the illumination contribution of daylight from a typical overcast Seattle sky through the full-height window wall. The reflected ceiling plan shows the layout of the neon grid.

LIGHTSOURCE

Curved glass reflects the theatre front it faces diagonally.

Daylighting can improve the quality of light — and save energy

Charles C. Benton

Cris Benton is an assistant professor of architecture at the Berkeley campus of the University of California and a faculty research associate with the Center for Building Science at the Lawrence Berkeley Laboratory. Much of his article is based on research conducted by the windows and daylighting group at that laboratory in programs sponsored by the U.S. Department of Energy and others.

The rapid escalation of fuel prices during the 1970s exerted new pressures on the professionals who design buildings. Awareness of fuel as a precious commodity led to efforts to reduce energy consumption. In both research and practice, early efforts were directed toward increasing efficiencies in the thermal performance of buildings. Professionals researched issues related to active and passive solar systems and improvements in HVAC system performance.

In the 1980s, lighting, which accounts for 30 percent to 50 percent of the energy consumed in office buildings, has become a topic of interest in energy conservation. Early attempts to improve lighting performance involved delamping fixtures and reducing illuminance levels. It also seemed that every energy improvement checklist recommended using daylight but provided little guidance. Substantial interest has developed in daylighting as an energy conservation strategy and as a means of deferring the expansion of electrical generating capacity. Qualitative gains can also be made.

System Design

In passive solar design, the building envelope is insulated to relatively high efficiencies; as the building envelope efficiency increases, the solar heating system's load becomes smaller. Some passive heating schemes have dropped the solar component altogether and rely solely on superinsulated envelopes to protect the house from a harsh winter.

An analogous situation exists for daylighting schemes. Supplemental electric lighting systems should be relatively efficient and include effective controls. As an electrical lighting system becomes more efficient, the operating savings available from substituting daylight for electrical light are reduced. Although this increases the amount of time required to pay back investments in a daylighting system, adequate economic incentives usually exist for including daylighting. Efficient approaches to the supplemental electric lighting system design include the following:

☐ *Efficient lighting hardware.* Existing lighting conservation technologies permit lighting power densities in offices as low as 1 watt per square foot. Current fluorescent lamps and ballast systems have a combined efficiency of 50 to 70 lumens per watt; most common 4-foot units average 60 lumens per watt. Electronic ballasts, improved phosphors, narrow lamp tubes, and higher output fixtures can boost fluorescent system efficacies into the 100 lumens per watt range. The high pressure sodium and other high intensity discharge (HID) light sources have also been specified for office environments despite their poor color rendition properties.

☐ *Improved design practices.* As installed lighting power densities decrease, effective lighting design becomes critical to achieve acceptable lighting environments. For instance, differentiating between task lighting and ambient lighting is an effective design strategy for reducing electric lighting levels.

☐ *Improved operation and maintenance.* As is true for HVAC systems, even the best system design and hardware will function poorly in the absence of good management. When dealing with high-efficiency lighting systems, operation schedules and maintenance become critical factors.

☐ *Integration with daylighting.* Even the most effective strategy to daylight a building interior will fail to save energy if the electric lights are left on. The proper integration of electrical and daylighting systems poses interesting and challenging issues. A designer must decide to what extent the user can provide effective lighting management and establish a system that captures the maximum possible benefit from interior daylight.

With a commitment to an effective electrical lighting system, the designer can attend to the elements of the daylighting system. Several major issues must be considered in the course of this task. The designer must identify the building design strategy that will admit daylight into a building's interior. The process should include analysis to evaluate the trade-offs between thermal and luminous energy gains. It is important in the early stages of design to identify methods for control of the system, especially the control of solar gain to minimize adverse thermal impacts and the control of electric lighting systems to claim the energy savings made possible by daylighting.

Daylighting techniques encompass the use of diffuse light from the sky (daylight), direct beam radiation from the sun (sunlight), and reflected light from surrounding surfaces. Two major categories of schemes to admit light into buildings are sidelighting and toplighting. Sidelighting uses natural light transmitted through vertical building surfaces, the windows common to single and multistory buildings. Toplighting uses skylights — usually in the form of horizontal apertures or vertical roof monitors — to admit light from above into an interior. Toplighting is characteristically limited to structures of one or two stories. Another relatively small category of daylighting is the rather esoteric use of optical systems to transmit beam daylight into deep interior spaces. Each approach has its merits, and each receives attention in today's daylighting designs.

Sidelighting

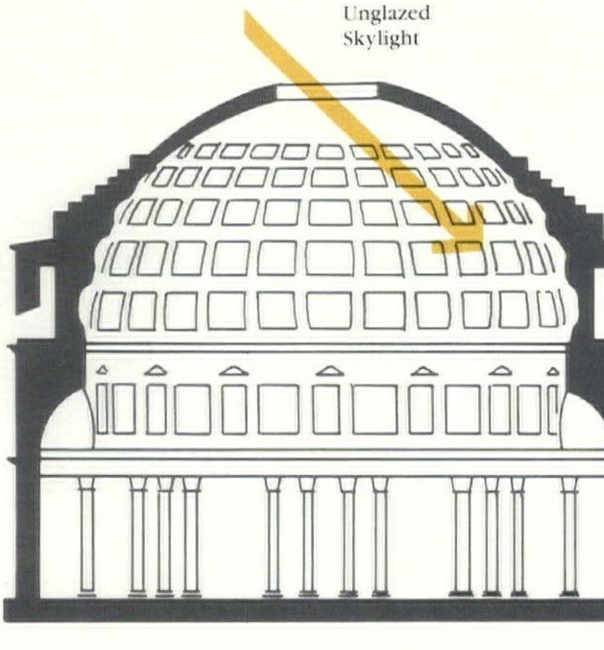
The most widely applied daylighting strategy requires elements already common to perimeter zone offices. Sidelighting approaches can be divided into two categories: lighting perimeter zones adjacent to vertical glazing and distributing sidelighting into interior zones remote from the exterior glass. A rule of thumb developed for diffuse daylight is that useful daylight penetration rarely exceeds 2 to 3 times the height of vertical glazing.

Using this guideline, perimeter zone daylighting is limited to depths of 20–25 feet for buildings with conventional ceiling heights. Daylighting within these limits can be accomplished using relatively conventional window designs that rely on the diffuse component of daylight as a source and specifically exclude direct beam solar radiation. Daylight penetration deeper than 25 feet, however, typically requires the use of beam sunlight and a reliable means of directing it toward the interior of the building. Systems that control direct sunlight, whether composed of architectural or optical elements, are particularly sensitive to the position of the sun and thus to window orientation, hours of use, and time of year.

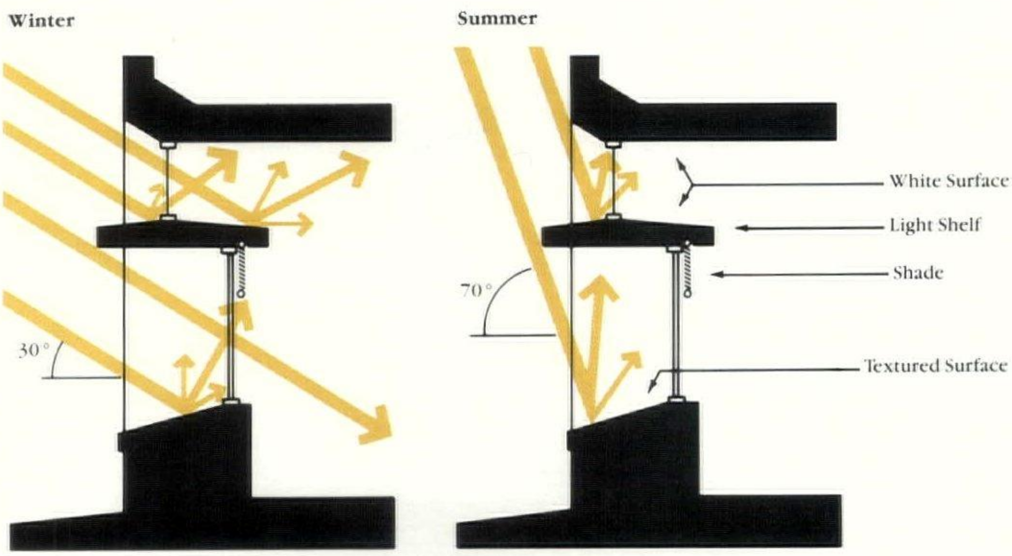
The greatest opportunities for sidelighting exist in easily lit exterior zones. As in discussions of thermal performance, the exterior zone of a building is taken to be areas within 13–20 feet of the exterior wall. Within these limits, it should be possible to provide daylighting at a level of 500 lux for 70–90 percent of daytime operating hours — depending on climate and orientation. In fact, it is relatively easy to provide daylight levels that exceed the nominal 500 lux typical of office lighting design. Excessive daylight levels, however, frequently introduce unnecessary cooling loads and suggest a shortcoming in system design or control.

Although daylighting the perimeter zone is easily accomplished with conventional building elements, a survey of contemporary U.S. office buildings would reveal few effective daylighting applications. Current design practices exclude the electric lighting control systems necessary to realize savings from available daylight. The control of solar gain and glare commonly relies on low-transmission glazing, which also rejects daylight. Small changes in design attitude could produce large daylight benefits.

To introduce daylight beyond the 20-foot perimeter zone boundary requires a different type of design. Apertures for deep penetration systems are typically large and feature a provision for reflecting beam sunlight. The use of direct sunlight challenges designers to allow deep light penetration while simultaneously controlling glare. Reliance on low-transmission glazing, while it controls solar gain and glare, also rejects useful daylight.



Rome's Pantheon is a venerable example of toplighting.



Light shelves can bounce sunlight deep into a building. Under cloudy sky conditions, daylight may not meet task lighting needs, yet provide adequate ambient light.

Most techniques for deeper sidelighting involve architectural manipulation to raise the height of the window head and ceiling. The increased window height provides larger glazed areas and a higher daylighting source. While that provides more daylight penetration, it also exposes occupants near the window to higher levels of glare (the upper sky) and direct sunlight. In short, the larger window admits too much light to the zone immediately adjacent to the exterior wall. A daylighting system would ideally displace the unneeded perimeter light flux to locations deeper within the building.

One architectural approach to achieving this objective is the use of a horizontal light reflecting and shading element between the upper and lower portions of glazing. Such an element, a light shelf, is typically located 7 to 8 feet above the floor with 2 feet or more of clear glazing above it. The upper surface of the shelf is finished as a diffuse or specular reflector and bounces daylight deeper into the space. The shelf also serves the area below it as a shading device and delimiter of space. This exterior zone will usually have some type of glare control for the lower-level vision glazing.

Light shelves have gained popularity because of their apparent simplicity. In fact, many light shelf schemes fail to raise light levels in the deep interior by dramatic increments. They do, however, perform valuable services: leveling the interior light gradient, reducing glare from the exterior window, and providing solar control. As a rule, sidelighting the deeper interior zones is somewhat less dependable than daylighting applications in the perimeter areas. The light-shelf scheme requires beam sunlight for effective performance at higher interior illuminance levels. Under cloudy, diffuse conditions, daylight may be inadequate for task illuminance but still perform admirably as a source of ambient light.

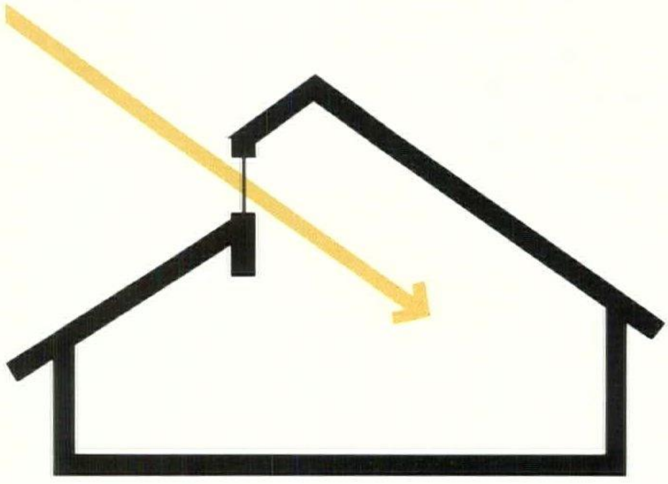
Toplighting

Rome's Pantheon illustrates toplighting, a venerable strategy for the admission of daylight. The admission of daylight through the roof plane is appropriate for single-story buildings and the top floors of multistory structures. Toplighting systems occasionally are used to light more than one floor level, which is possible when the upper floors have openings that allow light to filter through. Sidelighting's spatial relationships limit the penetration of natural light, but toplit spaces can rely entirely on daylight.

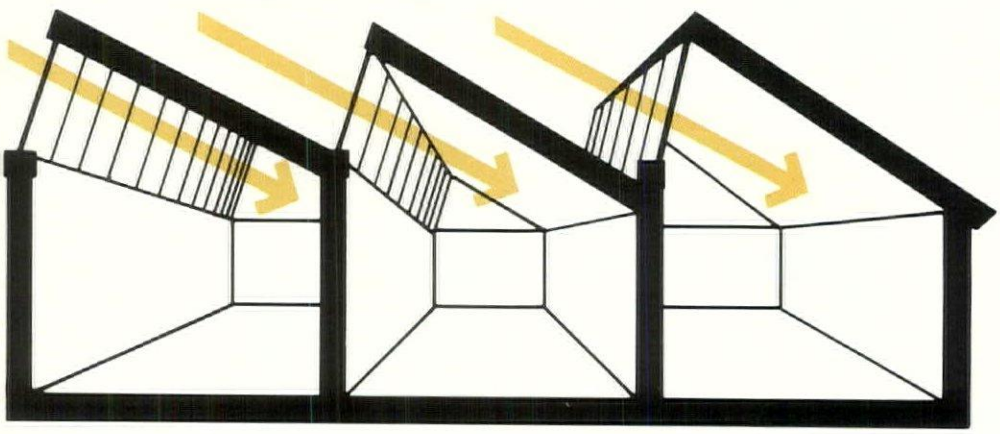
Daylighting systems in the roof plane may use flat or bubble glazing in a horizontal plane or a roof monitor with vertical or sloped glazing. Although most modern skylights adopt a horizontal plane configuration, it is the least desirable of the two. The fundamental difficulty with the horizontal glazing is the way in which it receives solar radiation. Heat gains peak in the summer, and represent a major cooling liability, but winter heat gains are relatively low. Nevertheless, horizontal glazing remains popular because skylights are available as manufactured, single-unit components that are relatively inexpensive and easy to install.

Recent developments in the use of horizontal apertures for daylight include the use of fabric roofs and the development of reflecting devices that enhance skylight performance. The reflector scheme involves the placement of a specularly reflecting surface to the north of a horizontal skylight to increase its apparent aperture and redirect beam sunlight. In some cases the reflector is mounted on a motorized carriage and serves as a single axis tracking system. Fabric roofs have been used on a number of structures, most of which are athletic facilities; a low-transmission translucent fabric forms a major area of the structure's roof. Both fabric roofs and reflecting devices are subject to the adverse heat gain problem.

Roof monitors were once common in the architectural vocabulary; they can be found in some diversity on older warehouses and industrial buildings. Usually associated with high ceiling heights, roof monitors provided excellent control of incident daylight in these older buildings and provided openings for natural ventilation. As a rule, the better examples of roof monitors excluded most direct radiation, a function of glazing orientation and geometry. North-facing monitors admit diffuse light, but very little solar heat; southern orientations provide diffuse light, beam sunlight, and winter heat.



Southern-oriented roof monitors diffuse and direct light into the interior spaces and provide winter heat. High ceilings allow openings for natural ventilation.



Roof monitors were once used much more frequently than they now are. The better examples of roof monitors excluded most direct radiation, a function of glazing orientation and geometry.

Advanced Beam Daylighting

Recent speculation about the use of optical control systems that direct beam daylight deep into building interiors revives an interest reflected in the patent literature of the early 1900s. Typical optical systems require three elements.

☐ A collection system gathers the available light flux and, in many cases, concentrates it.

☐ An optical path into the building transmits the light flux to points of use.

☐ A control device diffuses and distributes daylight at the point of use in a way that is consistent with occupants' requirements.

Collection systems typically involve the use of tracking reflectors that rely on a double-axis polar configuration or a simpler altitude-azimuth geometry. More speculative options considered in recent research include holographic coatings and fluorescent concentrators. Transmission systems include lens guide systems, hollow internally reflective light guides, and fiber optics.

Lens transmission systems suffer from relatively high transmission losses and heat buildup at the lenses. As high reflectivity coatings improve, the performance of hollow light guides will appear more attractive. With surface coatings of 95 percent reflectivity, a hollow light guide can transmit light 50 feet with less than 50 percent loss. Difficulties with solid transmitters hinge on the choice of the small cross-sectional area available with a fiber optic solution or the large physical size of a less efficient alternative.

Clearly, the successful integration of daylight into buildings requires design analysis beyond the floor plan. Critical to such success are building location, thermal analysis, orientation, and carefully considered fenestration arrangements. Part two of this article examines some of the analysis procedures available to practicing designers. ■

Lighting control technology grows in importance

Randal E. Swiech, PE

Randal Swiech, PE, is vice president and director of electrical engineering with Smith, Hinchman & Grylls Associates, Inc., Detroit, Michigan.

Lighting control systems are becoming increasingly important as lighting designers strive to minimize the energy usage and increase the flexibility of their lighting designs. Fortunately, in recent years lighting control technology has both advanced greatly and become more affordable. The first part of this two-part article moves from fundamentals of control to recent developments in lighting control systems.

Essentially, two major criteria guide the choice of lighting control. First, and most common, is a desire or need to optimize the lighting system's energy use. In the past, energy conservation in lighting design was mostly limited to attempts to reduce the watts consumed per square foot by using power-efficient equipment and by reducing lighting levels to the lowest permissible values. These two approaches to energy conservation, however, are not the whole answer.

It is important to note that watts-per-square-foot refers to power, not energy, and that a power-efficient lighting system does not necessarily save energy. Even a power-efficient lighting system can waste energy if it is left on needlessly. In addition, lighting designers can reduce illumination levels only so far for the sake of energy conservation. Low-level and power-efficient lighting systems will save energy, but significantly more energy can be saved by controlling the lighting system so that it is on only when needed. In recognition of this fact, many energy codes are beginning to require that certain minimum control methods be a part of any lighting design.

Another major reason for lighting control is to permit quick modification when a space is used for different functions. A conference room, for example, requires one type of lighting environment for general meeting activities and a different one for an audiovisual presentation.

Elements of Control Systems

There are three major elements in any lighting control system: the controller, the sensor, and the communication system between the controller and the sensor.

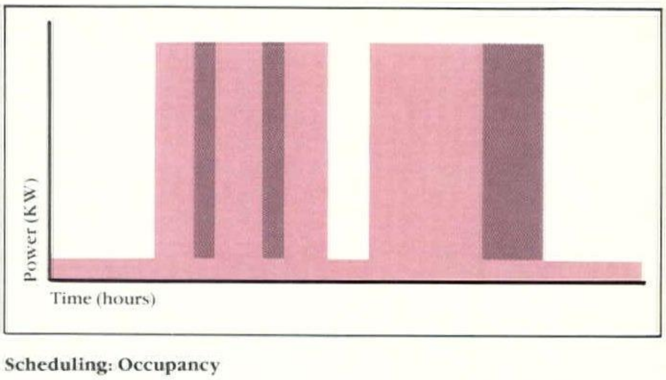
Controllers change the voltage delivered to the lighting system, changing the system's power input and lighting output. A controller may be a simple on-off device or may consist of more complex devices that modify the voltage wave form.

Sensors are used to determine the need for illumination. There are many different forms of sensors: photoelectric devices sense the light level in a space; timers and time clocks sense the passage of time; personnel sensors sense the presence of occupants in a space.

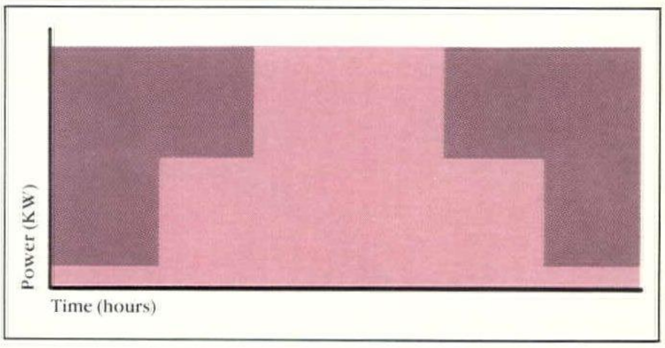
Finally, every control system must have a means of communication between the sensor and controller. This communication can be carried through low-voltage wiring, fiber optic cabling, or through a building's power wiring system.

Strategies for Lighting Control

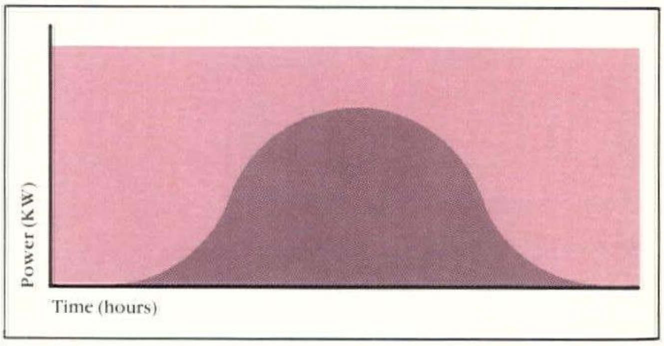
Some of the many different control strategies apply to new lighting control equipment discussed later in this article. One of the most common strategies is to develop a schedule of lighting needs based on time, a strategy that calls for activating the system only when lighting is needed. This is appropriate when the majority of occupants who use a facility arrive and leave together at set times. The shaded area on the time graph shows this strategy's potential for energy savings.



Scheduling: Occupancy



Scheduling: Time



Daylighting

Another strategy is based upon the assumption that lighting is required whenever a space is occupied. The lighting system directly senses the presence of occupants and activates lighting. When the space is not occupied, it is assumed that no lighting is required, and the lighting system is turned off. This type of control strategy is appropriate when the use of spaces is unpredictable and intermittent.

Designs that maximize daylighting achieve energy savings by varying the amount of artificial lighting in response to the amount of daylighting present. The shaded area on the daylighting graph shows the energy savings possible during periods of strong daylighting when the electrical lighting system is dimmed or turned off.

The lumen maintenance control strategy calls for dimming a lighting system during its initial years. All lighting systems are designed to provide maintained footcandles;

so, until light loss factors take effect, light levels are higher than needed. With this strategy, the power delivered to the lighting system is gradually increased as light loss factors take effect.

Power Conditioners

Electric power conditioners are devices that change the voltage wave form applied to a lamp or its ballast. By electronically modifying the voltage wave form, and thus the power, power conditioners modify the light output of a system.

Solid-State Dimmers. In addition to existing power conditioners for dimming incandescent and fluorescent lights, power conditioners have been developed to dim high intensity discharge (HID) lamps, such as metal halide and high-pressure sodium lamps. They are now available in many sizes, from low-wattage wall-mounted units to large 4000-watt systems.

