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Early next month PROGRESSIVE ARCHITECTURE will move, with its sister publications in Reinhold Publishing Corporation and Reinhold Book Division, to a new mid-Manhattan location. Reinhold will occupy three floors of the 430 Park Avenue Building, New York 22, N. Y. (described on page 106, May 1954 P/A). All communications should be directed to the new address, from July 12 on. Telephone: MURray Hill 8-8600.

Principal speakers at AIA Convention in Boston this month will be Gov. Christian A. Herter of Massachusetts and Edward A. Weeks, Editor of "Atlantic Monthly." Changing philosophy of architecture will be reviewed by Ralph Walker, Eero Saarinen, José Luis Sert, Paul Rudolph, and Robert W. Kennedy. Other speakers and panel participants will include Miles Colean, Paul Weidlinger, Charles Leopold, C. L. Crouch, Ben John Small, Leonard Haeger, Vincent G. Kling, John Stanley Sharp, Samuel E. Homsey, Charles S. Gibson, and Michael Waterhouse, former President of Royal Institute of British Architects.

Fine Arts Medal will be presented at AIA Convention to Sculptor Julian Hoke Harris of Atlanta. Craftsmanship Medal will be awarded to Maria Montoya Martinez, Indian potter from San Ildefonso, New Mexico. There will be no Gold Medal Award. Honorary Memberships will go to Dr. Richard Eugene Fuller, Director of Seattle Art Museum, and Morton O. Withey, former Dean of School of Engineering, University of Wisconsin.

Architects have been invited by American Hospital Association to submit exhibits of hospitals or related structures for Association's Annual Convention in Chicago, September 13 through 16. Information and entry forms available from Association at 18 East Division Street, Chicago 10, Illinois.

William W. Wurster, recently elected AIA Fellow, has also been appointed Fellow of Royal Academy of Fine Arts, Copenhagen, for his "great contributions to architecture."

Melvin H. Smith of Brooklyn, Cooper Union graduate now M.I.T. architectural student, has been awarded $5000 Lloyd Warren Scholarship for travel and study in Europe and U. S. Award was announced recently by The Beaux-Arts Institute of Design, administrator of fund.

Seventeen award winners were chosen from designs submitted to American Institute of Decorators' Annual Homefurnishings Design Competition. First awards were granted in following categories: fabrics—Eszter Haraszty; furniture—George Nelson; wall coverings—H. W. E. Riley. Designs were executed by Knoll Associates, Inc., Herman Miller Furniture Company, and Polyplastics United, Inc.
The departure of W. E. Reynolds, who retires the end of this month (June 30) as Commissioner of Public Buildings, closes an era in public buildings work. Although there has been virtually no public building activity since before the war, Reynolds played a major part in the great public construction activities of the 1930's. In more lasting fashion, he participated in the creation of the Federal Government's first centralized design and building service, and was its chief from the beginning. Here in the Public Buildings Service lie the century and a half traditions of Federal architecture.

It has been Reynolds' misfortune to be obliged to watch the instrument he forged rust in its scabbard. Public building has constantly declined. The central position of PBS has been shaken by the large autonomous building programs of defense, veterans, atomic energy, and other operating departments. Congress itself has made substantial inroads on the public buildings work, and has increasingly interfered with its administration. Reynolds' successor, Peter Strobel (a Danish-born, Copenhagen-trained management engineer) has little to inherit but the public buildings management duties of a once-high office.

Nor is it easy to see a role for the depleted PBS in any future revival of Government building activity. It will play but a small part in General Bragdon's calculations of a future works program. Operating departments are once again the chief initiators of buildings they require. Decentralization is the rule. Even the Post Office Department, which is well disposed toward PBS, writes its own programs and increasingly sets its own design standards. The important field of construction represented by Federal grants-in-aid is now mainly concentrated in the Housing and Home Finance Agency. Inheritor of the public works function of the Federal Government, HHFA today is the sole repository of experience and seasoned personnel in this field. It is closer to being a real department of local government or urbanism—the critical point d'appui of any future use of public works as a depression remedy—than any other Government agency.

PBS was conceived as an integral part of a Federal Works Agency embracing public roads, public works, housing, and other construction activity—a great professional engineering service. That agency has vanished. PBS now finds itself part of the General Services Agency, a huge, diversified procurement activity in which public buildings are regarded as just-another over-the-counter purchasing job. Worse, chief support of PBS comes from the Bureau of the Budget, where it is esteemed as a vehicle for standardized buildings interchangeable among Government bureaus to meet their fluctuating requirements, and a desirable central building management agency. This is hardly the environment to stimulate construction, much less for inspired design. On the contrary, it is just the place to find support for that "ideal" type of government office building which Reynolds perforce finds most desirable—a loft, accommodating bumper-to-bumper office layouts, best represented by the General Accounting Building in Washington.

The wonder is, as one reflects upon it, that Reynolds has done so much with such unpromising working conditions. He leaves public office for a Washington consulting practice with the gratitude of architects and engineers in private practice. There is general satisfaction with his commissioning of such designers and the terms of their engagement, with policies aimed at selecting local men. Reynolds great gifts were precisely where he failed: in dealing with Congress. He ranks in my estimation with the greatest types of career administrators: with MacDonald of Public Roads, Burlew of Interior, Kerlin of Commerce, Blandford of TVA. What such a managerial career shows, however, is that mere administration is not necessarily creative above the level of devices like the lease-purchase program—Reynolds' most notable recent conception. It must be associated with some driving pressure to undertake public building, if it is to rise above workaday levels. The failure to supply this leadership on the part of Congress, the executive, or the successive heads of the General Services Administration, has run the public buildings program into the ground, to the detriment and cost of the Federal Government and the disadvantage of its operating departments.

Architects, of all those concerned with building, appreciate how enormous are the efforts that must frequently go into the promotion of a building project before even the best design can be realized. How much building is accomplished by "waiting for the order"? It is just this effort which has been lacking. With this reflection, one wonders if the chronic malfunctioning of the PBS ought not to be treated by drastic measures of reorganization, designed to secure greater support for needed public building projects. Possibly the construction and management functions should be separated. Certainly we should rename a bureau which, however efficiently it runs elevators and empties wastebaskets, is doing no building and has little prospects of doing any.
Here is another excellent example where Stainless Steel Metal Walls have been employed to good advantage in dressing up a building which, because of its functional characteristics, would otherwise have been rather prosaic in appearance. The architects have achieved in this structure a result in modern design which has attracted much interest and many enthusiastic comments. The advantages of Metal Walls, however, are not confined to appearance and design effects obtainable. Important building economies are realized through lower material cost, lower labor cost, and the cumulative savings resulting from reduced construction time. Buildings can be quickly enclosed with Insulated Metal Walls—even under extreme low temperature conditions which would preclude masonry construction. Other important factors to be considered are the light weight of these modern curtain walls and the maintenance-free permanence of Stainless Steel or Aluminum exterior surfaces. Mahon Insulated Metal Walls are available in three exterior patterns—the Mahon “Field Constructed” Fluted or Ribbed Wall can be erected up to sixty feet in height without a horizontal joint—a feature of Mahon Walls which is particularly desirable in auditoriums, powerhouses and other types of buildings where high expanses of unbroken wall surface are common. See Sweet’s Files for complete information or write for Catalog No. B-54-B.
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The summer heat load on a roof can be reduced from a maximum potential of 19,000 Btu per hour to as little as 600 Btu per hour by proper detailing of a house, says A. M. Watkins in “Five Top Priorities for Designing an Air-Conditioned House” in the August 1953 “House & Home.”

In an average 1,000 sq. ft. $10,000 house, he states that with all the right detailing a 1-ton cooling unit costing about $600 could be safely specified; with all the wrong detailing a 7-ton unit costing up to $4,000 might be needed.

One of three important roof details is insulation: “A good thick layer of insulation spread over the ceiling will save more money than insulation can save anywhere else,” explains the article. “Even 6” of ceiling insulation at 1½¢ for installation plus 2¢ a sq. ft. for each inch of thickness will pay for itself.”