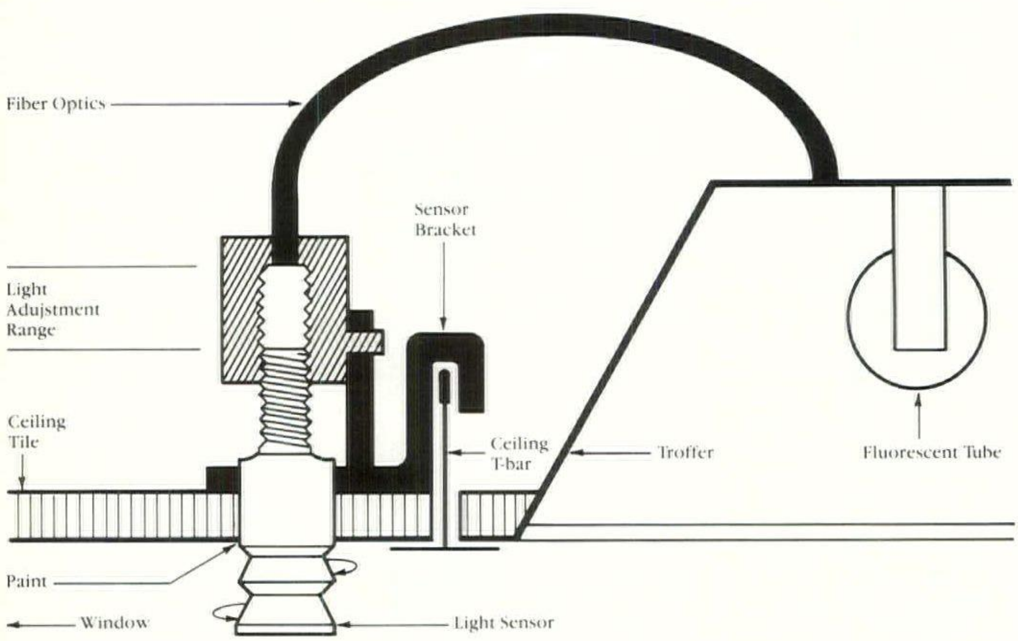
Low-Voltage Incandescent. Another recent development in power conditioners is dimmers for low-voltage incandescent lighting designed to vary the light output of low-voltage incandescent lamps from 0 percent to 100 percent without overheating the low-voltage transformer. These dimmers are also designed to withstand the overvoltage transients caused by the switching of low-voltage incandescent lights.

Neon. Dimmers are available for neon and cold cathode lighting. They can dim neon to 3 percent of full light output, yet ensure that the lamp arc strikes at any setting. These new dimmers also are designed to prevent overheating of the neon transformer during operation.

Fixture. Fixture power conditioners are wired directly ahead of the fluorescent ballast to be controlled and are small enough to mount on fixtures. They can dim standard fluorescent ballasts and lamps, making them ideal for retrofit applications. The unique feature of this system, however, is its use with a photosensor.

Photosensor. The ceiling-mounted photosensor can be manually adjusted to maintain different lighting levels in the space. It has no active electronic parts. Instead, light level information is conveyed through a fiber optic cable to logic circuitry in the conditioner. The power conditioner then modulates the electrical lighting to maintain the desired lighting level.

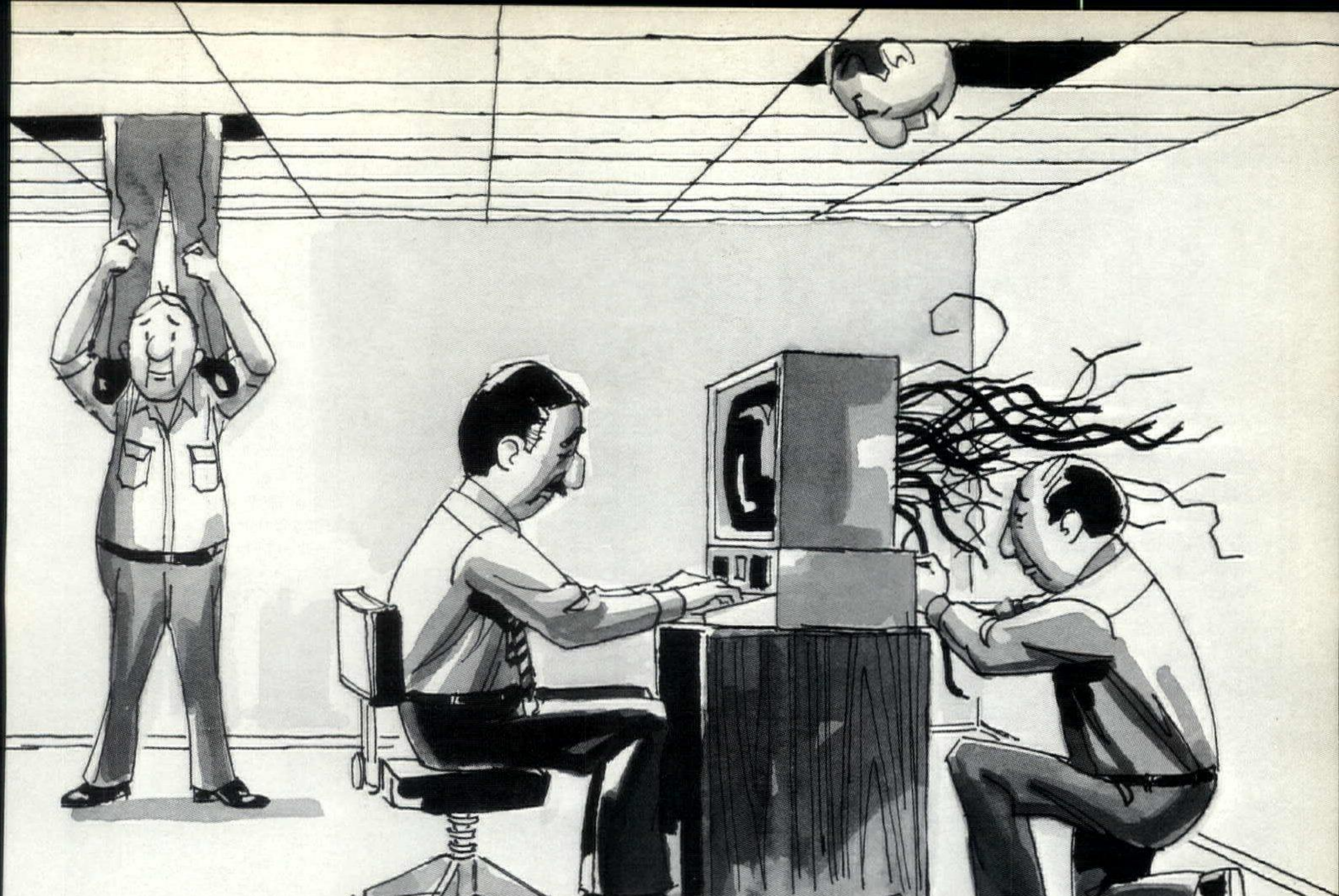
The manufacturer also offers high wattage units to control more than one ballast; they can operate from a single sensor. This system is suitable for automatic control strategies, such as daylighting compensation and lumen maintenance. Also, because the photosensor can be manually adjusted to maintain any desired illumination level, this system can be used to tune illumination levels to the specific needs of an individual or space.



Controllable Ballast. Controllable ballasts, another recently developed lighting control technology, are solid-state electronic ballasts that provide a variable power output relative to a low-power control signal input. Typically, they produce a high-frequency output in the range of 20–25 kilohertz (kHz), frequencies at which fluorescent lamps operate more efficiently, producing approximately 20 percent more light output for the same power input. The dimming range for controllable ballasts usually exceeds that obtained in power conditioners; some fluorescent-type systems dim to as low as 1 percent of full light output.

One advantage of these ballasts, which can easily be installed within most lighting fixtures, is that their high-frequency output is in the inaudible range, resulting in a very quiet operation. Some manufacturers provide a manual adjustment right on the ballast housing for setting the power and, therefore, the lighting output. Typically, however, the ballasts are manually adjusted from remotely located control stations. Only a potentiometer is needed to provide lighting level control information to the ballast, so control stations can be of a very simple design. For automatic control, controllable ballasts can be connected to a photosensor and used to maintain a preset illumination level under either a daylighting or a lumen maintenance control strategy.

Part II of this article, to be published in January, includes discussions of programmable controllers, power-line carriers, and infrared and ultrasound sensors. ■



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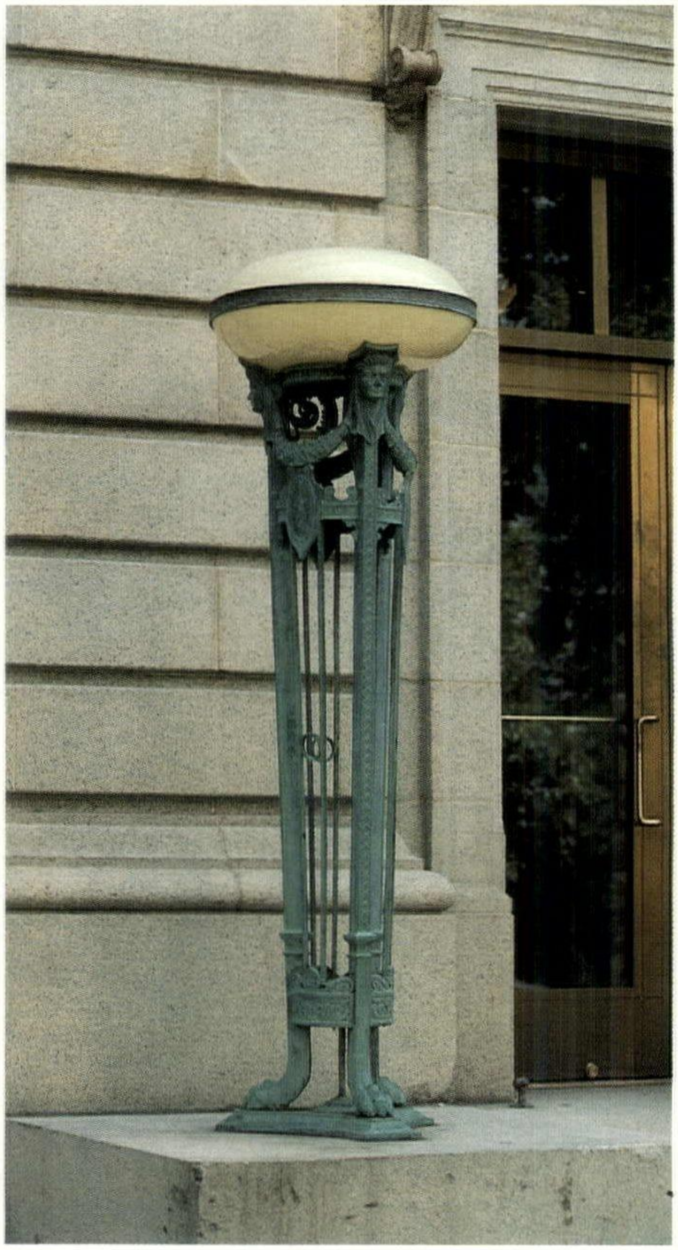
Richard R. Heinemeyer

Richard Heinemeyer is a practicing architect and free-lance writer in Denver, Colorado.

During its heyday in the early 1900s, the Sechrist Manufacturing Company plant in Denver shipped custom lighting fixtures to 40 of the 48 states. It competed successfully with manufacturers in New York and Philadelphia and had accounts as far away as Sydney, Australia.

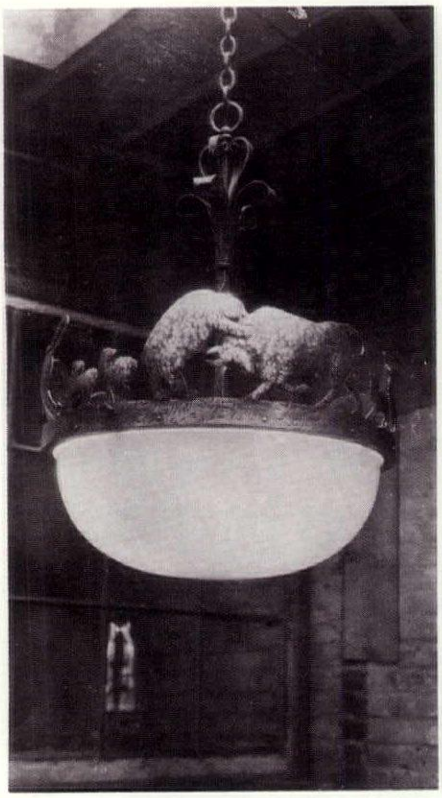
All the fixtures shown on these pages are examples of the fine craftsmanship of Sechrist's approximately 100 workers during the years surrounding 1920. Most of the designs are executed in tooled brass, cast bronze, and colored glass. Many of the globes and panels on Sechrist fixtures are of a very translucent "alabaster" glass because, as one old newspaper article put it, "few people want to pay for sixteen candlepower and get only eight candlepower for actual use."

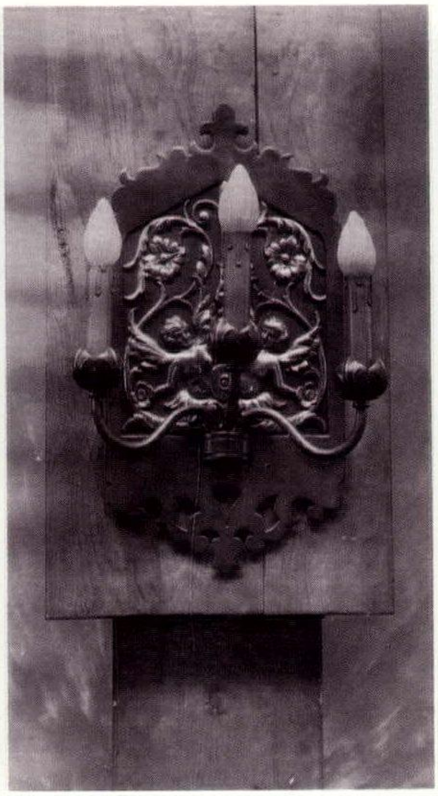
Denver native Albert Sechrist founded his company in 1888. He had worked in the fledgling electric power industry and had invented a low-voltage automatic switch similar to modern LV remote switches. His young wife was the company's first designer, working in the parlor of their home while Albert Sechrist toiled to execute the designs in a one-room shop under

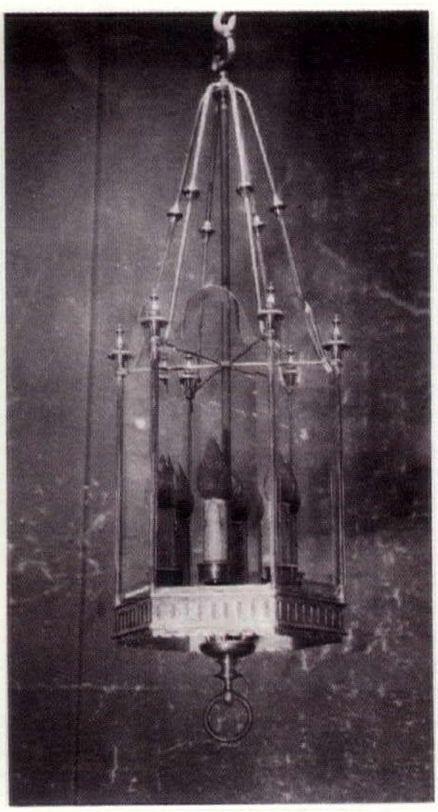


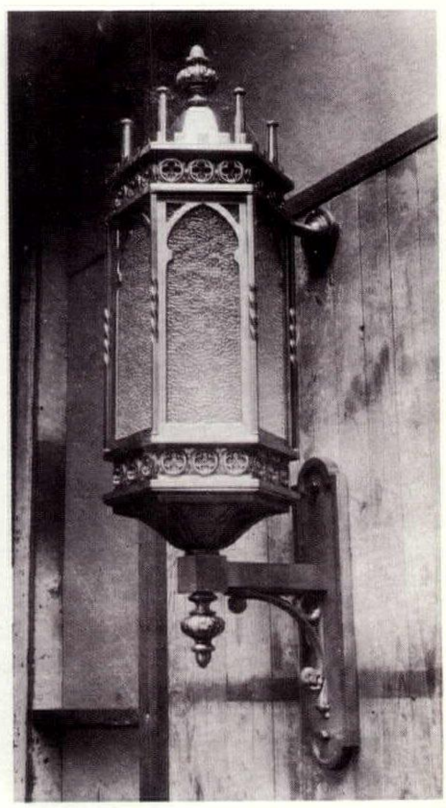
RICHARD R. HEINEMEYER

Exterior, Colorado State Office Building.







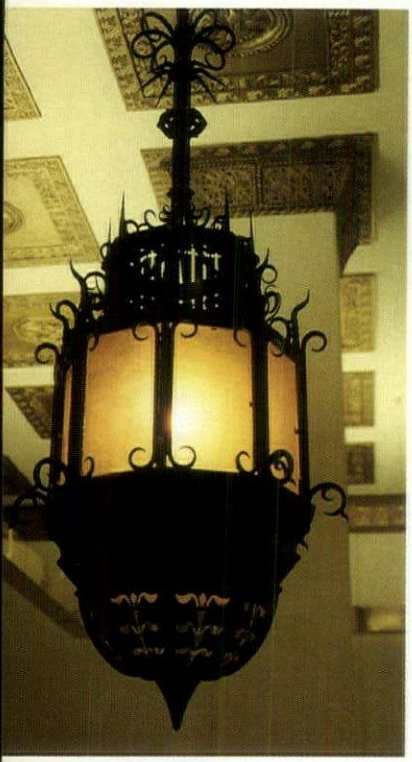


Courtesy of SHERWOOD SMITH ARCHIVES

Denver's Barclay building.

Later, Sechrist's head designer was Robert C. Ehlert, who probably executed most of the examples shown here. During his tenure, Robert Ehlert was much respected for his ability to team with designers in efforts to harmonize light fixture design with building design.

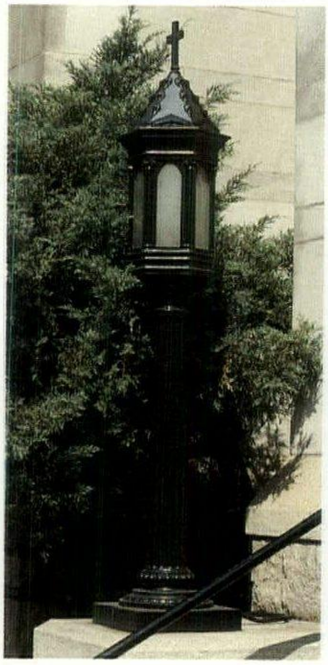
The architects of the buildings of the 1920s usually designed the



Colorado Federal Building.

major lighting fixtures. Drawings of the period usually delineated at least an idea of the shape that was desired. At Sechrist, the head designer would usually refine this idea and produce complete shop drawings for the architect's approval.

After the shop drawings were approved, craftsmen set to work making tooled brass, bronze castings, and blown and leaded glass, then assembling the components into finished fixtures. The accompanying vintage photographs are from 1920s Sechrist product literature. The photos were taken in the Sechrist factory and show custom-designed fixtures that were being added to the company's standard product line. That strategy was often implemented to help offset the cost of all the tooling required to produce custom fixtures.



Denver Cathedral.

Interior, Colorado State Office Building.

Sechrist died sometime in the late 1920s. The company leadership was assumed by Kenneth L. Francis and, later, by his son Thomas Francis. During World War II, the plant was engaged primarily in war matériel production. After the war, the company began mass-producing commercial lighting fixtures using fluorescent tubes, which had been recently developed. By 1954, Sechrist was heavily involved in the development of air-handling troffers and other then-modern manufactured lighting.

Most surviving examples of Sechrist fixtures are found in 1920s neorevivalist institutional buildings — buildings in which indulgent ornamentation was acceptable. "Lighting designers" of that period really designed only lighting fixtures; it was a natural extension of designing building ornamentation. The placement and look of the fixtures was still being influenced by fixtures that had been designed for gas-fueled light sources like the acetylene lamps that had only recently become obsolete.

Few people wanted to pay for sixteen candlepower and get only eight candlepower for actual use.

Photometric data were largely unknown or ignored, and most of the lamp sources used today were unknown. The purpose of light fixtures of the period was not, as it often is today, to hide reflectors, ballasts, or other operating hardware.

The company name has disappeared, but some Sechrist fixtures are still in use after nearly seven decades. That fact can probably be traced to their durable construction and materials and the excellence with which they fulfilled their ornamental function. It is a tribute to their design that these fixtures survive even after their original lighting function has been rendered obsolete by supplemental modern lighting.

Contemporary architecture seems to provide many fewer opportunities to use ornamental lighting fixtures — in some cases the projected beam of light functions as an ornament in its own right. It may be fair to ask how many contemporary fixtures will survive through the decades as Sechrist's did and be of interest for this kind of examination.

In 1968, the Sechrist Manufacturing Company was purchased by the Keene Corporation. By 1974, Keene had merged Sechrist with several other acquisitions to form the Keene Lighting Division. ■

Building a library of architects' lighting references

David Lord

David Lord is a professor of architecture at California Polytechnic State University, San Luis Obispo, California.

If an architect wants to build a personal library that is strong on the subject of lighting, the choices are many. One way to approach the selection of library material is to divide the field into categories, such as conceptual, technological, and reference works.

This article provides brief comments about some of the better books available. To purchase all the books described here could cost more than $750, but those not often needed may be found at a local university or public library.

Lighting Concepts

A book by William Lam, a lighting consultant to architects, is a good choice for those seeking broad coverage of conceptual possibilities. Other books have chapters devoted to the art of lighting, but Lam devotes a major part of his work to the quality of light in the design of delightful spaces.

Lam's *Perception and Lighting as Formgivers for Architecture* (McGraw-Hill, 1977, $65) is impressive for the number of case studies it presents. The introductory chapters on visual information, perception, and design processes are quite useful. Sometimes, however, the case studies that go back to the 1960s seem dated in today's design world.

Lam's soon-to-be-released book, *Sunlighting as Formgiver for Architecture* (Van Nostrand Reinhold, 1986, $69.50) will include more up-to-date examples and concentrate on the integration of daylighting and architectural form.

M. David Egan's *Concepts in Architectural Lighting* (McGraw-Hill, 1983, $38.95) is a technically oriented work that summarizes the fundamental calculations and assumptions necessary for electrical lighting design. This is a good place to start for those who desire a simple introduction to quantitative methods.

G.Z. Brown's *Sun, Wind and Light: Architectural Design Strategies* (John Wiley & Sons, 1985, $32.95, cloth; $17.95, paperback) is a book for designers who want basic information about the form-generating potential of daylight in conjunction with other climatic elements in the earliest stages of the design process. The organization of the book is based on architectural elements, such as streets, open spaces, rooms, courtyards, walls, roofs, floors, and windows.

Brown's information can be used effectively by those who are not energy experts. For those who wish to go further, he has provided an exhaustive list of references. In addition to the obvious economy of the paperback format, the sketch-like graphic quality gives the book the feel of being a serious working document. Highly recommended.

Technology and How-To

If the cost of books is a limiting factor in developing a lighting library, one might begin with Stein, Reynolds, and McGuinness's *Mechanical and Electrical Equipment for Buildings* (seventh edition, John Wiley & Sons, 1986, $49.95). In addition to being the best single reference for architectural environmental control systems, this encyclopedic text devotes more than 200 pages to illumination, including chapters on lighting fundamentals, light sources, and lighting design.

Those who need a greater amount of technical information can find more details in other reference books. These include works on both daylighting and electrical lighting.

For techniques of daylighting, Fuller Moore's *Concepts and Practices of Architectural Daylighting* (Van Nostrand Reinhold, 1985, $39.95) is clearly the star. The graphic quality is superb and the quantity of technical information extensive, encouraging readers to believe that they too can master the subject. Furthermore, those who are seeking inspiration from the architectural masters will appreciate the historical approach to the subject.

Less comprehensive than Moore, but still worth looking at, is Benjamin Evans's *Daylighting in Architecture* (McGraw-Hill, 1981, $46). Although it is five years old, it stands as a solid, straightforward introduction to the field of daylighting.

Both daylighting and electrical lighting are covered in Joseph B. Murdoch's *Illumination Engineering: From Edison's Lamp to the Laser* (Macmillan, 1985, $44.50). Murdoch's book is more than a history of lighting design; it is a technical reference work of the highest caliber, sprinkled with information necessary for architectural design. It will be satisfying to those architects of a more technical mind who want to go back to first principles. Calculations and formulas, accompanied by a straightforward text, explain lighting fundamentals, current theory and research in vision and color, lamps, and daylighting.

Of particular technical interest is Murdoch's chapter on optics and the control of light, which explains the theory and practice of reflector and lens design for the daylighting of buildings. This book reads somewhat like a textbook, with representative problems and solutions for each of the chapters. It is a must for the serious lighting designer's bookshelf.

Interior Lighting for Environmental Designers, by James L. Nuckolls (second edition, John Wiley & Sons, 1983, $42.95), contains valuable charts, graphs, and calculation routines.

Reference Works and Government Literature

The premier reference work for lighting design is the two-volume *IES Handbook* (Illuminating Engineering Society, $120 to IES members, $300 to nonmembers). The 1981 application volume contains information on lighting system design considerations, psychological factors, economics, and energy management. The remainder of the first volume is organized according to building type and gives major coverage to lighting offices, educational facilities, public buildings, merchandising areas, industrial facilities, residences, theaters, and roadways.

The second volume is the more recent 1984 reference volume; it covers fundamental definitions and theories of light and vision, light sources, and lighting calculations. Both of the IES volumes are indispensable for those engaged primarily in lighting design.

R.G. Hopkinson and J.D. Kay's *The Lighting of Buildings* (Faber & Faber, 1972, $16.95) is more of a text than a reference book. Because it refers primarily to European practices of daylighting and electrical lighting, few American architects would be likely to purchase it. Nevertheless, it contains excellent information and is a good value for the money. It uses SI units, which brings it in line with contemporary international practice.

Recent U.S. government research in lighting may also be of interest to designers. Documents about contracted lighting research funded by the federal government may be found by looking for the subject name (daylighting or lighting, for example) in *Government Reports, Announcements, and Index,* published by the National Technical Information Service (NTIS). This index lists the publications of such agencies as the Solar Energy Research Institute and the Lawrence Berkeley Laboratories.

The easiest way to gain access to Government Printing Office (GPO) publications is through government depository libraries. About 1300 libraries participate in the nationwide depository system; certain regional depositories carry all GPO publications. To find the nearest depository, check with the state library at the state capital; if it is not itself a regional depository, it can refer queries to the nearest one. Documents listed in the NTIS Index or the *Monthly Catalog of U.S. Government Publications* may be purchased from the Government Printing Office. ■

Lighting technology: from darkness to opportunity

Robert L. Smith, PE, FIES

Robert Smith is a professor at the University of Illinois School of Architecture.

Tracing the development of lighting technology can help designers to better appreciate and benefit from the full potential of today's lighting. Until this generation, for example, cost was a major deterrent to providing interior illumination. Our forebears had to evaluate the cost of candles, lamp oil, and electric lamps in terms of hours of labor, but technological advancement has radically changed the real cost of providing interior illumination.

A 14th-century English worker paid two-thirds of a day's wages for a small candle. In most areas of the United States today a 100-watt lamp — which provides 160 times the light of a candle — can be operated for less than a dime for 10 hours, a period of time during which a person at a minimum wage would earn $35. The safety, convenience, and flexibility of contemporary lighting are also great improvements upon the lighting of our ancestors.

The Beginnings

No one knows how cave dwellers first illuminated the dark recesses of their homes. It is reasonable to assume, however, that the glow of a cooking fire was a common light source. For portable light, perhaps a burning bundle of sticks — a fagot — was used.

The oldest known lamp was discovered in a cave in France. The 20,000-year-old sandstone bowl contained remnants of grease and a small piece of vegetable fiber that probably served as a wick. It is likely that natural objects were used even earlier. Perhaps bowl-shaped stones or sea shells were filled with the drippings from a cooked animal and a piece of moss or fibrous material was used as a wick.

Oil Lamps

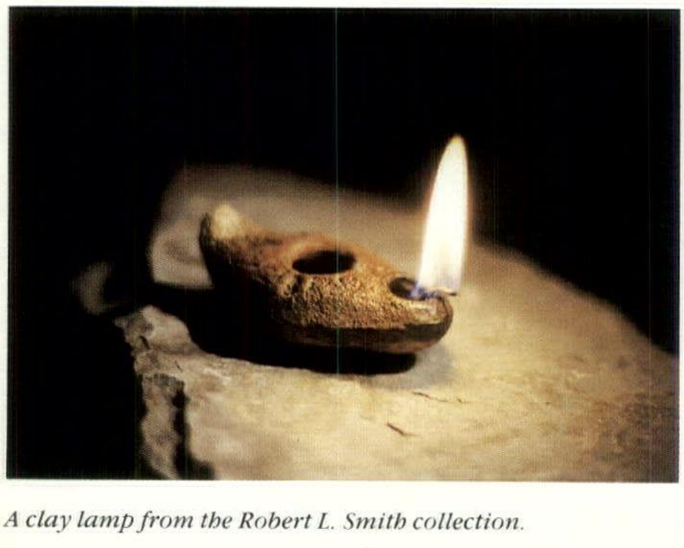
Lamps were fashioned from clay as early as 5000 years ago and either sun-dried or baked. Lamps were also made of gold or copper, but those were very rare.

The metal lamp that has survived in greatest numbers is the iron "crusie," probably a Celtic lamp of early Iron Age origin. Originally, it was a single bowl device with a wick hanging from a pinched spout. Oil constantly dripped from the wick; the oil not only was wasted but also created a mess. The Scottish people are credited with adding a second bowl to catch the precious oil. Often called a "Phoebe" or a "pan lamp" — and when fitted with a cover a "betty" lamp — this was typical of the oil-fueled light sources used by working people for several centuries.

The choice of fuels for these lamps depended mainly on availability, and a variety might have been used, including animal fat, fish oil, olive oil, vegetable oils, and natural petroleum seepages. There were definite preferences. Fish oil was used extensively, but the odor of its smoke would have been offensive. A Greek writer probably had fish-oil–fueled lamps in mind while writing, more than 24 centuries ago, "One could not

The double crusie lamp is probably from the early Iron Age (Early American Museum, Mahomet, Illinois).

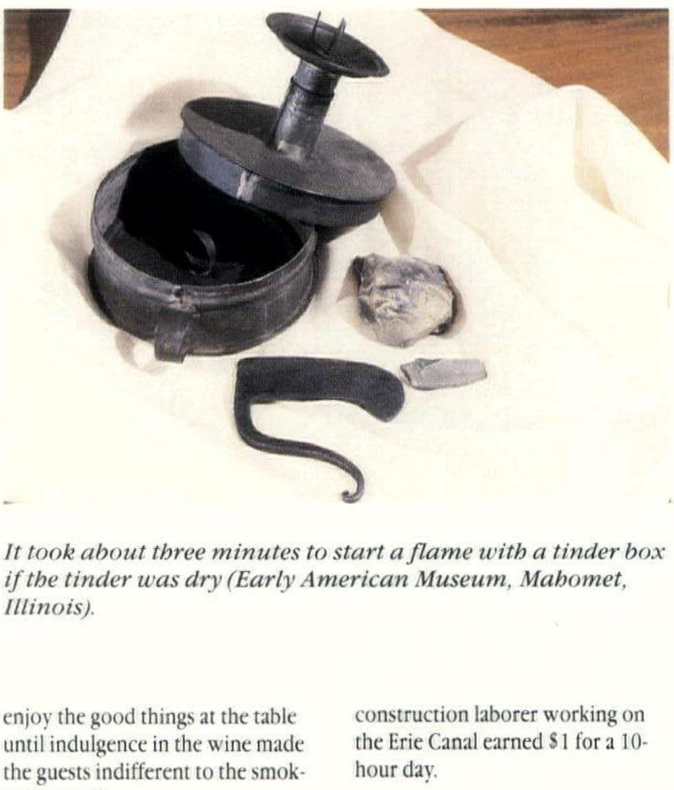
A betty lamp was typical of the oil-fueled sources used by working people for several centuries (Early American Museum, Mahomet, Illinois).



A clay lamp from the Robert L. Smith collection.

A rushlight or splinter holder (Early American Museum, Mahomet, Illinois).

An apparatus for use in a fireplace to catch dripping fat (Early American Museum, Mahomet, Illinois).



It took about three minutes to start a flame with a tinder box if the tinder was dry (Early American Museum, Mahomet, Illinois).

enjoy the good things at the table until indulgence in the wine made the guests indifferent to the smoking lamps."

By the middle of the 19th century, whaling fleets had greatly reduced the whale population, and sperm oil — the preferred choice for lamps — was beyond the reach of common people. In 1855, when raw sperm oil sold on docks in Massachusetts for $1.70 a gallon, a construction laborer working on the Erie Canal earned $1 for a 10-hour day.

Candles

The place of candles in antiquity is often misunderstood. Far from commonplace, they were expensive and considered a luxury. The candle evolved from splinters of wood that were lighted and carried about. Usually two to three feet long, the splinters were cut from knot-free pine logs.

Next came rushlights. In the fall, rushes were harvested, peeled, dried in the sun, and then dipped in kitchen fat. A pound of dry rushes, about 1600 stems over two feet long, and six pounds of fat would make enough rushlights to burn for about 800 hours.

The candles of olden times were made of either tallow or beeswax, and the wicks were fibers from the papyrus or rushes. The wicks were coated by dipping, pouring, or forming in molds. Because the process was long and tedious, wax candles were labor- and material-intensive items and were therefore available almost exclusively to the wealthy and the churches.

From the beginning of time to the late 18th century, only the light sources described above were available. The methods of lighting had important implications for the life-style of our forebears.

Lighting in Antiquity

Indoor lighting had a severe impact on living environments: walls and ceilings were discolored by smoke, and people lived in constant danger of grease drippings on the floor becoming ignited. As the accompanying table shows, all light sources produced about the same intensity of light; to get more light required multiple sources, such as a bundle of sticks or a chandelier.

Light sources required a high level of maintenance. Rushlights and splinters needed regular replacement. Unless candles were snuffed every 5 to 20 minutes, "guttering" would cause most of the tallow to drain off and the candles would rapidly be consumed. It was also necessary to have or start a fire every time a light was wanted. A fire could be started only by rubbing sticks together or by using a flint, steel, and tinder, so people often "carried their fire." It took about three minutes to start a flame with a tinder box, assuming the tinder was dry.

The cost of lighting was a barrier to adequate illumination. Oils used for lighting were also useful for food. When the cost of food required 80 percent of a worker's wages, little money would be used to provide light. Lighthouse keepers, it is recorded, often consumed large quantities of the tallow candles that were provided for use in the towers.

A 14th-century Englishman paid twopence for a small (12 to the pound) tallow candle. During this same period a carpenter received threepence a day for his labors; wine was fivepence a gallon; fagots were thirtypence a hundred. Lean meat cost but a farthing (one-fourth of a penny) a pound, but the fat used in oil lamps and to make candles and rushlights was twopence a pound.

According to a history of English agriculture, "A candle must have been a rare and choice personal luxury, and was used, as a rule, in the management of the farm only at the time in which the shepherd was attending to his ewes."

A Period of Discovery

Although virtually unnoticed at the time, a 1765 event marked the beginning of a new light source that would have a great impact on commercial activity. One Mr. Shedding piped gas from his coal mine to illuminate his office. He offered to install gas illumination on the streets of Whitehaven, England, but the city refused his offer.

In 1792, William Murdoch perfected a method of heating coal to produce gas for lighting. In 1806, David Melville of Newport, Rhode Island, installed illuminating gas in a textile mill; this is believed to be the first commercial use of gaslight in America. Thus began an industry that was to provide lighting for working and residential environments for over a century.

In 1784, Thomas Jefferson brought to America a lamp designed by Swiss chemist Ami Argand. Argand had developed a tubular wick, introduced air in its center, put a straight glass chimney over the flame for better draft, and created a light source of six- to eight-candlepower intensity.

Ironically, this increase in intensity — to a level well below that of present day sources — was greeted with some concern. The 1804 edition of the *Domestic Encyclopaedia* published this caveat about the Argand lamp: "As the light emitted from them is frequently too vivid for weak or irritable eyes, we would recommend the use of a small screen."

During the 19th century, the pace of lighting technology suddenly began to accelerate. After Sam Jones marketed the "Lucifer" in 1829, people could "carry the fire" in the form of a match. Between 1830 and 1860, approximately 500 patents for lighting devices were recorded in the United States Patent Office, including several new fuels.

In 1830, Isaiah Jenkins patented his "burning fluid," a combination of alcohol and turpentine. Samuel Rust of New York patented several improvements in wicks and chimneys. Then, in 1839, Augustus V.X. Webb began to manufacture distilled turpentine under the name camphine. These fuels were very volatile and the resulting explosions resulted in many unfortunate deaths.

Kerosene, often called paraffin oil or coal oil, was discovered by Abraham Gesner, of Williamsburg, New York, in 1845. With the 1859 development of the oil fields in Pennsylvania, a new era of lighting was opened; even the poor could have lighting in their homes.

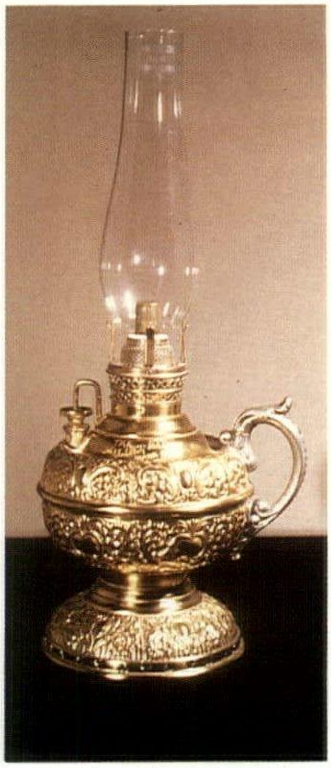
At the same time that gas and fluid fuels for use in lighting devices were being developed, electricity and the possibility of an incandescent lamp were being explored. In 1802, Sir Humphry Davy used electricity to heat thin strips of metal to incandescence, but they quickly oxidized. In 1841, the British government granted the first patent for an incandescent lamp to Frederick De Moleyns. In 1859, Professor Moses Farmer illuminated the parlor of his home in Salem, Massachusetts, using a platinum wire in open air as did many others of the day. But, it was as short-lived and impractical to operate as the other electric lamps of the day.

The Edison Era

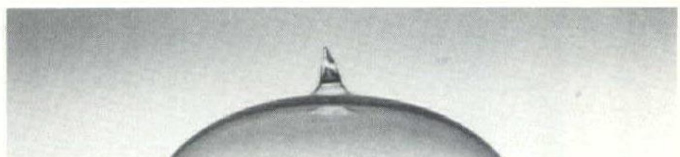
An 1879 event marked the beginning of a new era in lighting technology and design. In a laboratory close to Menlo Park, New Jersey, Thomas Alva Edison applied electric current to a slender carbonized cotton thread mounted in an evacuated glass bulb. The lamp burned brightly for two days, until Edison increased the voltage, overheating and destroying the filament of his latest invention. Edison was inventing not just an electric light, but an entire electrical system for illuminating homes and businesses.

During the next three years, Edison and his dedicated assistants invented and developed a comprehensive system of electric generation, control, distribution, measurement, and utilization that made possible the opening of the Pearl Street Central Station on September 4, 1882. This New York City facility began operation by supplying 85 customers with a connected load of about 400 incandescent lamps. These 16-candlepower lamps sold for $1 each; the young women hired to make them were paid on a piecework basis — and earned from 50 cents to 70 cents per day.

One of Edison's first customers was the *New York Times*, where 52 lamps were installed in the editorial office. The *Times* reported the effect as being "soft, mellow,



An early kerosene lamp by the Miller Company.



A tantalum filament lamp (1906) provided 5 lumens per watt (Robert Smith collection).

grateful to the eye; it seemed almost like writing by daylight."

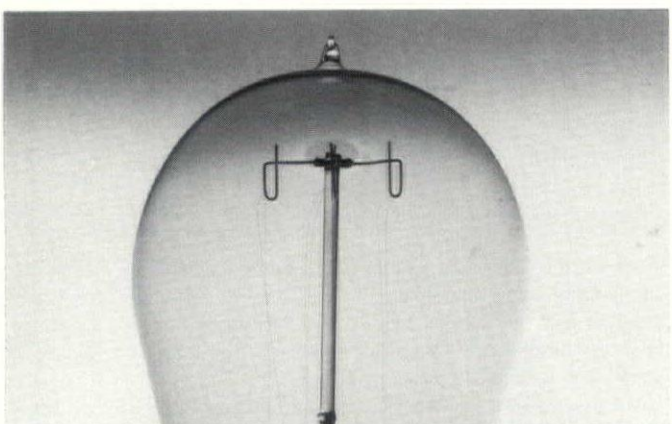
The first customers were not charged for the energy, so it was January 18, 1883, before a bill was collected — from Ansonia Brass and Copper Company for $50.40. The connected load increased until for the month of November the collections had increased to $9102.45 and as of December 1, 1883, there were 10,297 lamps in operation.

Tragically, the station and all the equipment, except for one generator, were destroyed by fire in 1890. The generator from the Pearl Street Central Station can now be viewed at the Greenfield Village & Henry Ford Museum in Dearborn, Michigan.

Edison was not alone in his endeavors to provide lamps and to install lighting systems. In fact, competition was fierce in the United States and abroad, which brought about rapid improvements in the equipment and techniques used to provide the lighting systems.

The incandescent lamps first marketed had free-blown bulbs with seal-off tips, a looped or hairpin shaped carbon filament, and any one of a dozen different bases, which were filled with plaster of Paris. But, 70 percent of them used Edison screw bases, so that eventually became the standard. In 1898, machinery was developed to assist the glass blowers; after that most bulbs had straight sides.

In 1901, black glass replaced the plaster of Paris in the base. Then, in 1905, the GEM (General Electric Metallized) lamp was introduced; it was rated in watts instead of candlepower. The tantalum filament, marketed in 1906, was quickly replaced by the tungsten filament in 1907. In 1922, the seal-off tip was eliminated, and the last vestige of that first incandescent lamp had disappeared.

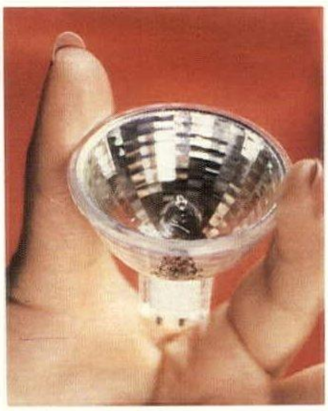


Nonductile tungsten lamp (1907) provided 7.85 lumens per watt (Robert Smith collection).

Time of Opportunity

Today the lighting industry is equipped to design lighting systems that were beyond fantasy when the Argand lamp appeared just two centuries ago. Five types of lamps are available to lighting designers: incandescent, fluorescent, high intensity discharge, high pressure sodium, and neon.

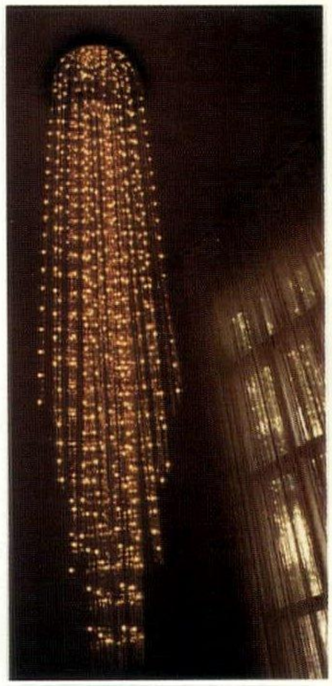
Incandescent lamps. Although incandescent lamps are now 10 times as efficacious as the first lamp, they are still the least efficient of these sources and still produce less than 20 lumens of light for each watt of power. Incandescent lamps are, however, especially useful where usage is low, where precise control of light is required, or where a very small source is needed.



An MR 16 lamp.

The multireflector (MR) 16 lamp, for example, is ideally suited to applications that need a lot of light on a very small area. Although the lamp with reflector is but 2 inches in diameter, it may provide from 20 to 75 watts. The tungsten halogen (quartz) light source provides a concentrated beam. The 20-watt narrow beam lamp will put 33 footcandles on a surface 10 feet distant. Its color characteristics are considered excellent.

Bud lamps are another judicious use of an incandescent source. These lamps, usually 1 watt, are installed in tubes or on a tape and provide exciting decorative lighting that requires only very low power.



A bud light chandelier.

Fluorescent. Designers can choose from a seemingly unlimited array of fluorescent lamp types. The main variations are in lamp current (affecting the lumen output), color characteristics, size (length, diameter), and shape. Energy-efficient fluorescent systems can produce 85 or more lumens per watt.

Fluorescent is recommended for applications in which diffuse ambient illumination is needed, where task illuminance is required on a specific area, and where color rendition is a major goal. The triphosphor lamp is of particular interest to discriminating designers; it provides both excellent color rendition and a visual clarity that is not achievable with other sources. Although it is more costly than other types, it is very popular in merchandising.

A new addition to the fluorescent family is a low-wattage lamp that may be used as a replacement for incandescent lamps with an efficacy of three to four times that of incandescents. The lamp also has a life rating more than 10 times that of the incandescent.

High intensity discharge. Metal halide sources belong to the high intensity discharge (HID) family. The use of this lamp — which is a high intensity, point source — should be limited to installations in which the light source is out of the field of view. It is ideal for spaces with high ceilings or in indirect lighting applications. An excellent lamp from an energy standpoint, its efficacy exceeds 80 lumens per watt.

High pressure sodium lamps. The highest efficacy sources discussed here are the high pressure sodium lamps, with values exceeding 100 lumens per watt. Available in a wide range of sizes, from 35 watts, these lamps are a preferred choice for security lighting and for large spaces where color rendition is not critical. Using them alongside metal halide lamps improves the color characteristics of the illumination.

Neon. As the generic name for a large family of electric discharge lamps, *neon* includes cold cathode, whose light output can be best described as a glow. Available in a wide variety of colors, the lamps can be sculptured to fit almost any configuration. They are ideal for providing soft ambient lighting, to enhance architectural elements, and as sculpture elements.

Designers' Choices

Once a lamp has been chosen, a luminaire must be selected to support the lamp, to provide a connection to electrical power, and to provide specific control of the lamplight. Designers today can choose among a multitude of luminaires for any lamp; their task is to locate those that meet their space and task criteria. Then they must sort through the array and identify the luminaire that will put the lamplight where it is needed, efficiently and without affecting the environment adversely.

The final hardware selection can be one of the most challenging and exciting design experiences. Electrical control choices for illumination systems range from simple toggle switches to exotic automatic control systems.

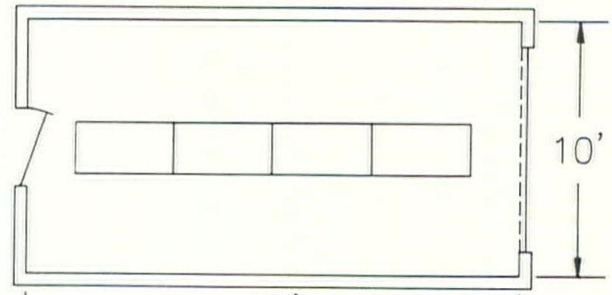
A wide area lighting controller (courtesy Lutron Electronics).

Beyond the traditional manual switching devices are many choices. There are relay-operated low-voltage systems that permit manual or automatic (including computerized) positive control and electronic systems that impose a signal on the power wiring that initiates relay operation at the load site. Some space monitors are sensitive to motion or to heat. Others are operated by photocell devices that monitor a space's illumination and maintain it at a preset level, whether the light changes because beneficial daylight intrudes or because the lighting system is aging.

Automation's Potential

To appreciate the potential, imagine walking into an office early in the morning to find the lights automatically turned on to a preset intensity and the sheers covering the windows already raised. As the available daylight increases, the lamplight lessens. But, if direct sun intrudes into the work area, a motorized shading system lowers a sheer over the windows — just far enough to block the undesirable direct sun.

In this demonstration office, when the worker's computer is turned on, the lamplight is decreased and the sheers adjusted until the illumination is correct for working at the video display terminal. Should an important guest arrive, a voice command can raise the sheers to expose the vista and modify the lamplight to create the right ambience for conversation. Lamplight is extinguished when the occupant leaves the office, and, depending upon the outside temperature, the sheers may be lowered to increase the thermal efficiency of the window.