“Since aluminum bounces back 95% of the long heat waves re-radiated from the under-side of the roof, three-layer reflective insulation at 7¢ a sq. ft. installed would be a bargain, for it can be the cooling equivalent of 6” of bulk insulation.”

For winter roof insulation, the author rates 3-aluminum-sheet multiple aluminum, when installed with four air spaces, as equal to 2½” to 3” of bulk insulation.

A commercial form of multiple accordion aluminum sheets, Infra Insulation Type 6, creates an “insulating blanket” of layers of air, aluminum and fiber. In addition to the reflection of Radiation or radiant heat, inner and outer Convection are retarded by the 3 sheets of aluminum and 2 sheets of fiber. The 6 layers of air spaces have low density, therefore slight Conduction. The slight mass is capable of little heat storage.

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The chief aspects of designing an air conditioned house—how to slash cooling costs, and the part roofs, windows, moisture, walls, and interior heat play in detailing for summer comfort—are interestingly and exhaustively discussed in Mr. Watkins’ article.

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Shepley, Bulfinch, Richardson & Abbott recently designed this “Project for an apartment house at 3134 N. Meridian Street, Indianapolis, Ind.: Allen W. Clowes, Owner.” The 11th floor plan (left) emphasizes the generous terraces. Typical floors of the reinforced concrete structure will have 7 apartments each. Note (model photo) openings provided for tenants’ air conditioners.

projects now on-the-boards in some leading Boston offices

Carl Koch & Associates neatly concentrated varied activities of a Theater Arts Building in the design (below) for Wheelock College. Approach to the theater is through the wide lobby, also used for exhibitions. The drama training area adjoins the stage. Students’ lounges opening into the sculpture garden encourage informality and reflect the genial atmosphere of such a building.
Anderson & Beckwith also created an essentially one-story plan to accommodate two related companies—Boston Manufacturers Mutual Fire Insurance Co. and Mutual Boiler & Machinery Insurance Co.—moving to a 70-acre site 10 miles west of Boston. Principal business functions of both companies are planned on the second floor; employees' lounge, cafeteria, and kitchen will be in the penthouse overlooking the court; services on ground floor.

The Architects Collaborative designed this compact, air-conditioned clinic for a group of doctors headed by Dr. Richard H. Overholt, specializing in heart and lung surgery. Facilities will be mostly on the second floor—operating suite, X-ray rooms, etc., in a central core surrounded by a corridor; doctors' offices and examination rooms around the perimeter of the plan, with large waiting room and a secretarial office, across the front. A paved parking area will occupy more than half the ground floor, the drive-in located beside the entrance unit (brick-faced wall in rendering). Edward K. True was Structural Engineer; Thomas Worcester, Inc., Mechanical and Electrical Engineers.
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Royal Barry Wills says of this small house to be built for under $5000 (without chimney) that "'T ain't traditional, 't ain't modern, but it's doggone liveable and dirt cheap—that last because it's built into the ground." This is designed to be home for a young couple.

Saltonstall, Morton & Morton designed for Mr. and Mrs. Francis V. Crane, who breed and raise show dogs, this group of kennels and related buildings for a heavily wooded rural site. The sketch (above) is of the gate house.
Modern flat-roof buildings usually have one or more construction features calling for roof curbs. These are: penthouse for stairs, skylights, ducts, vent pipes for plumbing, flagpole base, stub columns and many more. Properly flashed curbs keep standing or wind-driven water from leaking into the building at these points.

Shown here are several curb flashing details for both fireproof and wood construction. Flashing for a piece of equipment with a metal housing, such as a roof fan or dust collector, is also shown. Lead strips and washers isolate one active metal from the other. In general, use 16 oz. copper of cornice temper for all curb flashing.

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Compton & Pierce designed this unpretentious wood structure as Danforth Chapel for University of South Dakota, Vermillion, S. D. The budget provided for the chapel is $25,000.

Isidor Richmond & Carney Goldberg recently designed for Bridgewater State Teacher's College the new men's dormitory (above and left).

Hugh Stubbins Associates recall the severe simplicity of the New England parsonage in these faculty houses for Episcopal Theological School, to be built off Brattle Street just back of the Longfellow mansion.
Dear Editor: Felix Candela is an architect, I am an engineer. We are both fighting the same battle: we want architects to realize the possibilities of new structural concepts and to challenge with their creations the imagination of the engineers. Glory, then, to Candela for his biased article.