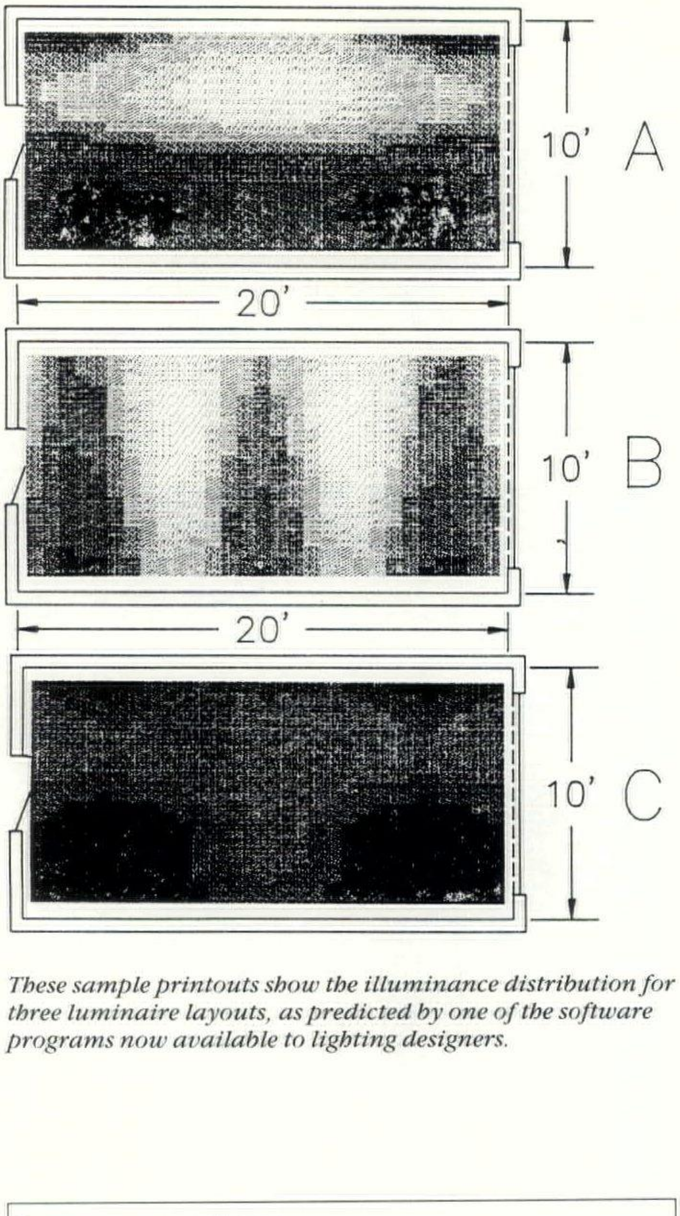
Throughout the day the conditions in the work environment have been optimized. When a high level of illumination was needed it was provided, but when the maximum lamplight was not necessary it was reduced to the proper value and energy was conserved, all with a minimum of action by the occupant.

Designers have recently gained increased understanding of the way illumination of a space affects its occupants' psychological reactions and productivity. This understanding has led to new technology to predict the quality and quantity of illumination in spaces being designed.

Equipment that measures illumination in existing spaces and provides information for proper evaluation is also available. Although much of the technology and many of the measuring devices have been available for several years, the microprocessor has now made them affordable and therefore accessible.

Computer Analyses

Software packages are now available that can create a lamp and luminaire data base for instant and repeated use. Then, using as many as eight different luminaires arranged in as many as 10 different layouts, the program will compute the illuminance at 400 points on the work plane, in four viewing



These sample printouts show the illuminance distribution for three luminaire layouts, as predicted by one of the software programs now available to lighting designers.

Lumen comparisons

Source	Lumens*
Tallow candle	12.5
Beeswax candle	11.5
Paraffin candle	14.9
Whale oil, flat wick	9.0
Whale oil, Argand lamp	98.0
Kerosene table lamp	60.0
Coal gas, #1 jet	30.0
Edison carbon lamp	160.0
Tungsten 50-watt (1909)	400.0
A19 50-watt incandescent	530.0
LU50 50-watt high pressure sodium	3800.0

**Although these values, taken from several sources, were not verified, they are believed to be reasonable for comparisons.*

directions, with or without body shadow. It will compute the equivalent sphere illumination (ESI) at 400 points in four viewing directions, the vertical illuminance in four viewing directions at each of the selected points, the illuminances on all the room surfaces, the exitances (luminances) for all the room surfaces, and the contrast at selected points, then give a statistical analysis of the data.

After the computations are complete, the information may be displayed in tubular form, by isocontour lines on a graphic representation of the area being exhibited, or by a gray-scale shading on which dark shading represents low values and progressively lighter shading represents increases in lighting. In just a few minutes, a user can input several alternate lighting design schemes, execute the program, and have a full set of exhibits that will permit the selection of the best design scheme.

An equally impressive set of tools is available to evaluate the character of the illumination in existing space. There are illuminance measurement instruments with digital displays, luminance measurement devices (both averaging and precise 1-degree spot meters), chromaticity meters to measure the light source color, and contrast-ESI meters. There are even contrast rendition meters that can be used to measure the precise effects of an illumination system on the readability of a cathode ray tube.

One meter with enormous potential for evaluating illumination simultaneously measures and records 20 characteristics of lamplight, including color attractiveness, color rendering index, color scheme stability, color temperature, chromaticity, color preference index, brightness units, visibility units, and visible, violet, and ultraviolet efficacy and density — everything you wanted to know about the illumination but didn't dare to ask.

Today's Challenges

For an eon, progress in lighting technology was static. After a century of searching and discovery, and another century of invention and development, designers are at the threshold of an era in which hardware and knowledge will permit the design of affordable illumination systems that can increase productivity and pleasure in working and living environments.

For an impressive example, think of the amount of light that can be afforded in terms of its potential to increase productivity. Assume that a $20-per-hour employee occupies 100 square feet of office space, electricity is 10 cents per kilowatt hour, the room is illuminated uniformly for tasks, and a combination of energy-efficient fluorescent lamps and ballasts are used with a luminaire to provide 35 lumens per square foot per watt in the room.

For each hour that this employee can increase productivity by 1 percent, it would be economically feasible to increase the illuminance in the space as much as 666 footcandles. This example clearly illustrates that when productivity is at stake it is a poor gamble to deprive employees of the illumination that they need.

No other technological development has had as profound an effect on human life-styles as the invention of electric illumination. Those who may suggest that the automobile has had a greater impact should be reminded that without electric lighting the auto would be a diurnal creature. Skillfully, abundantly, judiciously provided electric light can create environments that enable us to live better, more productive lives. ■

Lighting the outdoor landscape enhances the garden design

Enrique Noguera

Enrique Noguera has a degree in landscape architecture and is an associate with Grenald Associates, a firm of architectural lighting consultants with offices in Los Angeles, Philadelphia, and New York.

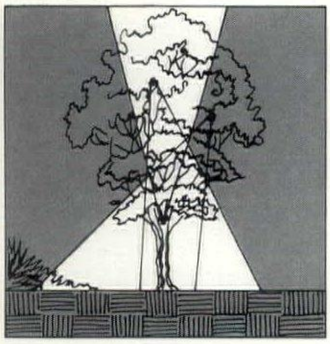
Our urbanscape indicates human development in controlling the environment. Architecture and landscape architecture cannot be separated; they are human expressions of space. Together these disciplines have brought us a wealth of examples from different eras.

From a design point of view, architecture and landscape architecture both follow the same thought process. Landscape architecture, however, can involve spaces as small as that used for a tiny bonsai garden to areas as large as that covered by a macrometropolis master plan. Landscaping is the link between different architectural structures and the environment.

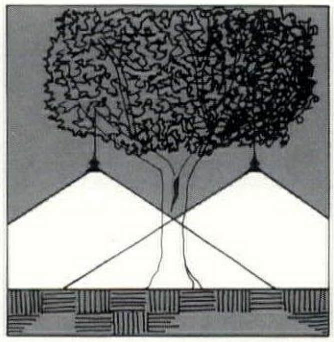
Sunlight and natural materials are the two key elements of landscaping. Landscape architects can enhance architectural design by using the endless variety of colors, textures, densities, proportions, and shapes provided by plant materials, water, and stones. Thomas Church introduced and developed many new concepts to landscape architecture. He used to say that gardens are simply "outdoor rooms" related to human needs. Unlike architectural structures, outdoor rooms are constantly growing and dynamically changing.

Light, like water and air, is essential for life. Through the centuries, civilizations have engaged in constant quests for new sources of light to make the dark hours more productive. Torches, candles, and oil and gas lamps are a few of the inventions that helped to advance societies, but the incandescent lamp brought dramatic changes to

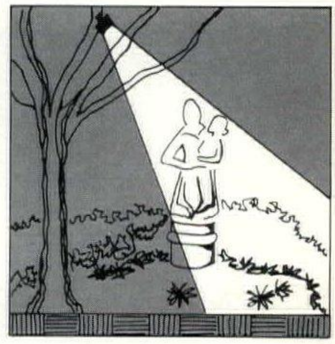
Design considerations landscape lighting	
Plant material	
Type	Evergreen Deciduous
Density	Open Medium Compact
Texture	Fine Medium Coarse
Color	Flowers Leaves Structure
Sizes and arrangements	
Space	
Users	Public Private
Uses	Recreational Vista Entertainment Safety Security
Orientation	Perspective Focal points Location of viewer
Proportions	
Function	
Effects	Transition Continuity Reflection on water Screening Forcing perspective Canopy Moonlight
Constraints	
Glare	
Maintenance	



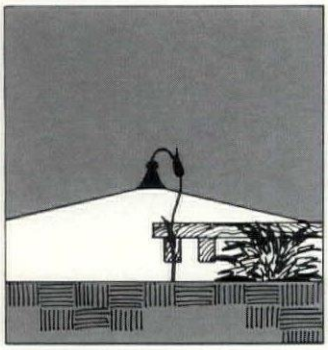
Up- and downlighting.



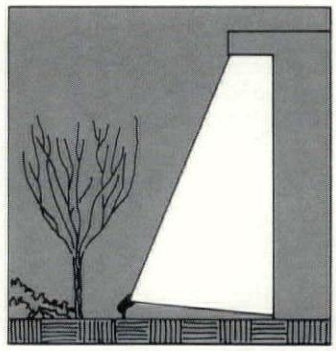
Downlighting.



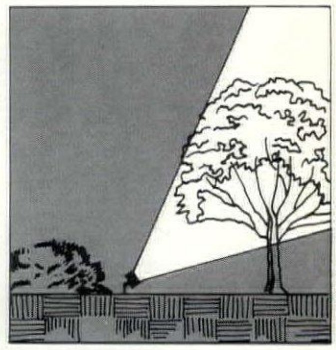
Down accent lighting.



Path lighting.



Backlighting.

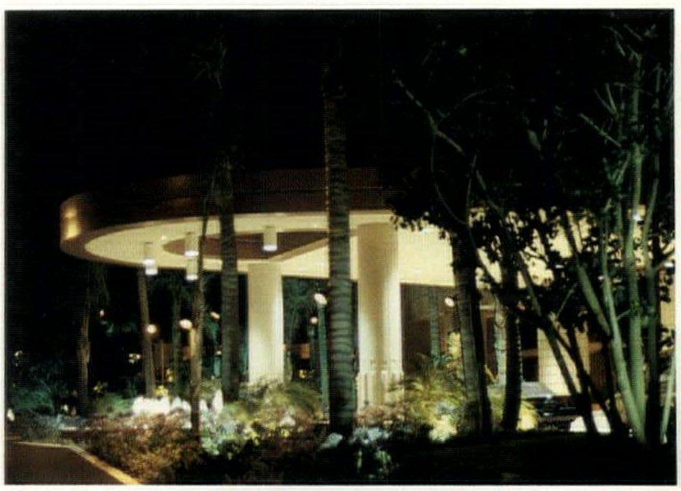


Floodlighting.

COURTESY OF KIM LIGHTING

environmental lighting, allowing illumination of the dark exteriors surrounding buildings. Beautiful daytime gardens used to disappear into the darkness after sunset. Now indoors can melt into that inviting and pleasant environment any time, day or night.

Landscape lighting is a new field. In landscape architecture the design concept is usually based on circulation patterns, axis, focal points, or perspective enhanced by light. Daylight color temperature and its intensity change according to the hour of the day and the season of the year, giving us a powerful effect wherever the sun shines. Under bright sunlight the garden is a continuous display of a changeable variety of textures, colors, and forms. Everything is there, perceptible. Nothing is hidden. Everything is alive. After dusk, moonlight and electric light bring the magical contrasts of darkness — shadows and light. Specific areas and objects can be lit by diverse light sources; lamps of different color temperatures and beam spreads create aesthetically pleasing effects. Moreover, by controlling the intensity of the lighting used, the space can be used in various ways.



Creating Special Effects

Basic lighting techniques can be combined to create special effects. Among factors to consider when designing such effects are maintenance, aiming, direction of lighting, use of gardens, nearby neighbors, and construction materials used.

Downlighting. The most common and efficient technique for creating the effect of sun- or moonlight is to use concealed light sources placed on poles, buildings, trees, or any other high structure and aimed straight down to highlight plant material or create patterns on surfaces to bring out their texture.

Plant materials and lamps criteria			
EVERGREEN			
Foliage density	**Viewer distance**	**Recommended lamps**	**Remarks**
OPEN	CLOSE	Low wattage I/F mercury vapor lamps	When flowers are not important
		PAR 38 and compact fluorescent lamps	When flower and branch structure are nice
		Blue-white lamps	When branches and leaves are important
		Combination of incandescent, fluorescent, and mercury vapor lamps	When foliage, trunk, and flowers are important; switch based on season
MEDIUM	MID-DISTANCE	Same approach as when CLOSE, but increase wattage	Check plant material textures
		Quartz and compact fluorescent lamps	Same
		Same approach; increase wattage and number	Check plant material textures, color of flower
		Use blue fluorescent lamps	For greenery
		Use Chroma 50	For greenery and background
COMPACT	FAR	Mercury vapor PAR 38	Only for far and very dark greens
DECIDUOUS			
Foliage density	**Viewer distance**	**Recommended lamps**	**Remarks**
OPEN	CLOSE	Incandescent PAR 38 in combination with blue-white lamps	For structure and flowers, for greenery
		Blue fluorescent	For fences and background
		Same approach, increase watts	Check colors and textures
MEDIUM	MID-DISTANCE	Combination of fluorescent with incandescent lamps	Small and medium size gardens; check colors
		Mercury vapor I/F color corrected lamps	For trees in background
		Combination of mercury vapor and incandescent	Have two circuits for seasons
		Chroma 50 and blue-white incandescent	For backgrounds including flowers
COMPACT	FAR	Use high-watt quartz lamps	For large areas and big trees; check colors and textures

Uplighting. Dramatic landscaping effects can be achieved by placing light fixtures on or in the ground and using the uplighting technique to accent foliage or tree structures. Uplighting, however, requires more maintenance than other techniques, and it is important that the placement and aiming of the fixture be properly executed.

Backlighting. Subtly lighting the background wall, fence, or rocky hillside allows plants to be seen in silhouette. This technique is recommended when the density and shape of plant material can clearly be seen — as in a sunset effect. Backlighting also can be effectively used as security lighting.

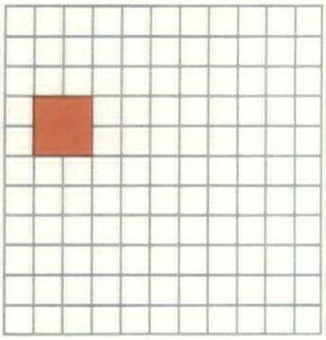
Floodlighting. Placing light fixtures on buildings, poles, trees, underwater, or in the ground is the most common technique for general illumination. As with uplighting, however, proper placement and aiming of fixtures and lamps is critical for effective results.

Lighting Criteria

Since the introduction of the first reliable incandescent lamp, many new light sources have been produced. Fluorescent, mercury vapor, and metal halide lamps, to mention only a few, allow landscape architects to choose the appropriate light source for different applications based on the plant material, the space, the effect sought, and other considerations. The accompanying table lists many of the factors to be considered. The most sucessful designs have appropriately balanced the components; none of the components should be overwhelming. Whether in indoor or outdoor spaces, architecture, landscaping, and lighting balanced in a symbiotic relationship create a pleasant perception and feeling for users. Through lighting, an outdoor room can become more useful when the weather allows people to play and entertain outdoors. Even in winter an exterior garden or city view can expand the indoors.

A garden is the synthesis of materials, colors, and textures; lighting is the medium that lets people perceive that synthesis. Sucessful landscape lighting requires that the designer think about each element in the garden, its uses, and its users before establishing the criteria to be used. ■

The Design Department



Gary Gordon, IES, IALD

Light is fundamental in architecture. It affects the usefulness of a building and the enjoyment of a building interior. It also affects the way users feel about themselves and others. It shapes or misshapes the attraction a user feels for the surrounding activities and objects; the resulting attitude is a major factor in maintaining effective interest in an activity or task. For these reasons, the visual impressions induced by the lighting system are fundamental in planning and design, and they become a functional part of the activity.

The use of light is an inseparable part of the architectural conception. Many building projects require the help of special consultants to solve complex problems of lighting system design. Only the original designer, however, can visualize how things are to appear in the finished structure, that is, what will be emphasized and what will be subdued. To convey this concept to a consultant, it is essential to communicate ideas in a mutually understandable language.

This column is intended to provide designers with a basic analysis of lighting in architecture. The first columns will provide a general overview of many facets of light and lighting design. They will concentrate on the emotional aspect of lighting problems and pay particular attention to the subjective impression of light. Later columns will focus more specifically on the technical aspects of lighting design. They will offer an appraisal of the mechanical and physical characteristics of light sources and systems, with detailed information to guide designers toward achieving specific design objectives. The purpose of the column is to provide a background in the use of light as a creative medium.

Gary Gordon is principal of Gary Gordon Architectural Lighting Design, New York, a firm that designs lighting systems for commercial and institutional settings. He was a project manager for Carroll Cline and James Nuckolls as an associate with Incorporated Consultants Ltd. and was a designer for FAIT Inc. He now teaches advanced courses in architectural lighting design practice and techniques at the Parsons School of Design Lighting Institute.

Designing a complete and suitable luminous environment is more complicated than simply selecting lighting fixtures. To develop spatial patterns of light, shade, and color requires thinking about light in three dimensions. A mechanistic approach confuses a room's visual quality with the footcandles on the work plane. Preventing that confusion demands recognition of the psychological aspects of lighted space. Such recognition implies understanding of and sensitivity to techniques that create an environment where observers react with feelings of pleasantness and well-being through the use of silhouette, sparkle, focal emphasis, color tone, and other patterns of spatial light.

It is a mistake to concentrate on luminaires (lighting fixtures) as objects rather than on the surfaces being lighted; where the light lands is more important than the object that produces it. Luminaires should be the last components selected; early in the design process the designer should decide which surfaces and objects to light and which to leave in relative darkness. That is, first decide what you want to light, then work backward toward a solution.

The initial step in planning light for a space is to establish an appropriate emotional environment for the activity that will take place there. Lighting can affect impressions of spaciousness, relaxation, privacy, intimacy, and pleasantness; it can produce a festive, carnival-like atmosphere or a quiet place for contemplation; it can create cold, impersonal public spaces and warm, intimate, private ones. Light can have a strengthening or reinforcing effect in creating a suitable psychological setting, similar to that provided by background music.

After mood has been considered, the next question to be answered is, where do we need light? People and activities in a space become the dominant features and the architecture a secondary factor when horizontal surfaces — the normal work plane for activities such as reading, typing, drafting, cooking, and sewing — are illuminated. Increased consciousness of movement, people, and nearby detail creates a personality for the lighted space that encourages a gregarious attitude among its occupants.

When the lighting emphasis is shifted to the architecture, however, activity becomes visually subordinate to the architectural environment. People interpret the architectural environment through vertical and horizontal brightness relationships because these surfaces appear as major elements in their field of view. This shift reinforces a more introspective attitude, an intimate atmosphere with a feeling of privacy. Many times, horizontal illumination (downlighting) combined with vertical (wall washing) or overhead illumination (uplighting) is the most desirable solution. The important thing is to *first decide what to light*.

To specify a combination of surfaces to be lighted with those left in relative darkness, the designer must next think about the direction and distribution of light within the space. A luminaire with narrow, concentrated, downward light distribution deemphasizes ceilings and vertical surfaces, yielding an impression of comparatively low general brightness with high brightness accents. A downwardly directed luminaire that diffuses (spreads) the beam pattern increases the incident light on walls and vertical surfaces, reducing the concentration of brightness within the space. A multidirectional lighting unit that delivers diffuse upward and downward light reduces shadows and contrast, creating a bright, generally uniform lighting condition.

Visual perception of space, of course, depends upon both incident light and surface finish. When designing a lighting system, then, it is important to recognize the influence of reflected light. Low reflectance and dark finishes absorb much of the light that strikes them, reflecting very little toward the eye. Because surface brightness is low, such finishes contribute to a general impression of a dark space. High reflectance and light-colored surfaces reflect a large proportion of the light that strikes them, which produces a brighter interior with a more general diffusion of light. It is essential that designers understand this fundamental relationship between lighting units (initial distribution) and building surfaces (reflected distribution).

When horizontal surfaces are illuminated, people and activities become the dominant features in a space.

The next step in the lighting design process is to determine how much light is required for the activity that will take place in a space. In general, the light needed for visibility and perception increases as the size of details decreases, as contrast between details and their backgrounds is reduced, and as task reflectance is reduced. Recommended lighting levels are published in the *IES Lighting Handbook 1981 Application Volume*. The IES standards are intended as a guide to providing the amount of light needed for

Project Submission Guidelines

Architectural Lighting's editors will select a number of projects each month as examples of the finest work by lighting design professionals today. Projects will be published as statements and articles.

Projects submitted to the editors of *Architectural Lighting* must include a suitable selection of slides or transparencies that illustrate the quality of lighting that makes this project worthy of publication. Also send relevant details, plans, and sections to show how you did it. The editors need a brief statement about the use of the project, along with the architect's, engineer's, or lighting designer's comments on the challenges and design processes involved in its execution. Include some discussion of the qualities that make the project worthy of coverage.

All submissions will be handled with reasonable care and every effort made to ensure the safety of your artwork. All materials are returnable.

Once a project is selected for coverage by *Architectural Lighting*, a member of our staff will contact the person who submitted it to get further information and to develop the material into an article. This process may take from three to six months, depending on such factors as the complexity and timeliness of the work.

Statements

Statements may be drawn from a large- or small-scale project. In either case, Statements focus on a particular space or spaces in the project, not upon the overall achievement. Three project categories are covered regularly: commercial, industrial, and institutional.

The goal is to put particular challenges into perspective to give readers immediate, precise guidance for developing their own lighting solutions. For example, a municipal aquarium presents a multitude of lighting opportunities. Exhibit lighting could differ from species to species and would differ from the lighting of glass shelving in the gift shop.

Articles

Projects written up as articles exemplify the best work being done in the lighting professions. Articles involve the full range of lighting situations and provide solutions that involve effective use of daylighting, interior and exterior electrical lighting, and the illumination of a variety of spaces. Grandeur is not a requirement, but quality is. A structure as direct and utilitarian as a warehouse, if it exemplifies the best potential of the lighting professions, would be considered alongside the spectacular projects frequently seen in the architectural press.

Architects and Designers:
Share your solution to a lighting problem — large or small. See the Project Submission Guidelines in this issue. Call or write for more information about spotlighting your work in *Architectural Lighting*.

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specific seeing tasks; that light, however, can be provided in many ways. Qualitative factors — user attitude, well-being, and motivation — are as important as the quantitative illumination requirements.

Color perception is yet another factor important to the appraisal and performance of a visual task. Color characteristics of light can significantly alter a person's appearance. Incandescent light sources, which are rich in the red region of the spectrum, complement and flatter the complexion, imparting a ruddy or rosy hue to the skin. Some fluorescent and high intensity discharge (HID) sources, which emphasize the yellow or blue range, produce a sallow or pale appearance.

Psychological experiments indicate that people are more accepting of "warm" colors of light (in the red region) at low brightness levels, while they accept "cooler" colors (in the blue region) at higher levels of illumination. This makes sense when one remembers that traditional sources of low level illumination for people were open fires, torches, candles, and oil and gas lanterns — all sources rich in the red region of the spectrum. Traditional sources of high intensity illumination have been the sun and sky, both relatively "cool" colors of "white" light.

Choosing the light source follows easily once you decide on the color, quantity, and distribution of light for a space. At the counter of a gourmet food shop, for example, a diffuse distribution may be desired to provide a general brightness level and shadow-free illumination at the work surface, in a color that renders food appropriately. To do so, one might choose a line voltage incandescent lamp for several reasons: a low-voltage light source, with its compact filament, would produce too narrow a beam spread to achieve a great diffusion of light; a fluorescent lamp, because of its poor color-rendering qualities, would make many foods appear unappetizing.

Placement and position of light sources depend to a considerable degree on the direction and distribution of the light decided upon. The visual perception of surface textures and sculptural form is drastically altered by the lighting scheme's location and distribution characteristics. To reinforce the natural textures and sculptural relief of a stone wall, for example, it is possible to accentuate the relationship between highlight and shadow with a grazing light produced by concentrated sources mounted close to the surface. Conversely, a more diffuse lighting condition will reduce the visibility of surface flaws and create a visual impression more suitable for a gypsum board wall or an acoustical tile ceiling.

When you have reached this point in the design process, choosing a light fixture to meet your requirements will lose much of its mystery. The staggering array of lighting equipment available will narrow to a few choices: luminaires that use the source selected, produce the required light distribution, and provide enough brightness control to prevent glare in the normal field of view.

The lighting equipment should also be coordinated with the architecture. Surface- or pendant-mounted fixtures, in particular, become architectural elements as well as lighting units and are important to design harmony and the general impression of space. A proper relationship between lighting units and materials produces a coordinated architectural result.

In a well-integrated space, a casual observer should even be unaware of the lighting and the mechanics of light production. Observers should be conscious only of the overall architectural environment — an environment that affects the way users feel about themselves and others and shapes the attraction they feel for surrounding activities and objects. In the end, it is not only the quality of light with which we are concerned, but also the quality of life. ■

The Parts Department

Sidney M. Pankin

The unpredictable cost of energy, precipitated by the high costs associated with the oil embargo of 1973 and 1974, has had significant and lasting effects on lighting design and applications. Restrictions and limitations in the art have become abundantly clear.

Some states are legislating limitations on lighting application that tie watts per square foot to construction permit approvals. The high cost of construction has at the same time forced reductions in the cubic footage of new buildings. These reductions, in turn, have squeezed the space between floors, which has reduced finished ceiling heights and thereby affected lighting distribution. Tighter plenum areas reduce the number of choices available to designers and may, for example, prevent the use of deep recessed fixture configurations.

Changes in architectural design concepts have modified the nature of the finished space and the resulting lighting design criteria. One such change is a reduction in lighting levels.

End users require energy-efficient systems that will reduce the utility energy bills, which weigh heavily on total energy costs and on each company's bottom line. Yet, those same end users may not accept bare-bones systems because they have a newfound awareness of lighting's importance to the environment of any space. Increasing numbers of users recognize a relationship between productivity and the visual comfort of people who use any given space.

Gone are the overgeneralized lighting design and excessive light levels common to the construction boom of the 1960s. The restrictions and limitations placed on lighting design by energy conservation have created exciting opportunities for creative lighting design and application.

The good news is that the lighting fixture and component manufacturers have come through with a remarkable flow of new products. This has been accompanied by the improvement and revitalization of many existing components. In combination, these factors provide designers with a wide range of tools and techniques for accomplishing effective design within the constraints of energy conservation demands.

In some states, construction permit approvals are tied to watts-per-square-foot limitations.

Interest in the retrofit of existing fixtures has also been stimulated by the development of new concepts and products, such as optical reflectors; solid-state high-frequency, and high-performance core and coil ballasts; and miniature fluorescent lamps. Now older fixtures can be updated and lighting problems can be solved based on effective investments funded by energy-use cost-reduction dollars.

Over the next few months, this column will explore the new products and developments listed in the accompanying table. The goal is greater awareness of and basic knowledge about the products available to lighting designers to benefit both designers and end users.

An admonition applies even to this column, however: don't believe anything you read, see, or hear about lighting. Try it yourself. The ultimate challenge to and responsibility of designers is to combine the various components into an effective lighting system — a system that considers the quality and quantity of light required to meet the needs of a space within project budgets and energy use limitations dictated by economics and legislative mandate. ■

New products and developments

Fluorescent
Higher performance energy-efficient lamps
Color temperature and triphosphor lamps
Miniature fluorescent lamps
Energy-efficient ballasts
High-performance ballasts
Solid-state high-frequency ballasts
Solid-state continuous- and intermittent-dimming systems
Shielding devices

High intensity discharge
Color-corrected metal halide
Lower wattage high-pressure sodium lamps
New fixture approaches to HID

Incandescent
Tungsten-halogen (quartz) PAR lamps
Low-voltage accent lighting systems
Reflector and PAR lamps

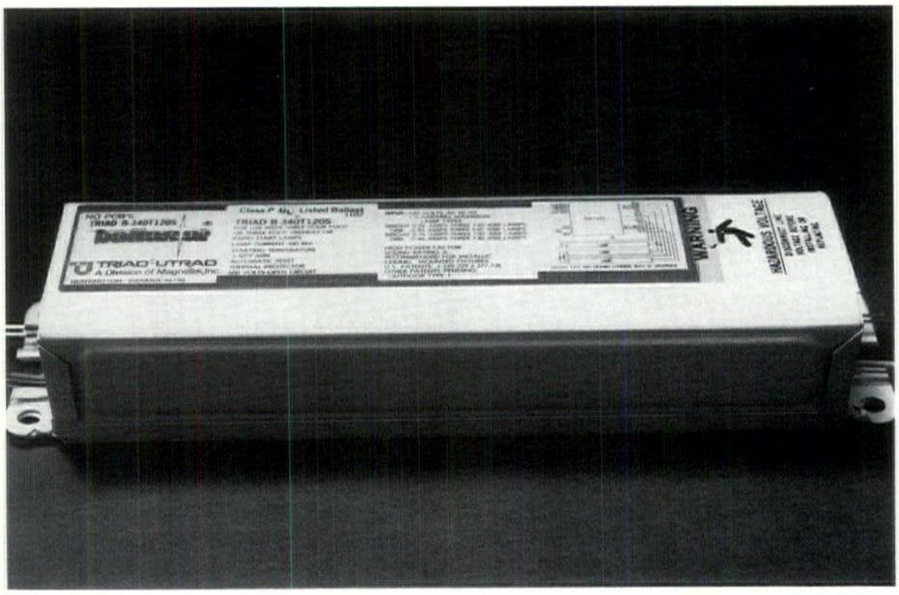
Shielding devices
Louvers, lenses, and special application shields

Retrofit components
Optical reflectors

Lighting controls
Occupancy sensors
Impedance-modification devices
Voltage control
Programmable timers
Dimming

Sidney Pankin, the principal of Pankin & Associates, Inc., is a lighting applications engineer who specializes in lighting design, energy conservation, and the design and fabrication of lighting retrofit components.

Product Showcase

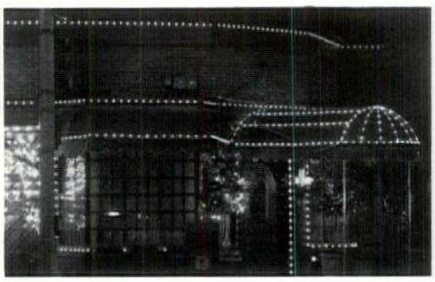


■ Light-level switching system

The Triad-Utrad Ballastar light-level switching system ballast, an integral feature of six Ballastar models, gives the user the option of reducing lighting levels by 50 percent. This capability suits the ballast for reducing glare on computer screens and for reducing maintenance and security costs for nighttime lighting in commercial and institutional applications.

The ballast can be manually activated with a blade-type wall switch and is compatible with any standard 30- or 40-watt fluorescent lamp. A three-year warranty covers the ballast, which is interchangeable with standard ballasts for easy retrofit, according to the manufacturer. Triad-Utrad, Huntington, IN.

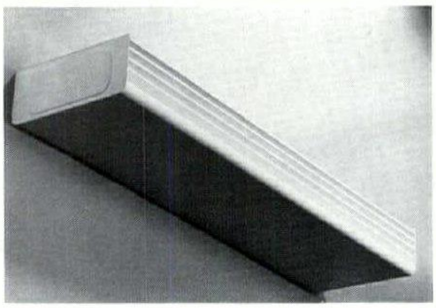
Circle 55



■ Decorative tube lights

New 12-volt decorative tube lights from Verax can be used with the firm's UL-listed solid state power supply. The 1/4-inch-diameter lights, which previously had to be custom made, can now be purchased off the shelf with all accessories included. Ordinary scissors are adequate to cut the lights to size on the installation site. Verax Corporation, Los Angeles, CA.

Circle 56

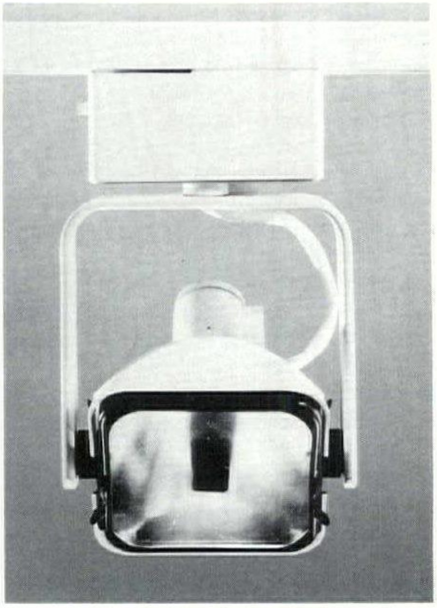


■ Indirect lighting

The ILS System from Mark is an indirect fluorescent lighting system designed to create a comfortable working environment and eliminate glare on computer screens. The design allows light transmission through both the side louvers and the open top of the fixture. This develops a wide lateral distribution and avoids the problem of a ceiling hot spot directly above the fixture, according to the firm.

The wall mounted (shown here) and pendant fixtures are supplemented by the Solitaire line of independently mounted fixtures and by panel and cabinet units for open office spaces. The system can keep energy use below 1.8 watts per square foot, the manufacturer reports. Mark Lighting Fixture Company, Inc., Moonachie, NJ.

Circle 57



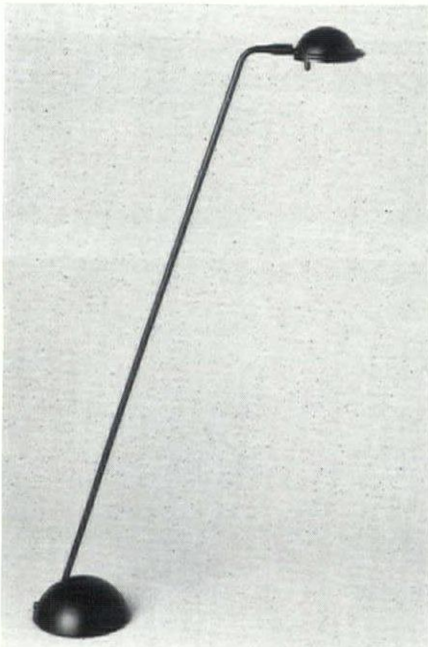
■ Adjustable track lighting

The Super Beamer from Lightolier is one of the latest additions to the manufacturer's Lytespan track lighting collection. The 75-watt luminaire is the only low-voltage fixture with an adjustable beam spread, according to the firm. By turning a knob, a user can change the spread from very narrow (6 degrees) to medium (18 degrees). This flexibility permits a variety of lighting effects with a single lamp.

Another unusual feature of the luminaire is a permanent, built-in reflector designed to precisely control and direct light without spill. The fixture uses a miniature tungsten halogen lamp (manufactured by OSRAM) that is substantially less expensive to replace than conventional low-voltage lamps with reflectors. A lens cap placed directly over the lamp cuts glare.

The optical system generates 20 percent more light per watt than comparable low-voltage units, according to the firm. Two spread lens accessories allow the user to create wide or "stretched" beams. Dimming requires only conventional dimmers instead of the special low-voltage types commonly used. Lightolier, Secaucus, NJ.

Circle 58



■ Designer lamp

Koch + Lowy's 3-foot, 6-inch Haute Couture designer lamp is furnished with a 20-watt multimirror halogen bulb. A full-range dimmer switch is mounted on the shade. Polished brass, polished chrome, and black enamel finishes are available. The Couture, a 2-foot adjustable desk lamp, is similarly designed. Koch + Lowy Inc., Long Island City, NY.

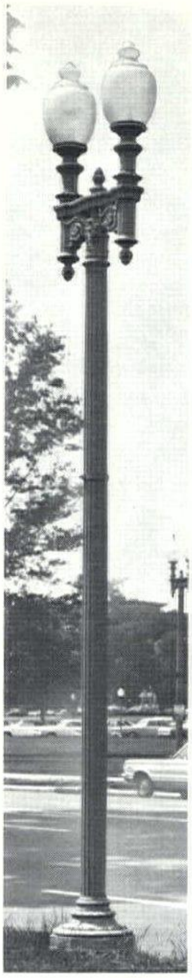
Circle 59

Enhance the beauty of your landscape with the elegance of superbly crafted lighting posts by Spring City

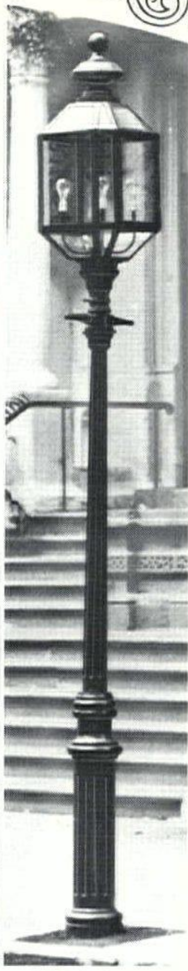
You will be in good company when you light the way with our historically accurate, heavy duty, *Cast Iron* lighting posts. Independence Hall in Philadelphia, for example; the U.S. Military Academy at West Point; Boston Common and William and Mary College in Williamsburg to name just a few of the thousands of locations where these lighting posts are prominent.

The light sources available are: incandescent, mercury vapor, metal halide or high pressure sodium.

Write or call for further information and literature that will illustrate and describe why we are the leading manufacturer of ornamental lighting posts in the United States.



WASHINGTON-TWIN - Capitol Area, Washington, D.C. 10'8" to 17'8" heights (excluding luminaires), 17" O.D. to 25" octagonal bases. Available with four luminaires.



HANCOCK - Boston, Mass. 9' to 13' heights (excluding luminaire) with 10½" O.D. base. Available as a 46" high bollard.

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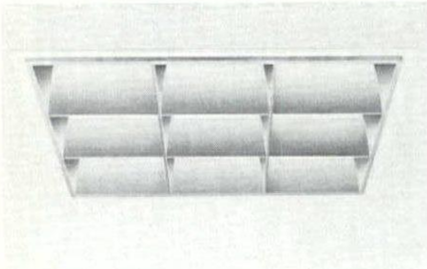
Circle 22

■ Luminance meter

The Minolta Luminance Meter 1° takes spot readings of light sources and surface brightness. The meter features a flareless optical system that ensures that its photo cell will measure only the light within the 1-degree reading spot, without influence from the surrounding area. Measurements are instantly registered on the viewfinder's LED digital display.

The meter's ability to read flickering sources makes it ideal for metering video and movie screens as well as indoor and exterior lighting, reports the manufacturer. Available accessories include three close-up lenses that provide accurate close-up readings of small light sources and surface areas. Industrial Meter Division, Minolta Corporation, Ramsey, NJ.

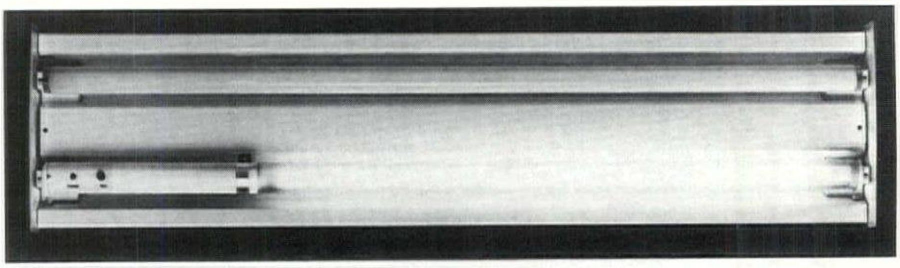
Circle 60

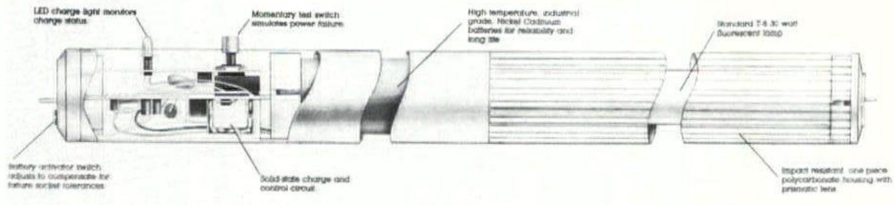


Fluorescent downlights

New fluorescent downlights from Omega Lighting use three 13-watt PL lamps for operation. A nine-cell aluminum parabolic assembly snaps into a 12-inch-square aperture with trim. Omega Lighting, Melville, NY.

Circle 61



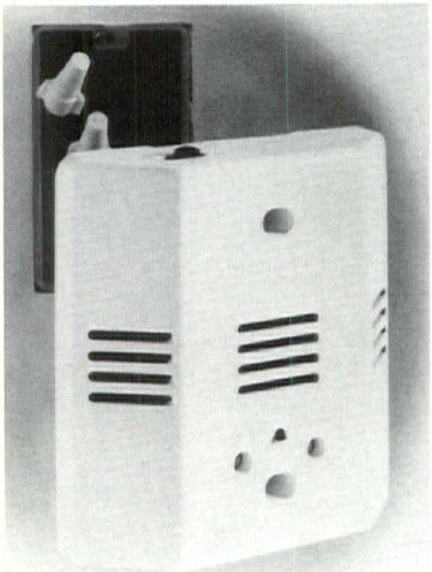


Emergency lighting unit

The Stick SLS 4, a new self-contained unit that allows a standard fluorescent luminaire to operate as an emergency light for up to 2 hours, has been introduced by Sure-Lites. Designed to function in both new and existing fluorescent fixtures that would typically be fitted with integral emergency ballast packs, the unit requires no special wiring or connections, according to the firm.

The unit fits into most 4-foot fluorescent fixtures and under normal conditions functions as a lamp. In emergency mode, the unit supplies enough battery power to maintain an illumination level of 650–700 lumens. The nickel-cadmium batteries are coupled with a solid-state charging and switching circuit. Sure-Lites, Elk Grove Village, IL.

Circle 63



Sensor switch

The Ultralight 800 presence-sensing automatic light switch from International Conservation Systems directly replaces a conventional light switch and can operate on any voltage from 125 to 227 volts AC. The device automatically turns lights on when it detects body movement. It turns lights off after the last occupant leaves and no motion is detected for a preprogrammed interval of 5 to 25 minutes. The manufacturer recommends the switch for offices, restrooms, storage rooms, copy rooms, and other areas of up to 250 square feet. International Conservation Systems, Inc., Austin, TX.

Circle 62

Electronic tuning ballast

A single Model 440 electronic tuning ballast from XO Industries drives all four lamps in a standard fluorescent fixture. Its solid-state circuitry permits full light output at low lamp currents, cutting the cost of power for lighting by as much as 35 percent, according to the manufacturer. XO Industries, Inc., Mountain View, CA.

Circle 64

Indoor-outdoor luminaire

The Mini-BMF luminaire, which uses a 250-watt metal halide lamp, is a cost-effective replacement for 300- to 1000-watt standard incandescent

PAR lamps, according to ARC Sales. Equipped with a clear lens, the fixture supplies an elliptical beam pattern with an intensity of 311,000 candlepower.

Two optional spread lenses allow for custom shaping of the beam for specific tasks at a task distance of 500 to 150 feet. Suitable for both indoor and outdoor applications, the luminaire provides excellent color rendition (93 CRI) and is especially useful for controlled accent lighting. ARC Sales, Inc., Salem, MA.

Circle 65

AC, DC or Both . . . Designer Series Signs Fit One Size.

The physical dimensions of Yorklite Designer Series Exit Signs do not change, with or without the battery pack.

Yorklite is trying to help eliminate dimensional fitting problems for exit and emergency lighting designers and engineers. Our unique internal battery system design in the PAX model will allow you to choose any Designer Series Exit Sign in all locations, whether self-power or remote power is required.

The durable (injection-molded Lexan®) and compact Designer Series' are available in beige, black or white. Red or green letters (6" × ¾") are standard and lenses are specifically designed to eliminate hot spots and dark areas. Universal knockout arrows are also standard but arrow end caps are available as an option.

All Yorklite Designer Series units are available with 5 Watt PL lamps for excellent illumination as well as high efficiency. Top, back or end mounting capabilities also exist for easy installation to any 3½", 4" or single gang box.

Simplify your fitting problem by specifying Yorklite's Designer Series. The Exit Sign that fits one size. For more information concerning emergency lighting or power systems, call us at 512-385-1773.

YORKLITE

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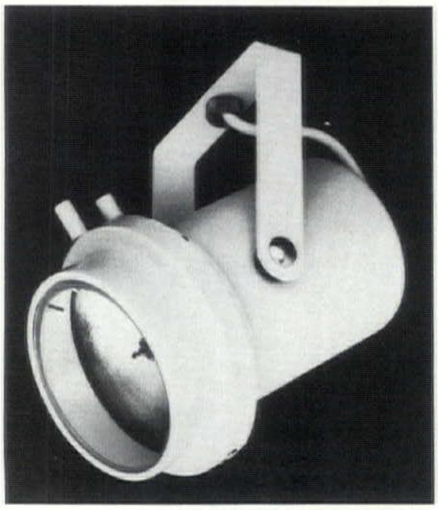
Circle 23

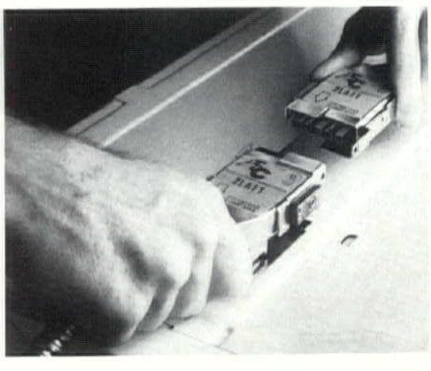


■ PAR 36 lamp holder

The Litelab LPB-5 lamp holder allows PAR 36 beam orientation to be rotated 355 degrees and the lamp secured in place. The holder features external control of the rotating lid and locking device; it allows precise control of the horizontal and vertical orientation of the projected beam and allows users to preset the desired placement for replacement lamps.

The unit's louver and glass filters are retained within the fixture lid to prevent the spill and glare of untreated light. The lamp holder is available with the manufacturer's standard array of 16 fittings and 10 painted and metallic finishes. Custom installation and color matching are optional. Litelab Corp., Buffalo, NY.