But battles must be fought with weapons capable of giving lasting fruits in victory, and I am afraid that many of Candela’s assertions may imperil the results of our battle. As his “ally,” I would like to throw light on a few points in his article, before the “enemies” attack.

In the field of structures “propaganda by slogans” will not do. Catchwords cannot be substituted for ideas and their understanding. “Passive and active structures” are some we run into in this article. The word “passive” seems to have disparaging connotations. An “active structure,” says Candela, is “capable of changing the direction of the loads and of forcing them to move throughout the structure.” By this definition the much despised beam is the “most active” structural element we can conceive of, since it is capable of taking a vertical load, changing it into horizontal stresses and back again into vertical loads, while the inclined members of Figure 1 are nothing else but inclined columns and hence hated “passive” elements. The truth of the matter is that the idea of “passive” or “active” structures is misleading and immaterial, since all structures are active. The only important concept here is economy, as Candela points out.

Another catchword is, of course, “stereo-structures.” Apart from my personal dislike for words coined by juxtaposition of two words taken from different languages, and apart from the fact that “space-structures” says exactly the same thing by using two Latin words, I am at a loss as to what is meant by a “non-stereo” structure. Candela is absolutely right in emphasizing the “plane thinking” of most architects and engineers and in asking for more “spatial thinking” or “stereo-thought” (not to be confused with stereotyped thought), but this distinction has to do with people, not structures. All structures are built and work in space.

If catchwords will not do, magic tricks will do even less. And Candela performs prestidigitation of a most interesting nature in transforming the structure of Figure 1 into a beam. This is a fabulous vanishing trick by which the essential hinge, connecting the two struts, peters out as the subtended angle approaches 180°. Of course, the two struts connected by a hinge cannot carry a vertical load if laid along a straight horizontal line; but without the hinge they can, and do so in all of our structures. Again, all that is implied here is the change from (Continued on page 20)
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And while on the subject of bending, it would be fair to recognize that the action of gravity is vertical and, unfortunately but naturally, men like to walk horizontally. Aldous Huxley’s characters play tennis on a Riemann surface, but I doubt that they would like anything but horizontal planes when they are not in a playful mood. “Piled-up” boxes are not of our making: gravity is the villain and until we counteract it by powerful electro-magnetic “stereo” fields, we’ll have to put up with them.

The heavy artillery fire, used by Candela against the mathematical engineers who hide the truth about the shells in order to make larger profits, must be neutralized by a counterbarrage. I am not acquainted with a single engineer interested in shells who has not tried hard to explain by words and sketches their behavior to his friends, architectural or otherwise. What the mathematical engineer cannot and will not do is sell half-truths, the other halves being, by definition, half-lies. Some of the fine points of shell design are tricky. Would anyone believe, intuitively, that the free longitudinal edges of a cylindrical shell do not deflect downwards under the action of a uniform snow load? Or could anyone state that, of course, he would have thought of a hyperbolic paraboloid as a good roof surface, even before the pioneering efforts of such mathematical engineers as Almond? We are all in favor of sound intuition, but we must recognize that in science intuition is often a “post facto” rather than an “a priori” state of affairs. And whether we like it or not, structures can only be designed with a large amount of intuition and an equal amount of scientific knowledge. Candela has both, just as Pier Luigi Nervi has both, and that is why they build such wonderful structures.

In the present state of our civilization, it is hard to state at times what is the cause and what the effect in certain situations. But this is not so in the case of “membrane stresses versus shell thickness.” The statement that “membrane theory is especially appropriate to picture the stress condition of doubly-curved surfaces,” was unfamiliar to at least one reader, but while Candela’s analysis of it is correct if applied to surfaces with curvatures of opposite sign (saddle surfaces), it is incorrect if applied to synclastic surfaces. The materials shells are made of are “relatively inextensible,” to be sure, but this does not mean that they will not give in. It means, instead, that in order to give in they will develop stresses beyond the elastic limit, and this is why a very thin shell cannot develop bending stress even if the loads try to. The statement that “a thin shell cannot develop bending stresses” means: the maximum elastic bending moments developable in the shell are so small, because of its small thickness, that they may often be neglected. This is part of the fundamental phenomenon Candela calls “metastasis,” borrowing a Greek word with cancerous connotations to ex-