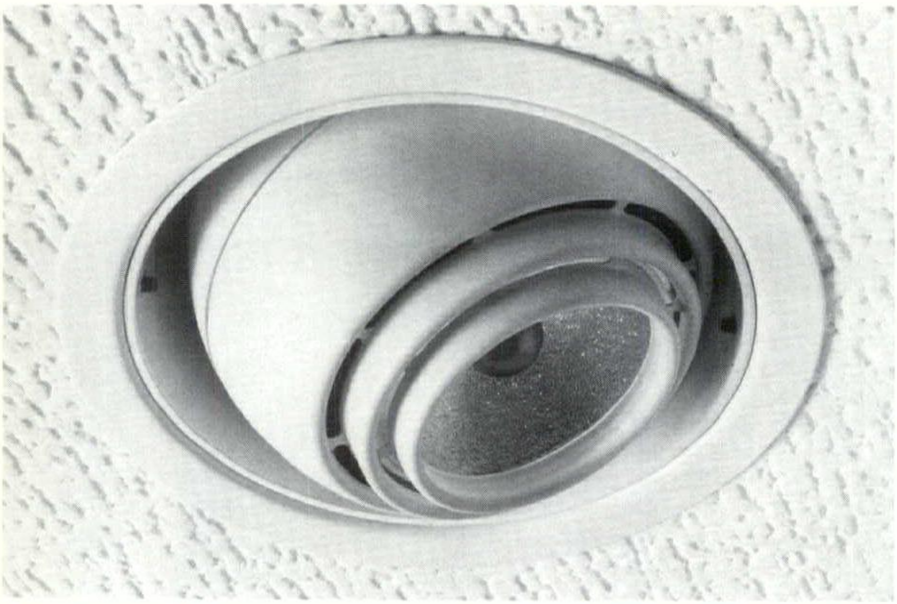
Circle 66

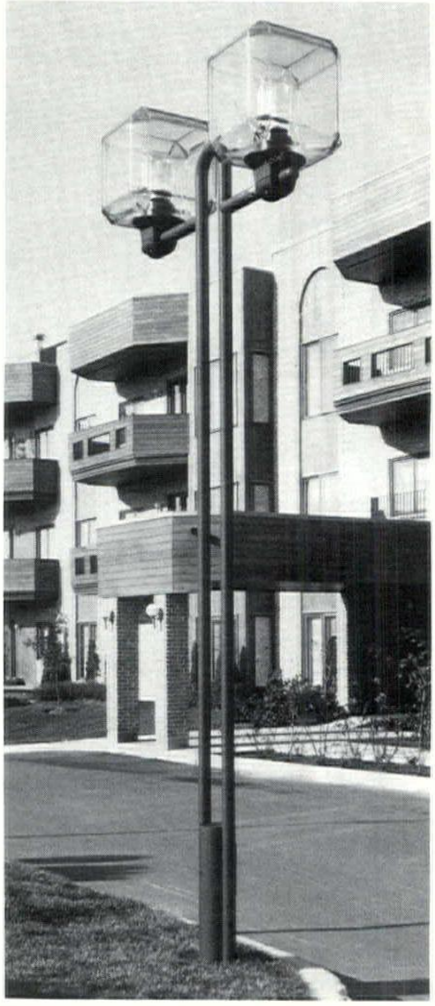


■ Wiring system

AFC has introduced a flexible wiring system that is UL listed and labeled (95B6). The Flex' system features fast and easy installation of a coordinated means of distributing lighting branch circuits and is compatible with all fluorescent and incandescent lighting fixtures, according to the manufacturer. AFC, New Bedford, MA.

Circle 67



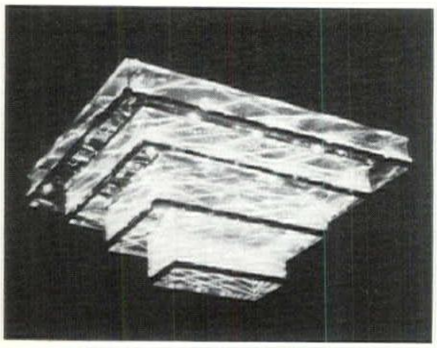


■ Low-voltage miniature luminaire

The Recessed Orb II miniature recessed luminaire for 20-watt and 50-watt quartz halogen lamps has been added to the Alesco line of fixtures by Sylvan Designs. The luminaire is less than 6 inches in diameter, including trim ring; it rotates 360 degrees horizontally and can be adjusted as much as 30 degrees from vertical. The fixture aim point can be locked in place, and once locked remains in position even after relamping.

The firm offers the luminaire in narrow spot and wide flood versions. It can be used to light small areas selectively, to provide functional lighting for reading or traffic control, or to highlight decorative accents, according to the manufacturer. Sylvan Designs, Inc., Northridge, CA.

Circle 68



■ Custom-made chandelier

A chandelier created for the Green Bay Performing Arts Center in Green Bay, Wisconsin, exemplifies the services provided by Appleton Lamplighter, a custom lighting fabricator. The firm designed and built the chandelier, which reflects the Art Deco style of the 86-year-old building, and also designed and supervised the installation of a winch system for suspending the chandelier. Made up of more than 2000 glass rods, the chandelier measures 10 feet by 8 feet, is 7 feet deep, and features a mirrored acrylic top to reflect light downward and create more sparkle. Appleton Lamplighter, Appleton, WI.

Circle 69

■ Pole lighting

Clear, opal, and champagne versions of Lumec's LLPLC Polycube globes can be mounted in a variety of standard arrangements or can form the basis of a custom design. Each 18-inch-square globe is formed of a single cube-shaped piece of molded polycarbonate, a material that offers superior resistance to impact and ultraviolet rays, excellent optical quality, white color purity, and a smooth surface that reduces dust collection, according to the manufacturer.

The luminaires created with the globes can accommodate 50- to 150-watt high pressure sodium, 175-watt mercury vapor, or 200-watt incandescent lamps. A constant-wattage ballast is located within the globe or inside the mounting base, depending on project specifications. An isolated secondary type of ballast can also be used.

Poles and mountings for the globes are made of aluminum or steel and can hold from one to five units. The manufacturer offers black semi-gloss and bronze-colored finishes. Lumec Inc., Boisbriand, Quebec, Canada.

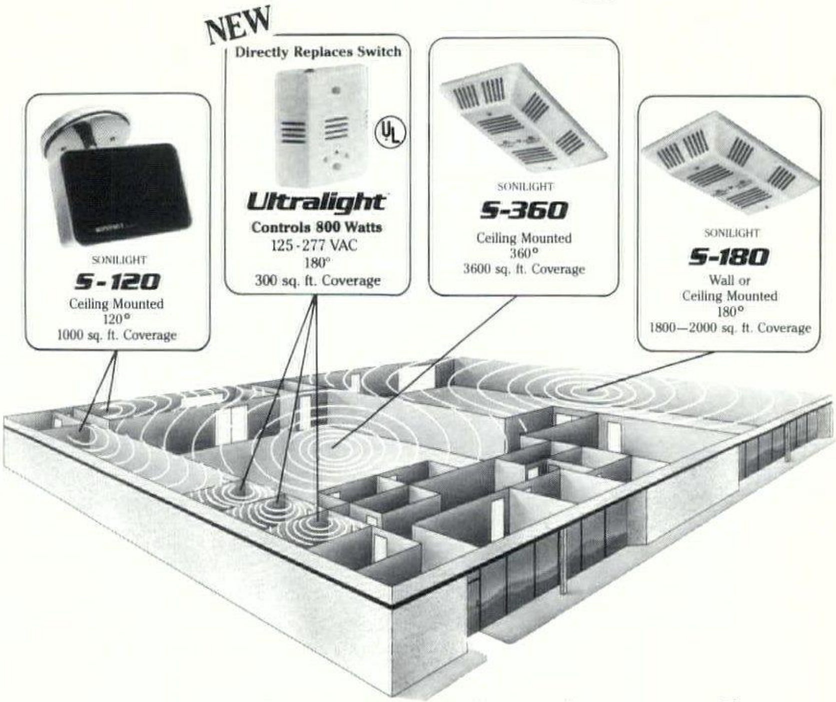
Circle 70

■ Floodlight

The AFL series architectural floodlight from Kim Lighting is designed for both indoor and outdoor use. The floodlight is available in three beam patterns, three colors, nine mounting configurations, and six high intensity discharge lamp modes. Kim Lighting, City of Industry, CA.

Circle 71

Now automatically control lighting in ANY area with presence-sensing control technology!



Any size or shape. . . we have it covered!

ICSI's line of presence-sensing devices automatically turn off lighting (and HVAC when used with ICSI's SB-5090 setback thermostat) when presence has not been detected in coverage area.

ICSI's Presence-sensing devices automatically control lighting and HVAC in:

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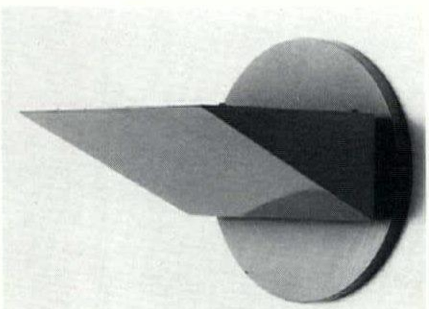
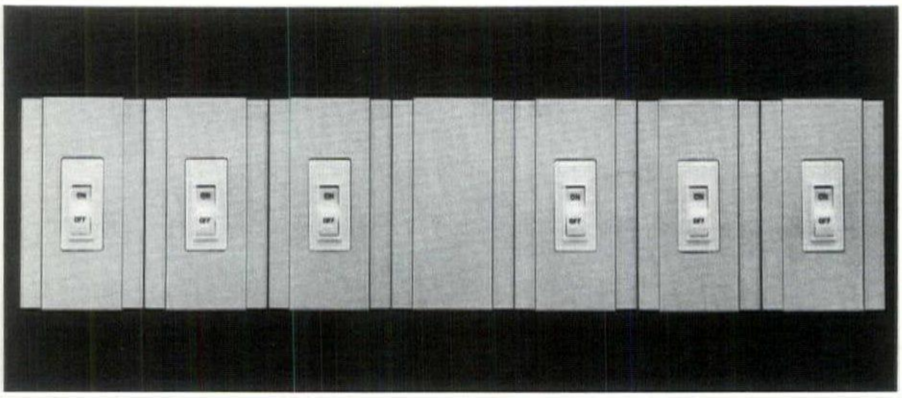
Circle 24



■ Uplight

The Wedge, a wall-mounted miniature uplight from Norbert Belfer Lighting, projects only 5¼ inches from the wall. Its specular anodized reflector directs a wide beam of light upward from a 150-watt quartz halogen lamp. The luminaire's body and back plate are formed of cast aluminum and can be finished in matte black, matte white, or dark bronze. Norbert Belfer Lighting, Ocean, NJ.

Circle 72



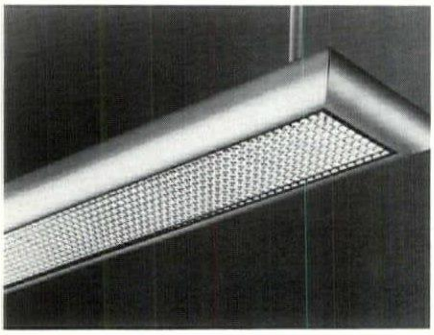
■ Dimmer module

The M-PAC remotely controlled dimmer module from Prescolite Controls can be used with a standard or low-voltage incandescent, fluorescent, neon/cold cathode, or fan-motor load. The 1200-watt, UL-listed module features toroidal RFI filtering, both voltage and temperature compensation, and silent electronic on-off switch operation.

Each module contains an illuminated, magnetic circuit breaker and high and low trim controls that are accessible from the front of the unit. No larger than a standard 600-watt single gang wall-box dimmer, the unit is suited for applications in which a large number of small lighting loads must be controlled, such as restaurants, bars, small churches, and audiovisual rooms.

The manufacturer supplies the modules preganged, prewired, and ready to install in standard 3 1/2-inch-deep masonry boxes. Prescolite Controls, Carrollton, TX.

Circle 73



■ Direct and indirect light

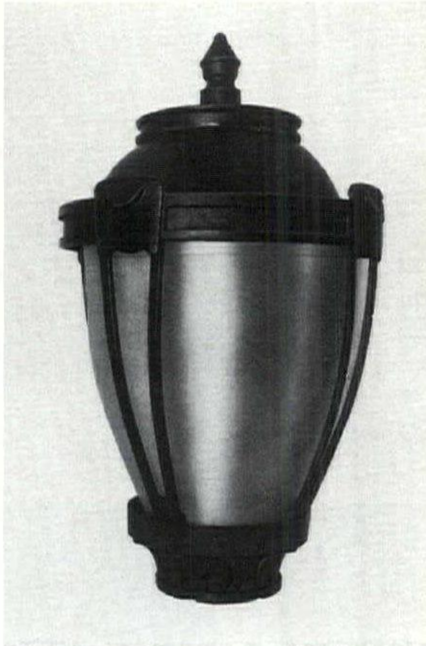
The Series 66 luminaires from Neo-Ray Lighting provide both direct and indirect light for open spaces and video display terminal applications. A small-cell parabolic louver controls the direct downlighting. Two 1-inch-diameter T 8 lamps are enclosed in the aluminum body of each luminaire; finishes vary from polished and anodized mirror chrome to a wide variety of painted colors. Neo-Ray Lighting, Brooklyn, NY.

Circle 74

■ Compact fluorescent floodlight

The newest Reflect-A-Star PL compact fluorescent floodlight from Lumatech uses a 5-watt lamp that can replace a 75-watt incandescent lamp. Its compact, screw-in design allows it to fit most downlights, track lights, and outdoor flood holders, according to the manufacturer. Optional colored lenses are available. Lumatech Corporation, Oakland, CA.

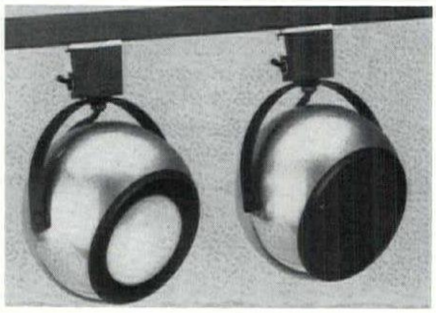
Circle 75



■ Outdoor lighting

Sentry Electric's SBP luminaires combine a traditional appearance with vandal-resistant construction. Metal halide, high pressure sodium, or mercury lamps can be used with the luminaires, which can be installed atop poles. In a streetside setting, internal prismatic refractors can direct the beam spreads so that two-thirds of the light falls on the roadway and one-third on the sidewalk. Sentry Electric Corporation, Freeport, NY.

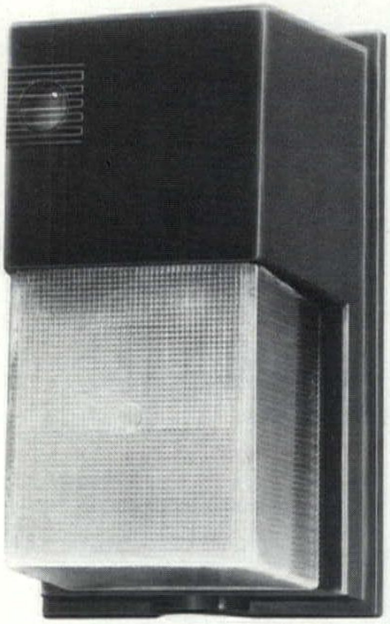
Circle 76



■ Sound and light

Trimtrac Lighting has developed Stereotrac, a track lighting system that accommodates both luminaires and miniature stereo speakers. The speakers, similar to those typically used in automobile stereos, fit inside the same housings chosen for the track lights and can be connected to any type of sound amplifier compatible with external speakers. The system uses R 30 lamps, which can be controlled by a dimmer switch independent of the speakers. Trimtrac Lighting Corporation, Miami, FL.

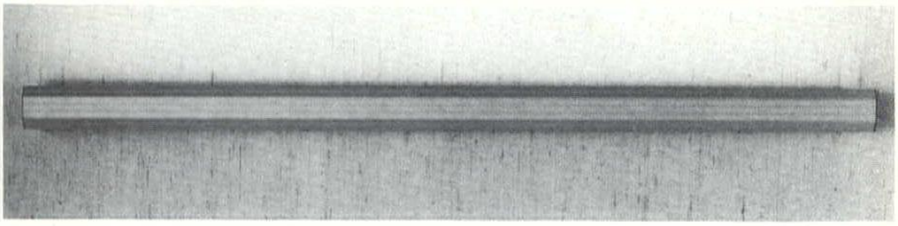
Circle 77



■ Wall-mount luminaire

The Energy Savr II outdoor wall-mount luminaire is offered by American Electric for use with 35-, 50-, or 70-watt high pressure sodium or 9-watt compact fluorescent lamps. The luminaire's one-piece polycarbonate housing has a pebble-grain texture and a bronze finish, and its die-cast aluminum back plate allows for either electrical-box or conduit flush wall mounting. American Electric Division, FL Industries, Inc., Southaven, MS.

Circle 78



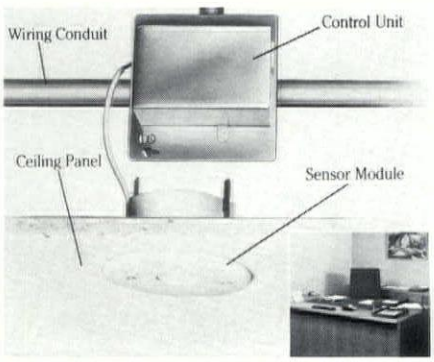
■ Wall-mount fluorescents

Wallscapes wall-mount fluorescent luminaires from Alkco can provide downlighting, indirect lighting, or a combination of the two. A 10½-inch-long version of the luminaire performs as a sconce; the fixtures are also available in 2-, 3-, 4-, and 5-foot lengths. They may be row mounted for continuous runs of uninterrupted illumination.

The downlight, used for task lighting, can be specified with either a prismatic acrylic lens for diffuse illumination or a specular parabolic cell louver for a more concentrated downlight. Either version can be combined with the indirect lighting lens, or the unit can perform solely as an indirect light. Sconces use compact fluorescent lamps; longer fixtures use either T 8 or T 12 lamps.

All luminaires in the series are UL listed for use in damp locations. They are constructed of extruded aluminum and are finished in standard neutral gray or a custom anodized or painted finish. Alkco, Franklin Park, IL.

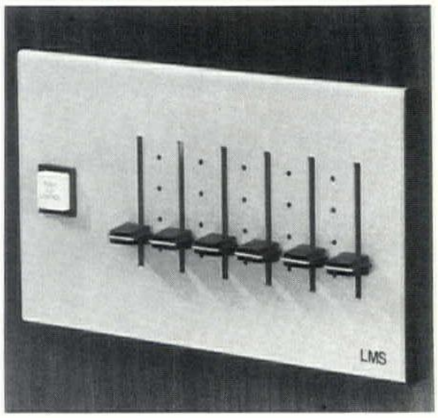
Circle 79



■ Occupancy sensor

The Lite-Sense system from Thomas & Betts comprises a control unit and a passive infrared sensor that detects the movement and body heat of persons entering or leaving a room. The system automatically turns lights on as persons enter; it turns lights off after a delay of up to 22 minutes after they leave the room. The time delay is designed to allow momentary traffic without turning lights on and off needlessly. Electrical Group, Thomas & Betts Corporation, Raritan, NJ.

Circle 80



■ Control station

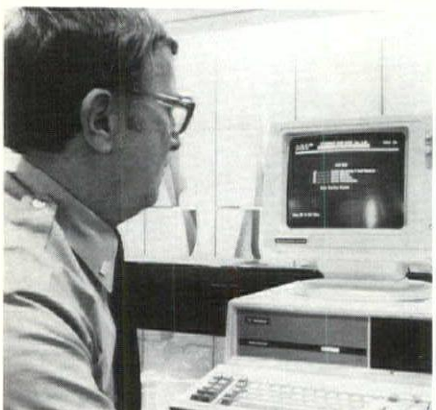
Colortran's LMS 100 architectural lighting control stations provide direct manual control over as many as six lighting channels. Sliding controllers provide precise control and flexibility for applications in which lighting needs cannot be met with a series of predesigned settings. The firm also offers three other groups of control stations with its LMS control system. Colortran, Inc., Burbank, CA.

Circle 81

■ Table lamp

Both body and shade of the Zink table lamp from Ron Rezek Lighting + Furniture are constructed of galvanized steel and brass and may be finished in satin black. The luminaire accepts an incandescent lamp and measures 14 inches in diameter at the shade and 21 inches high. U.S. distributor: Artemide Inc., New York, NY.

Circle 82



■ Computerized system

INCOM, a new lighting and energy management system from Westinghouse Electric, is controlled by a personal computer operated by security guards or other building management personnel. Designed for use in buildings of more than 50,000 square feet, the system can be used to control heating and cooling as well as the lighting in office buildings, retail stores, warehouses, and other commercial and industrial buildings.

As many as 128 remote units, each of which controls 42 circuits, work together with the computer and software to maintain desired lighting levels. Local override switches located throughout the building enable personnel or tenants to adjust lighting in specific areas. The manufacturer offers optional dial-up load control, off-site access, remote diagnostics, and data logging and report generation. Westinghouse Electric Corporation, Pittsburgh, PA.

Circle 83

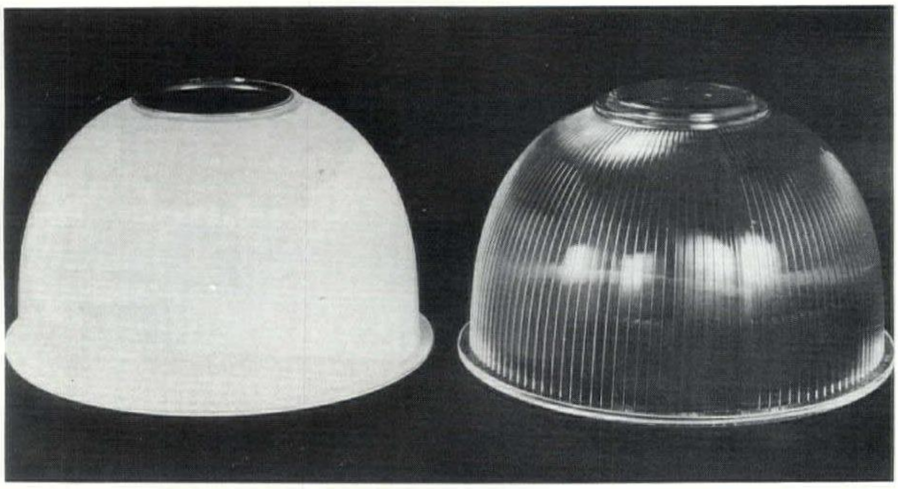
■ Low-voltage luminaires

Die-cast luminaires in the Multi-Reflector (MR) Series from Lighting Services Inc are miniaturized low-voltage units that accommodate 20- to 75-watt MR 16 dichroic lamps. Beam spreads range from very narrow spot to wide flood. Each unit comes complete with an integral transformer for standard 120-volt input, except for a transformerless version compatible with the firm's 12-volt LSI track.

Track fittings, twist-on fittings, universal fittings, C-clamps, conversion units for recessed fixture mounts, and freestanding bases for desktop, shelf, or floor use are among the mountings available for the units. Glass color filters in 49 different permanent colors are offered, as are a beam conditioner, spread lens, louver, ultraviolet-blocking filter, and light blocking screen.

The basic fixture colors are black, white, and aluminum; the unit's swivel cap is available in a six colors. Lighting Services Inc, New York, NY.

Circle 84



Reflector metallization

Holophane's new Prismetal process fuses a metal coating to the rear surface of a circular prismatic glass reflector, enabling it to produce a uniform square or rectangular distribution.

Without the coating, dark spots and hot spots can occur when reflectors such as the one shown above at left are used to light a quadrilateral area. The square light pattern produced by a coated reflector such as the one shown above at right minimizes light overlap and the number of units needed to illuminate a given area, according to the firm.

Typical applications include parking lots, shopping centers, plant production floors, and highways and streets. Partially coated reflectors are particularly suited to warehouse aisle lighting, in which vertical illumination of the stacks is necessary. Holophane, Denver, CO.

Circle 85

Area lighting

North Star Lighting furnishes its new 1000-watt area and sports lighting fixture with a metal halide lamp. The lightweight, compact fixture is said to require less support than standard sports lighting and has five interchangeable lenses to modify the light beam.