(Continued on page 22)
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plain one of the most useful properties of two-dimensional states of stress. Taking into consideration yield (if necessary) one can ascertain the results of statically indeterminate calculations, as thousands of experiments have consistently proved. Engineers are less prone to articulation of ideas than architects and therefore less liable to attack. But actions count more than words. By their shells ye shall know them, and Candela's are wonderful.

M. G. SALVADORI
Department of Civil Engineering
Columbia University
New York, N.Y.

Dear Editor: Although I have read and reread Felix Candela's "Stereo-Structures," I find it difficult to give an opinion in a brief letter because of the danger of being unfair either to the author or to the "inner circle" "handful of initiates as eminent scientists" so bitterly attacked by him. The main reason for the difficulty lies in the article itself, which presents both praiseworthy and also completely erroneous ideas in an erudite language.

Anybody who advocates a more imaginative approach to structural engineering and architecture, who proposes that architects regain their lost status as "master-builders," etc. is supporting a worthwhile cause. Those who agree with the desirability of these objectives do not need convincing but those who disagree will scrutinize the validity of the arguments. Unfortunately, the argumentation of this article is erroneous in a great many instances and the reasoning is rather primitive, unprecise, and oversimplified:

Does Candela really believe that the use of the theory of elasticity is a "pseudo-scientific vogue" or that the "fundamental principle" of economy is the avoidance of bending stresses?

It also appears that he, himself, has some mistaken notions about the application of membrane stresses to shell analysis. An intuitive understanding and visualization of complex structural problems is a highly desirable quality and a great help to the engineer or architect in guiding the analytical work itself. Significant advances can only be made by imagination and inspired thinking. But to dispense with the analytical tools, because they are best expressed in the form of mathematical formulas, which Candela apparently dislikes, would mean to return to the era before Archimedes. Unfortunately, even in that period, there were those who were able to master the language of numbers and measures and those who did not; a simple addition appeared just as distasteful to the uninitiated as the differential equation, describing the equilibrium conditions of the cylindrical shell, appears to the author.

PAUL WEIDLINGER
Consulting Engineer
New York, N.Y.

Dear Editor: Candela's statement presents, with remarkable clarity, the potential...
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OTIS ELECTRONIC ELEVATOR DOORS
The Otis Electronic Door is the crowning achievement in the field of the Operatorless Elevator. Its unmatched “electronic politeness” is available only with AUTOTRONIC elevators. The successful development of this door insured the ability of operatorless elevators to move great masses of people in busy buildings with the greatest degree of safety.

Only AUTOTRONIC elevators have car and hoistway doors with an electronic zone of detection. It is a proximity zone that extends in front of the leading edges of both the car and hoistway doors up to shoulder height. Naturally, it is invisible to the passengers. (See phantom drawing at the left.)

No time is lost. The doors close promptly after each stop. If the electronic zone detects a person’s presence, the doors politely reverse—even before they can touch the passenger. But if there is no chance of passenger interference, the doors continue to close without unnecessary car delay.

This zone of detection politely helps to prevent passengers from delaying the elevator, too. If a talkative passenger lingers overlong in the doorway, a buzzer sounds and the doors slowly, firmly—but politely nudge the passenger out of the doorway so the car can proceed on its way.

And most important from a building manager’s viewpoint, this zone of detection is on duty all of the time the elevators are in operation. Its electronic reflexes never tire or slow down. It is a most vital point of AUTOTRONIC elevatoring. Its unmatched superiority makes possible uniformly fast, regular service in Otis automatic passenger elevators.

Otis AUTOTRONIC elevatoring saves up to $7,000 a car, each year. It is suitable for office buildings, hotels, hospitals, banks, and department stores. Visit a new or modernized installation. Ask any of our 268 offices for details.