The optional sealed beam lamp for hot restrike features a high-voltage ignitor system that restarts the lamp in 2 seconds or less in case of momentary power dips or failures. The standard lamp restarts in approximately 7 minutes, still less than the 15 to 20 minutes characteristic of lamps of this type, according to the manufacturer. North Star Lighting Inc., Broadview, IL.

Circle 86

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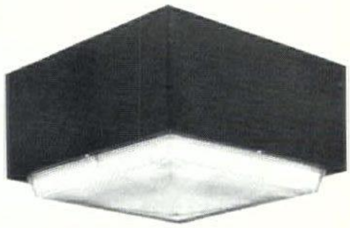

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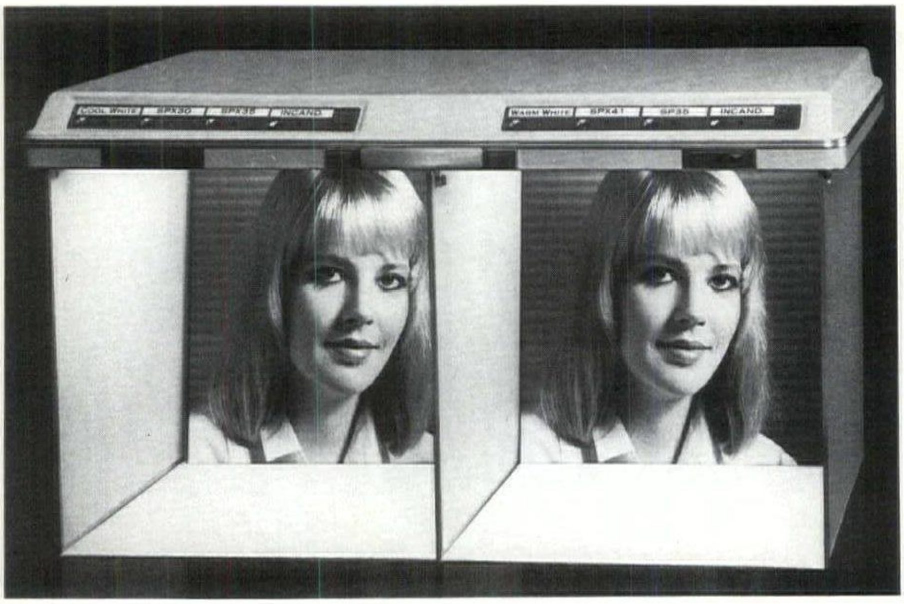
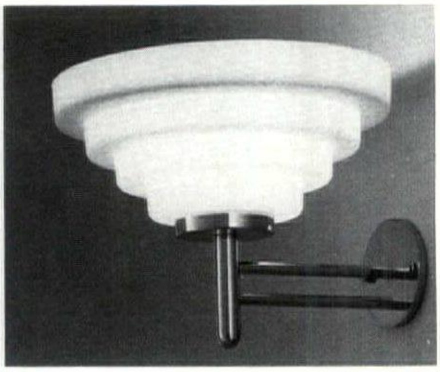


■ Color evaluator

A new portable lighting color evaluator from General Electric Lighting Business Group permits visual comparison and evaluation of fluorescent and incandescent lamps in a controlled environment. The table-top demonstrator weighs 35 pounds and folds into a carrying case. It opens to reveal two 18-inch-square lighted compartments, each equipped with four lamp positions, including three for fluorescent and one for incandescent.

The unit is supplied with two lamps each of 10 different fluorescent lamp colors plus two incandescent lamps, a pair of identical comparison cards with a color portrait on one side and color bars on the other, and a hand-held remote control. The manufacturer recommends the evaluator for client presentations. General Electric Lighting Business Group, Cleveland, OH.

Circle 87

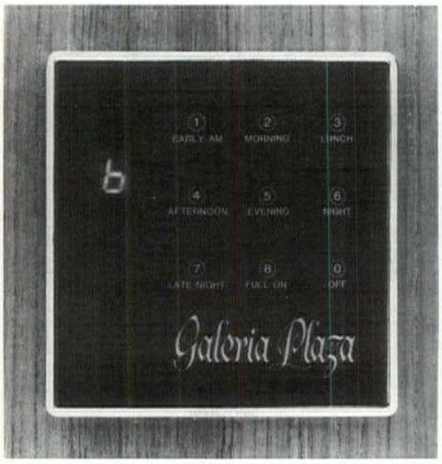


■ Glass sconces

Visa Lighting is introducing a line of glass fixtures. The sconces feature hand-blown cased European glass diffusers accented with brass, chrome, or a painted finish. Incandescent or fluorescent lamping is available.

The CB1600 fixture, shown here, combines a stepped glass diffuser with brass, polished chrome, or painted accent pieces. The fixture, which is 10½ inches high and extends 15 inches, requires either a 100-watt incandescent lamp or a 44-watt fluorescent lamp. Visa Lighting, Milwaukee, WI.

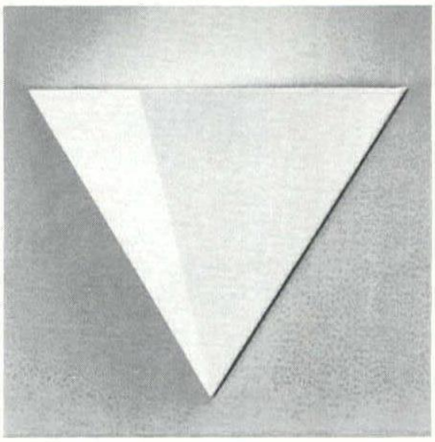
Circle 89



■ Control panels

Control panel of the new élan series from Master-Dim define lighting application by function, simplifying selection of lighting levels. A user touches any corner of the neutral gray 5-inch by 5-inch unit to illuminate a display of as many as eight preset choices, then touches the command for the desired choice. All lighting for the application selected is set automatically. Once the selection is made, the panel display turns itself off. Master-Dim, Dallas, TX.

Circle 88



■ Incandescent sconces

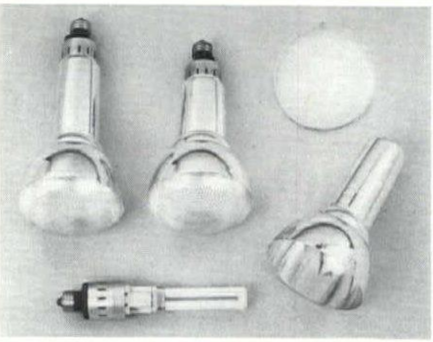
Designed by Gruppo Lefsina, the Argo incandescent wall sconce from Eleusi is available in two sizes and in brass or baked enamel finishes. U.S. distributor: Innovative Products for Interiors, Inc., New York, NY.

Circle 90

■ **Theatrical lighting**

Times Square manufactures a line of theatrical lighting fixtures that also are suitable for display and exhibit applications. Focusing knobs on the 3-inch and 6-inch fresnels pictured here let the user adjust focusing from narrow spot to wide flood. The fresnels are equipped with color frame holders that accept a wide range of diffusion filters, colored gel media, barn doors, and other accessories. All fixtures are compatible with energy-saving long-life lamps and can be specified with track adapters, pipe clamps, ceiling canopies, or wall brackets. Times Square Lighting, Stony Point, NY.

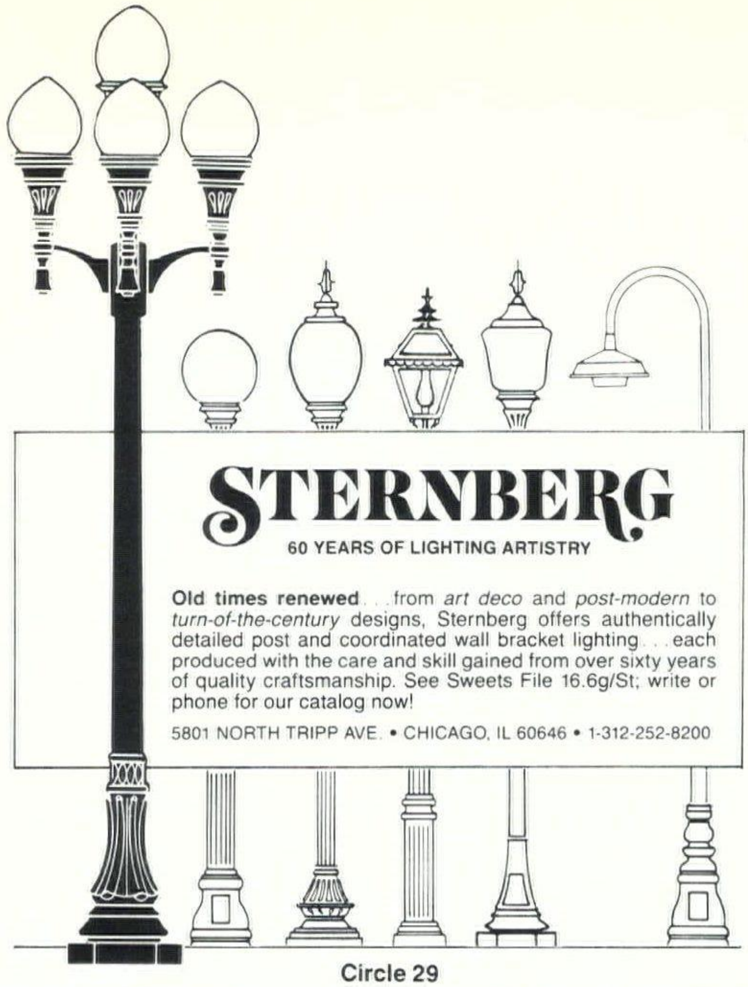
Circle 91



■ **Screw-in fluorescent units**

Energy Conservation Products has developed screw-in fluorescent fixtures that replace incandescent lamps. The fixtures simply screw into existing incandescent sockets; they accommodate 5-, 7-, and 9-watt fluorescent lamps that replace 25- to 150-watt incandescent lamps. An optional diffuser gives the unit an appearance similar to a PAR lamp. Conversion to the fixtures can save the user up to 94 percent on lighting costs, the manufacturer reports. Energy Conservation Products, New York, NY.

Circle 92



Circle 29

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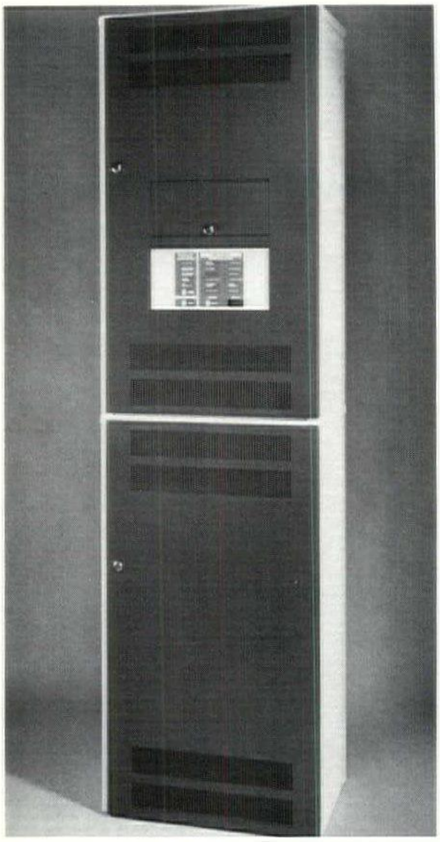


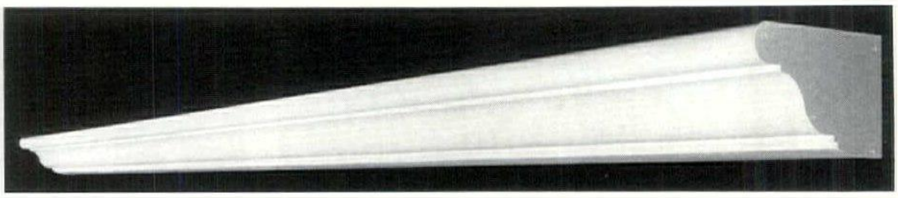
■ Emergency power system

The Spectron emergency AC power system provides power for emergency lighting and other electric equipment within 500 milliseconds of an outage or a 20 percent reduction in voltage, according to the manufacturer, Dual-Lite.

The microprocessor-controlled system automatically monitors performance parameters, performs periodic battery discharge and recharge cycling, and provides self-diagnostic service indications on a central display panel. Audible and visible alarms alert maintenance personnel if the system detects potential or actual malfunctions.

Modular cabinetry design and compact base dimensions allow individualized equipment layout and installation of the system in areas with limited space available. Dual-Lite, Inc., Newtown, CT.

Circle 93



■ Linear lighting

Robert Sonneman has designed a new group of articulated linear lighting fixtures for Architectural Lighting Systems. The cove lighting system, shown here, is a wall-mounted indirect light source that can be customized to meet individual job requirements or specified from four standard lengths, individually or in continuous runs. The system is available in four styles and in one-lamp and two-lamp configurations. Architectural Lighting Systems Inc., Taunton, MA.

Circle 94

■ Ornamental globes

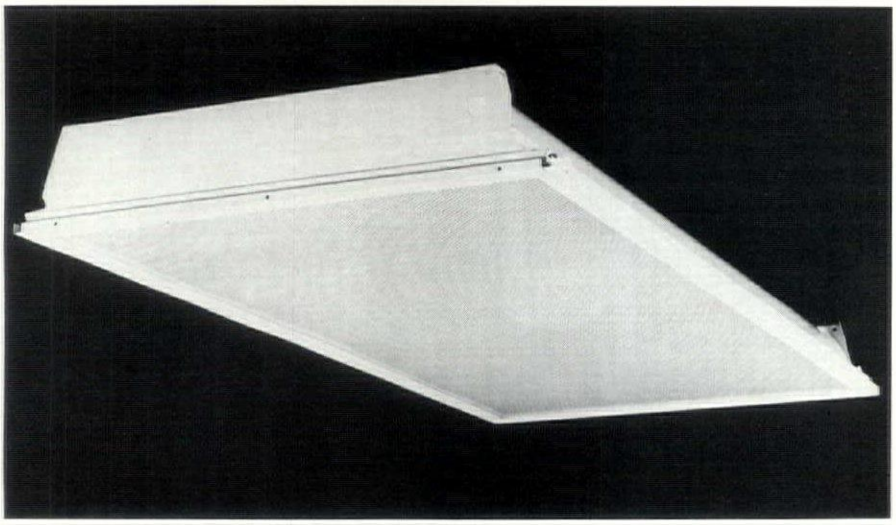
TrimbleHouse's new polycarbonate replacement globes feature impact resistance to −40 °F, excellent light transmission, and high heat resistance, allowing the use of high-intensity lamps, the manufacturer reports. Globes are available in a variety of styles in frosted, white, or smoke. TrimbleHouse, Norcross, GA.

Circle 95

■ Power reducer

Save-A-Watt fluorescent lamp power reducers (FLPRs) are said to reduce the power consumption and extend the useful life of fluorescent lamps and to reduce ballast operating temperature. A magnetic base permits fast installation at any convenient location in the troffer. Ten-year warranties cover these FLPRs, which are designed to withstand physical and environmental extremes. All components are potted in a material that is resistant to cracking under operating conditions. Save-A-Watt, Inc., Miami, FL.

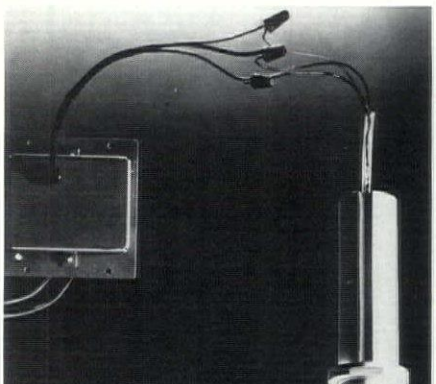
Circle 96



■ Lensed troffers

The new 5000 + series of lensed fluorescent troffers from Columbia Lighting includes both static and air-handling luminaires with steel or extruded aluminum doors. All are available with a variety of optional features to fit specific installation requirements. These include fusing, dimming, special wiring systems, special ballasts, RFI suppressors, and — for the static luminaires only — emergency ballast packs. Columbia Lighting Inc., Spokane, WA.

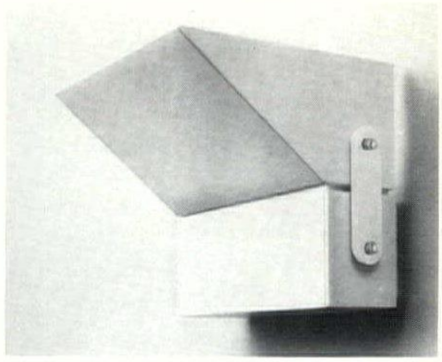
Circle 97



■ Infrared sensor

Infracon, a passive infrared lighting control and occupancy sensor developed by Tishman Research Company, automatically turns lights on and off by sensing the infrared radiation produced by human movement. The control unit, shown at the left side of the photo, and the recessed ceiling occupancy sensor, shown at the right side, together provide coverage for offices of up to 200 square feet. Up to four sensors can be used with one control unit to cover an area as large as 800 square feet. After installation, the only visible portion of the system is the sensor's 2-inch-diameter bezel. The manufacturer reports that use of the system can reduce lighting energy consumption in commercial buildings by as much as 50 percent. Tishman Research Company, New York, NY.

Circle 98

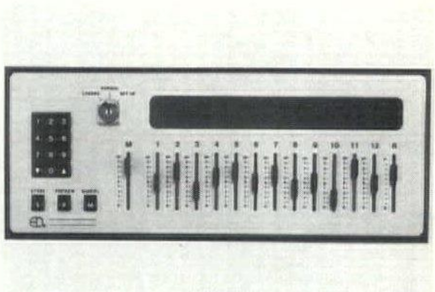


■ Wall sconces

The Ensconce line of wall sconces from Elliptipar is based upon a reflector and ballast joined by brackets that allow a range of reflector orientations. Decorative wall sconce shapes, available in eight colors, complete the wall-mounted luminaires. Designers can also create their own sconce shapes to enclose the basic module, or they can use architectural elements such as coves or cornices for concealment.

The new double-ended HQI metal halide lamp is the source for this line of fixtures. The combination of source and reflector shapes light into broad, uniform patterns projected evenly across planes, according to the manufacturer. Primary applications include indirect lighting and wall washing in lobbies, reception areas, and other commercial and institutional spaces. Elliptipar Inc., West Haven, CT.

Circle 99



■ Programmable control

Electronics Diversified's computer-based, programmable Starlite architectural lighting control can control six or 12 zones and 100 scenes. The unit features multiple location control, manual control, adjustable fade rate, autosequencing of programmed scenes, battery-protected memory storage, and an optional lockout key switch. Electronics Diversified, Inc., Hillsboro, OR.

Circle 100

■ Metal halide cylinders

Prescolite's new line of low-wattage metal halide cylinders features faceted lower and hammer-toned upper reflectors specifically designed for the recently introduced 100-watt metal halide lamp by Sylvania. The line incorporates the tempered lens, die-cast trim, die-cast heat dissipating top with radial fins, and molded gasket that are standard on all the firm's high intensity discharge cylinders. Prescolite, San Leandro, CA.

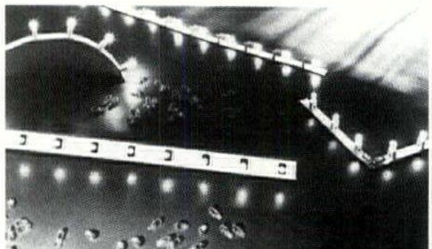
Circle 101

■ Task lamp

A 13-watt compact fluorescent lamp is the source for a new task lamp from Nessen Lamps. The light source generates less heat than incandescent lamps and provides light output equivalent to a 75-watt incandescent source.

The round metal reflector, which rotates 90 degrees with a concealed stop, and the base of the 16-inch-high fixture are painted ruby red or black. Polished brass or chrome accents complete the task lamp. Nessen Lamps Inc., New York, NY.

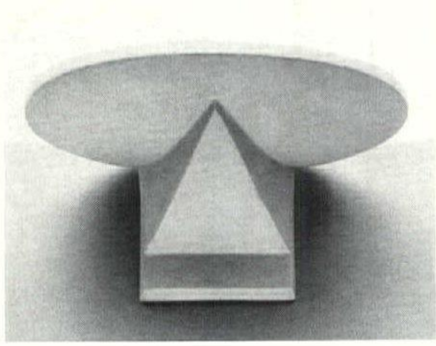
Circle 102



■ Miniature lighting

Ribbonlite miniature lighting from Willem Wirtz Associates is suitable for both indoor and outdoor use. Lamps are mounted on parallel bronze strips insulated with PVC film. Maximum energy use of the lighting strips is 38 watts per foot. Willem Wirtz Associates, New York, NY.

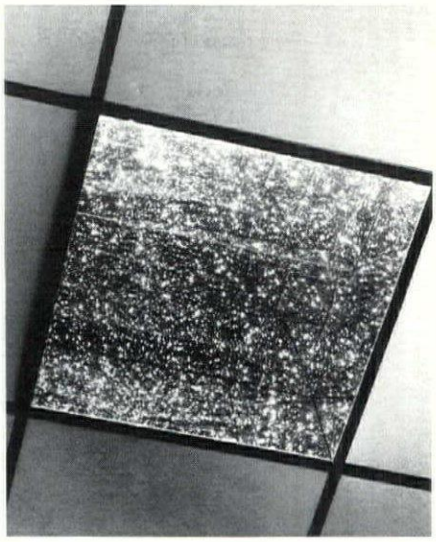
Circle 103



■ Wall bracket

The Olympus wall bracket from Boyd Lighting is compatible with tungsten halogen, standard incandescent, or compact fluorescent lamping. The sculptured porcelain fixture is $5\frac{1}{4}$ inches high and 12 inches in diameter and extends $11\frac{3}{8}$ inches. Designed by Doyle Crosby, the wall bracket was honored in the Spec IV Design Competition in Chicago earlier this year. Boyd Lighting Company, San Francisco, CA.

Circle 104



■ Decorative ceiling panels

Galaxy ceiling panels from Starfire Lighting use fiber optics to create the illusion of hundreds of pinpoint lights extending above the level of the ceiling. The system uses angled mirrors and a semitransparent mirrored panel to achieve the effects, even in a conventional lay-in ceiling. Starfire Lighting, Inc., Jersey City, NJ. ■

Circle 105

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Product Literature

Skylighting

The latest catalog of Wasco Products skylights for commercial buildings introduces a new line of heavily insulated, venting skylights and details other skylights, heat and smoke vents, and glazing systems. Commercial Skylight Division, Wasco Products, Inc., Sanford, ME.

Circle 106

Interior design lighting

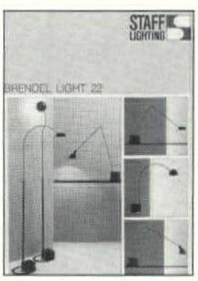
The Odyssey Illuminations color brochure from RWL demonstrates modular linear lighting, the Oasis floor fixture, and the Deco Door illuminated door frame. RWL Corporation, Solvang, CA.

Circle 107

Programmable control

Literature from General Electric Wiring Service Department introduces the firm's programmable lighting control system, outlining its characteristics as an investment opportunity. General Electric Wiring Service Department, Warwick, RI.

Circle 108



Halogen lighting

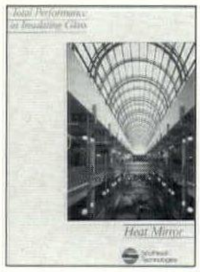
A family of task lights and other fixtures make up Staff Lighting's Brendel Light 22 system, which is depicted in a color brochure. All the luminaires use low-voltage halogen sources. Staff Lighting Corp., Highland, NY.

Circle 109

High intensity luminaire

A data sheet features the Edison high intensity luminaire from Beacon Illumination. The aluminum fixture accommodates mercury vapor, metal halide, and high pressure sodium sources. Beacon Illumination, Inc., South Plainfield, NJ.

Circle 110



Insulating glass

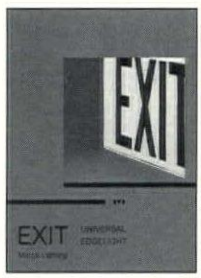
Heat Mirror glass from Southwall Technologies insulates, blocks noise and ultraviolet radiation, is clear and colorless, and can block solar heat like dark reflective glass, according to a brochure issued by the firm. Southwall Technologies, Palo Alto, CA.

Circle 111

Decorative ceiling panels

A brochure from Envel Design illustrates examples and applications of the company's modular ceiling panels that simulate stained, frosted, and beveled glass. Envel Design Corporation, Los Angeles, CA.

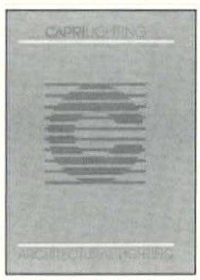
Circle 112



Exit signage

A brochure from Marco Lighting describes the Universal and Edgelight models of exit signs. All signs are available with either incandescent or fluorescent lamping. Marco Lighting, Los Angeles, CA.

Circle 113



Architectural lighting

Capri Lighting's architectural lighting catalog provides information about a series of incandescent and high intensity discharge recessed and surface fixtures. Capri Lighting, Los Angeles, CA.

Circle 114

Indirect lighting

Softshine lighting illuminates spaces indirectly and also reveals light through a visible strip of lens, as shown in a brochure from Peerless Electric that details the system's options. Peerless Electric Company, Berkeley, CA.

Circle 115

■ Lanterns and mountings

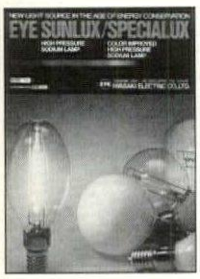
ELA demonstrates its line of lanterns, posts, pier mounts, wall brackets, cross arms, and other mounting accessories in a brochure that also outlines the firm's custom lighting service. ELA Company, City of Industry, CA.

Circle 116

■ Landscaping luminaires

Greenlee specializes in the design and manufacture of landscape lighting fixtures, and it offers a brochure that presents six product lines through illustrations, diagrams, and specifications. Greenlee Landscape Lighting Mfg., Carrollton, TX.

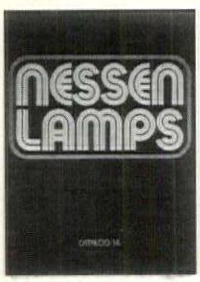
Circle 117



■ Sodium lamps

Iwasaki Electric has published a brochure that provides information about the new Eye Sunlux and Specialux high pressure sodium lamps. Distributor: C.E.W. Trading, Inc., Dallas, TX.

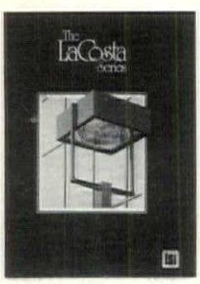
Circle 118



■ Portable lighting

Nessen Lamps has released its 50-page Catalog 14 of portable luminaires. The catalog introduces more than 40 new designs. Nessen Lamps Inc., Bronx, NY.

Circle 119



■ Area lighting

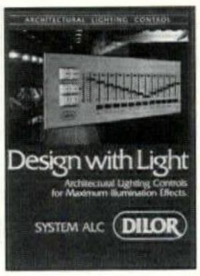
The LaCosta series from Lighting Systems Inc. (LSI) provides light in either a Type V or Type III distribution, depending on project needs, as explained in a brochure that shows typical installations. Lighting Systems Inc., Cincinnati, OH.

Circle 120

■ Commercial luminaires

Holophane's catalog of luminaires for indoor and outdoor commercial installations summarizes the features of a variety of product lines. Ordering data for each line demonstrate how to construct a catalog number. Holophane, Denver, CO.

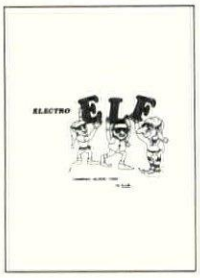
Circle 121



■ Dimming control station

Data sheets released by Dilor Industries detail the System ALC series of lighting control panels. The panels combine with the firm's dimmers to meet complex project requirements, reports the firm. Dilor, Squamish, British Columbia, Canada.

Circle 122



■ Fluorescent fixtures

A foldout color brochure from Electro Elf outlines the manufacturer's line of outdoor fixtures that use energy-saving compact fluorescent lamps. Electro Elf, Temple City, CA.

Circle 123

■ Polarizing panels

Literature from Polarized International describes the characteristics of Polarized/Radialens panels, which produce polarized light for interior illumination. Polarized International Inc., Tarzana, CA.

Circle 124

■ Tubes and beams

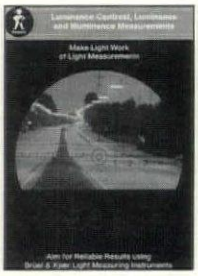
A brochure from JW Lighting displays applications and components of Integratube and Integrabeam aluminum tube and beam fixtures. Diagrams and an availability chart supplement the full-color presentation. JW Lighting, Inc., Integralite Division, Houston, TX.

Circle 125

■ Outdoor, industrial lights

Ruud Lighting's 1986 catalog and price list details the firm's line of outdoor products and its industrial, parking-structure, and surface lights. Photometric data are provided for several models. Ruud Lighting, Inc., Racine, WI.

Circle 126



■ Measuring instruments

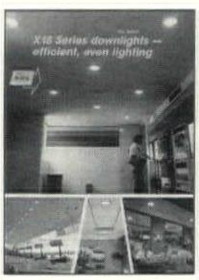
Brüel & Kjaer features its luminance contrast meter, luminance meter, and precision photometer in a brochure complete with applications information and condensed specifications. Brüel & Kjaer Instruments, Inc., Marlborough, MA.

Circle 127

■ Task and ambient lighting

An 18-page brochure from Elliptipar details the Lite-A-Part and Series TK task and ambient lighting systems. The brochure features photos, drawings, and descriptions of the systems in various office applications. Elliptipar, Inc., West Haven, CT.

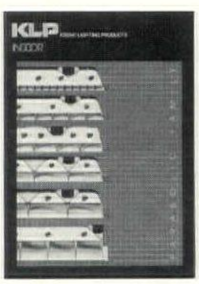
Circle 128



■ Downlights

Scientific NRG features its X18 Series downlights in a foldout brochure. Replacement of incandescent lamps with X18 downlights can cut power consumption by 75 percent, according to the manufacturer. Scientific NRG Incorporated, Minneapolis, MN.

Circle 129



■ Louvered luminaires

Keene Lighting Products (KLP) details the features of its parabolic family of louvered luminaires in a 20-page brochure. Six styles are available with a wide variety of options. Keene Lighting Products, Wilmington, MA.

Circle 130

■ Glass structures

English Greenhouse Products has produced a folder of materials highlighting its greenhouse-style structures. An illustrated specifications and data sheet, a color brochure, and a series of elevations demonstrate uses of the modular structures. English Greenhouse Products Corporation, Camden, NJ.

Circle 131

■ Window control systems

Specification data available from Clearline describe the firm's manual and motorized control systems for inaccessible windows in clerestory areas. The systems may be surface-mounted or concealed within walls. Clearline Incorporated, North Wales, PA.

Circle 132

■ Lighting controls

Conservolite offers a dual brochure that presents the Series IV line of lighting controls and the Eclipse dimming system, both for fluorescent lighting. Wiring diagrams and electrical data are included. Conservolite, Inc., Oakdale, PA.

Circle 133

■ Dual-source system

A foldout brochure announces the Tempo II dual-source indirect lighting system from Forum. The combination of metal halide and high-pressure sodium lamps is said to produce light especially suited for the workplace. Forum, Pittsburgh, PA.

Circle 134

■ Decorative lighting

The New Horizons Lighting catalog offers a range of lamps and fixtures, including tube lighting, tube-light chandeliers, tree lighting, miniature spotlights, star panels, ceiling coffers, marquee lights, and a tubular fluorescent lighting system. New Horizons Lighting, Inc., Stuart, FL.

Circle 135

■ Exit signs

A brochure outlines the features of exit signs supplied by York-Lite Electronics. The compact signs are available with or without a self-contained battery. York-Lite Electronics, Inc., Austin, TX.

Circle 136

■ Control stations

Five dimming control stations for the Environ 2 system are illustrated in a brochure from Strand Lighting. Data sheets within the brochure provide updates on the company's latest product releases. Strand Lighting, Los Angeles, CA.

Circle 137

■ Indoor, outdoor fixtures

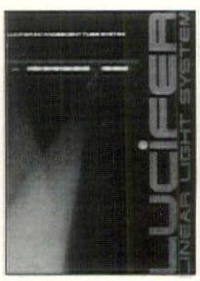
Stilnovo's summary catalog illustrates the firm's line of indoor and outdoor lighting fixtures. Table, floor, suspension, wall, and ceiling lamps are included, as are track lighting and recessed lighting systems. Stilnovo s.p.a., Milan, Italy.

Circle 138

■ Color specification guide

General Electric Lighting Business Group has updated "Specifying Light and Color," a lighting application bulletin. Graphs, diagrams, tables, and descriptions in the bulletin provide guidelines for the selection of lamps. General Electric Lighting Business Group, Cleveland, OH.

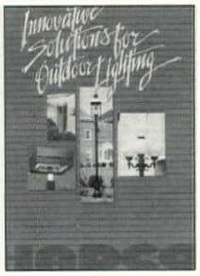
Circle 139



■ Incandescent tube system

A brochure from Lucifer Lighting catalogs the components of the firm's tube system, which uses incandescent festoon lamps for downlighting and halogen lamps for spotlighting. Lucifer Lighting Company, Miami, FL.

Circle 140



■ Outdoor lighting

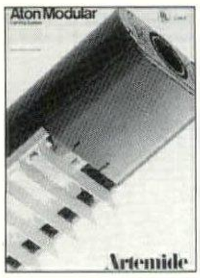
A brochure available from Hadco profiles the company's background, product line, manufacturing technology, and technical services. Hadco, Littlestown, PA.

Circle 141

■ Luminaires and accessories

Full-color product literature from Valenti srl provides background on the design of the Valentina table lamp and presents the firm's 1985–1986 collection of indoor luminaires and decorative accessories. Distributor: Contract Marketing International, New York, NY.

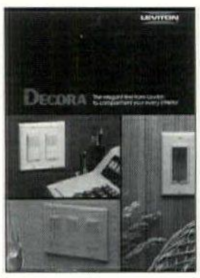
Circle 142



■ Modular lighting system

A 48-page brochure details the Aton modular lighting system from Artemide. The system accommodates fluorescent, halogen, or incandescent sources and a variety of accessories. Artemide Inc., Farmingdale, NY.

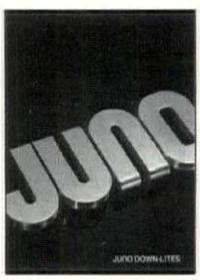
Circle 143



■ Control devices

Leviton features its Decora line of devices, including switches, dimmers, fan-speed controls, receptacles, wall plates, combination devices, and telephone wall jacks, in a full-color brochure. Leviton Manufacturing Co., Inc., Little Neck, NY.

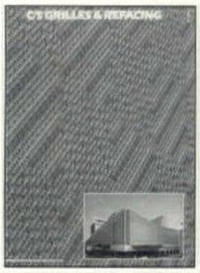
Circle 144



■ Downlights

Juno's catalog of downlights encompasses a variety of fixtures designed for use in insulated noninsulated, and suspended ceilings, as well as the commercial round series of recessed luminaires. Juno Lighting, Inc., Des Plaines, IL.

Circle 145



■ Solar controls

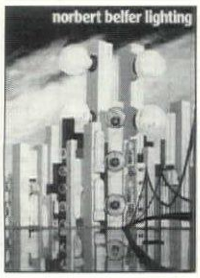
A folder of materials available from Construction Specialties provides descriptions of and specifications for a variety of sunshades, canopies, and grilles that block the sun's heat and glare. Photographs of representative installations are included. Construction Specialties, Inc., Cranford, NJ.

Circle 146

■ Outdoor lighting

A four-page brochure outlines the major categories of outdoor lighting available from BEGA/FS. Each luminaire group is available in a selection of lamps and wattages. BEGA/FS, Santa Barbara, CA.

Circle 147



■ Lighting collection

The Norbert Belfer Lighting catalog lists a variety of products, including light strips, low-voltage lighting, marquee lighting, quartz halogen luminaires, and light tubes. Norbert Belfer Lighting, Ocean, NJ.

Circle 148

■ Indoor luminaires

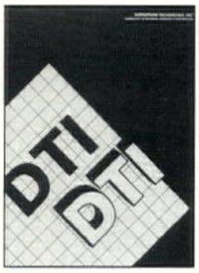
The Brilliant Lighting catalog features the firm's line of colorful multipurpose luminaires. All listed products are UL approved. Brilliant Lighting Inc., San Fernando, CA.

Circle 149

■ Glass fixtures

Chandeliers, pendants, and coordinating ceiling and wall lamps are highlighted in Forecast Lighting's Series 2 catalog. The company offers contemporary and traditional designs in clear and frosted glass. Forecast Lighting Company, Inglewood, CA.

Circle 150



■ Fluorescent conversion kit

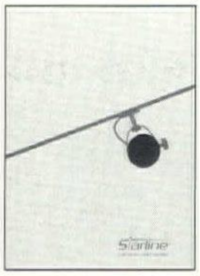
Deposition Technology has introduced Lumolite, a cost-cutting retrofit kit for fluorescent fixtures. Data sheets describe how the precut, adhesive-backed reflective film can enable a four-lamp fixture to produce adequate light with only two lamps. Deposition Technology Inc., San Diego, CA.

Circle 151

■ Energy-saving adapter

North American Philips Lighting has released a foldout brochure outlining its new PL* lamp-and-adapter system, which is said to provide three to four times more efficient lighting per watt than 25- through 60-watt incandescent lamps. North American Philips Lighting Corporation, Bloomfield, NJ.

Circle 152



■ Track lighting

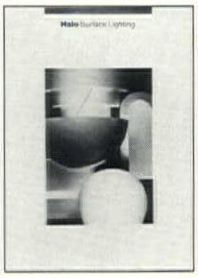
Luma Lighting Industries has released a folder of data sheets that illustrate and list options for the Starline low-voltage track lighting collection. One group of outdoor luminaires is suited for use in direct rainfall. Luma Lighting Industries, Inc., Santa Ana, CA.

Circle 153

■ Architectural lighting

Kliegl's architectural lighting catalog is a folder of materials highlighting a variety of products, including the Ambiance lighting control system, other digital control and dimming systems, and selected indoor and outdoor luminaires. Kliegl Bros., Long Island City, NY.

Circle 154



■ Surface lighting

Halo Lighting's 38-page catalog of surface lighting products offers lamps and fixtures suitable for decorative, architectural, and commercial applications. Halo Lighting, Elk Grove Village, IL. ■

Circle 155

Calendar

November 1–8, 1986 Second International Daylighting Conference, Hyatt Regency Hotel, Long Beach, California. The week-long program begins with two days of meetings and with a full-day workshop on November 3. Design Day, the official opening of the conference on November 4, includes a series of design presentations and panel discussions. The next three days are dedicated to research paper presentations and, on November 6, a software and instrumentation show. The program concludes with an architectural tour. Contact: Marjorie Matthews, Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, TN 37831, (615) 574-4346.

November 2–7, 1986 Preview '87 Lighting/Accessories Market, 230 Fifth Avenue MarketCenter, New York City. Contact: 230 Fifth Avenue MarketCenter, New York, NY 10001, (212) 532-4555.

November 5–7, 1986 Fundamentals II, short course, General Electric Lighting Institute, Cleveland, Ohio. The course, designed for professionals with five or more years' experience in commercial and industrial lighting, provides an update on indoor lighting techniques, lamps, controls, and calculation methods. CEUs are available. Contact: Janet Allen, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614.

November 6–7, 1986 Energy-Conscious Redesign, short course, University of Virginia at Charlottesville and Hampton University, Hampton, Virginia. The course is cosponsored by the Virginia Department of Mines, Minerals and Energy and the Virginia Society of the AIA. Participants will apply redesign concepts and principles during a design charette on the second day of the program, which is offered in two locations. Contact: Virginia Society AIA, 15 South Fifth Street, Richmond, VA 23219, (804) 644-3041.

November 8–9, 1986 Rehab Fair Northeast, third annual exhibition, New Scotland Avenue Armory, Albany, New York. The exhibition features products and services used in the rehabilitation and maintenance of older buildings. Contact: Historic Albany Foundation, 44 Central Avenue, Albany, NY 12206, (518) 463-0622.

November 14, 1986 IALD awards presentation, The Mansion on Turtle Creek, Dallas, Texas. The presentation will be followed by an optional architectural and lighting design tour, including the Kimball Art Museum, Fort Worth, on November 15. Contact: Marion Greene, International Association of Lighting Designers, 18 East 16th Street, Suite 208, New York, NY 10003, (212) 206-1281.

November 17–19, 1986 First MALE international convention, Monterrey, Mexico. Contact: Mexican Association of Lighting Engineers, C.A., P.O. Box 6843, Laredo, TX 78042.

November 19, 1986 Restaurant lighting seminar, New York City. The seminar is sponsored by the New York chapter of Designers Lighting Forum. Contact: Forbes Ergas Design Associates, (212) 534-1711.

December 1, 1986 First Monday, 230 Fifth Avenue MarketCenter, New York City. Contact: 230 Fifth Avenue MarketCenter, New York, NY 10001, (212) 532-4555.

December 1–2, 1986 Light and Color for Human Performance, short course, Georgia Institute of Technology, Atlanta, Georgia. The course is cosponsored by the institute, ASID, AIA, IBD, IDSA, and the Georgia section of IES. It explores the effects of light on behavior, the physics of light, and the physiology of human vision in relation to the design of lighting and surface colors. Contact: Deidre Mercer, Department of Continuing Education, Georgia Institute of Technology, Atlanta, GA 30332, (404) 894-2547.

December 1–5, 1986 Fundamentals I, short course, General Electric Lighting Institute, Cleveland, Ohio. The course, designed for newcomers to lighting design and application, covers basic aspects of indoor commercial and industrial lighting. CEUs are available. Contact: Janet Allen, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614

December 6–10, 1986 Eighty-ninth Visual Merchandising/Design Market Week, Passenger Ship Terminal Piers 90 and 92, New York City. Contact: Patricia A. Vitsky, National Association of Display Industries, 419 Park Avenue South, New York, NY 10016, (212) 213-2662.

December 8–10, 1986 Electrical contractors lighting conference, General Electric Lighting Institute, Cleveland, Ohio. Contact: Janet Allen, GE Lighting Institute, Nela Park, Cleveland, OH 44112, (216) 266-2614.

January 11–14, 1987 ElectriLight 87, exposition, Infomart, Dallas, Texas. The exposition features lighting and electrical equipment. Contact: PSA Show Management, P.O. Box 214, Sea Girt, NJ 08750, (201) 974-1900.

January 14, 1987 Office lighting seminar, New York City. The seminar, sponsored by the New York chapter of Designers Lighting Forum, features a lecture by Lumen Award winner Jerry Kugler at an office site. Contact: Louis Baldinger & Sons, Inc., 19-02 Steinway Street, Astoria, NY 11105, (718) 204-5700 or (212) 678-0414.

January 30, 1987 Daylighting: Design and Performance, seminar, Mammoth Lakes, California. Seven speakers will address topics including historical background; design issues, strategies, and elements; calculations; integrating daylighting with electrical and mechanical systems; Title 24 of the California energy code; the design team; and daylighting applications. Contact: Gregg D. Ander, Director of Daylighting Programs, Southern California Edison, 2244 Walnut Grove, Room 391, Rosemead, CA 91770, (818) 302-4624 or (818) 302-1967.

February 18, 1987 Museum lighting seminar, New York City. The seminar, sponsored by the New York chapter of Designers Lighting Forum, features a lecture by Bill Riegel, lighting designer of the Metropolitan Museum of Art. Contact: Louis Baldinger & Sons, Inc., 19-02 Steinway Street, Astoria, NY 11105, (718) 204-5700 or (212) 678-0414.

February 20, 1987 Deadline for submission of portfolios, IALD internship program. Contact: Marion Greene, International Association of Lighting Designers, 18 East 16th Street, Suite 208, New York, NY 10003, (212) 206-1281.

May 11–13, 1987 Lighting World International, Jacob Javits Convention Center, New York City. The event is jointly sponsored by IALD and IES. Contact: Marion Greene, International Association of Lighting Designers, 18 East 16th Street, Suite 208, New York, NY 10003, (212) 206-1281.

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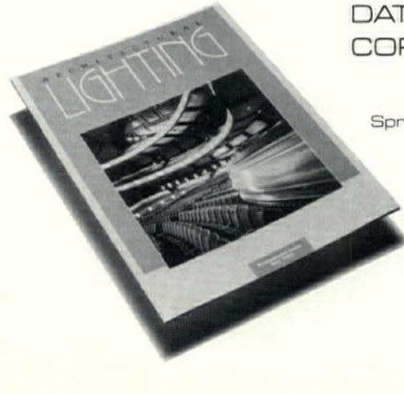

Manufacturer Credits

"Sawtooth" ceiling design protects computer screens from glare (Park Avenue Plaza, New York City). Luminaires: Linear Lighting.

Lighted glass columns welcome railroad and bus passengers (Battle Creek Transportation Center). Glass block: Pittsburgh Corning.

Lighting presentation cooking for fast turnover (ChinChin, Brentwood, California). Recessed downlights: Halo Lighting Division, McGraw-Edison Company.

Illuminated sculpture a standout on Charles River skyline (Lotus Development Corporation Headquarters, Cambridge, Massachusetts). Fixtures: Sterner Lighting. Sculptor: John Raimondi.

Bridge lighting concealed by day, controlled from river by night (Eads Bridge, St. Louis, Missouri). Fixtures: Hubbell. Controls: Custom-designed by Sverdrup Corporation.

Flexible lighting matches the needs of Eli Lilly's multipurpose atrium (Eli Lilly Biomedical Research Facility, Indianapolis, Indiana). Fluorescent fixture with radiant heat fan: Custom-made by Integra Dimming. System designed by Luminoptics. Porcelain fins in atrium walls: William H. Scarlet & Associates, Inc. Fixed seamless mullion windows: Kawneer. Insulated clear glass: PPG.

MARTA shop lighting meets utility and safety requirements (Metropolitan Atlanta Rapid Transit Authority Major Maintenance Facility, Atlanta, Georgia). Pit lights: Peerless. Warning lights: Appleton. Metal halide high bay fixtures: Lithonia.

Loyd-Paxton Galleries: Optimum lighting for peerless antiques (Loyd-Paxton Galleries, Dallas, Texas). Track lighting and track: Lite Lab. Exit lighting: Kurt Versen. Recessed incandescent, sidewalk lights, and 2x2 fluorescents: Edison Price. 24-volt shelf, cove, and step lights; exterior signage lighting: Norbert Belfer. Recessed incandescents: Mark Lighting. Under-counter fluorescents: Alkco. 4-foot fluorescents: Day Bright and Williams. 12-volt incandescents: Alesco. Recessed incandescents: Halo. 12-volt light tape: Sylvan Lite Buds. Exterior recessed burial fixtures: Hydrel. High-intensity discharge exterior lights: Sterner. Outlets: Lighting Services, Inc. Exterior spotlights: Infranor. Switch and outlet covers: Touch Plate. Dimming computer and controls: Electro Controls. Loading dock lights: Keene Lighting.

The glow of a neon "sky" lights a Seattle banking hall (Washington Federal Savings and Loan headquarters). Neon: Tubeart. Downlights: Kurt Versen and Addison Price. Grid: Aluminum and Bronze Fabricators, Seattle.

Lighting technology: From darkness to opportunity. A videotape covering this subject is available from the Illinois Power Company. For information, contact Eric W. Novak, Illinois Power Company, 500 South 27th Street, Decatur, IL 62525-1805.

Lighting the outdoor landscape enhances the garden design. Line art courtesy of Kim Lighting. ■

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