Otis Elevator Company
260 11th Ave., New York 1, N. Y.
modern gymnasium-auditoriums deserve
"the finest floor that grows"

NORTHERN HARD MAPLE

The multi-purpose room, so characteristic of the modern school building, ought always to be floored with Northern Hard Maple. And for reasons that aren't mere whims or opinions.

As a gym floor, no other wood and no mere floor covering serves so well, so long, with such universal satisfaction on the part of players, coaches and trainers. Northern Hard Maple is highly resilient—resists dents and mars. Court-lines stand out sharply on its bright surface. It's smooth, tight, enduring. It's "foot-friendly"—has a "live" instead of a "dead" feel. Routine maintenance is easy, re-surfacing quick and simple.

And for other purposes, your Maple floor is, invariably, either better or equally acceptable. Cost of MFMA-certified Maple, especially in the handsome, thoroughly sound Second-and-Better grade (popularly known as "the gymnasium grade") is no more than most substitutes—often less. Maintenance is cheaper, service life much longer, satisfaction much greater. This, gentlemen, is a fair and true statement of the case. We believe you'll agree it points to Maple emphatically as the prudent choice.

MAPLE FLOORING MANUFACTURERS ASSOCIATION
Suite 583, Pure Oil Building, 35 East Wacker Drive, Chicago 1, Illinois

FLOOR WITH NORTHERN HARD MAPLE
BEech and BIRCH
Their Safety Is Important

Safeguard Showers with POWERS

Powers Thermostatic Water Mixer complies fully with Veterans Hospital safety requirements and Federal Specifications WW-P54a.

10 to 20% Water Saving. No need to get out of shower and readjust it because of fluctuating water temperature.

ONE Shower Accident May Cost Many Times More than POWERS MIXERS.

For Utmost Comfort, Safety and Economy Install Powers Mixers • Write for Bulletin 365.

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Your clients see Chase Copper Tube Radiant Heating, Copper Roofing, and Bronze Insect Wire Screening advertised in the most popular national magazines. So they know the name Chase... know it means quality. Chase Copper flashing, gutters, downspouts and bronze screening are corrosion-resistant, rust-free, built for beauty and lasting dependability. Chase Copper Tube for radiant heating has been the finest since Chase first pioneered the use of copper for floor and ceiling installation. Cost? The cost is no more when you consider the long life, better service, lower maintenance costs, top resale value. Give your clients the brand they know and have confidence in.
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Albany Boston Chicago Cincinnati Cleveland Dayton Detroit Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York Philadelphia Pittsburgh Providence Rochester San Francisco Seattle Waterbury (tablet office only)
New schools across the nation
make better use of daylight
with glass block walls

Today, really modern schools use every known way to bring as much controlled daylight as possible indoors.

Experiments at the Daylighting Laboratory, University of Michigan, have proved it is quality not quantity of daylight that creates good seeing.

The ideal seeing environment consists of steady, even lighting without glare and harsh contrasts.

That's why, today, in every corner of our land the really modern schools have modern panels of Light-Directing Glass Block that capture and properly use daylight from early morning to late afternoon. The prisms within the block direct daylight up to the ceilings where it is spread evenly over all parts of the classroom. With Owens-Illinois Light-Directing Glass Block®, there is no glare and no shades are necessary.

*Formerly known as INSULUX
Research Laboratory Classroom, Daylighting Laboratory, University of Michigan. Educational authorities call it the most advanced schoolroom in America today.

It was made possible by the findings of a continuing 12-year study into the problems of schoolroom daylighting conducted by scientists at the Laboratory.

WASHINGTON, King County. Mercer Island School. Naramore-Bain-Brady and Johanson, Architects


Your present school, or one you are planning, can have the same good daylighting that these schools have. Write for the details. Address: Kimble Glass Company, subsidiary of Owens-Illinois, Dept. PA-6, Box 1035, Toledo 1, Ohio.

OWENS-ILLINOIS GLASS BLOCK

OWENS-ILLINOIS

general offices • Toledo 1, Ohio
... can be made up in your choice of attractive patterns. For all the Pittco Store Front Metal profiles have been designed to enable you to combine these mouldings into many handsome patterns, a few of which are shown here. These mouldings are carefully extruded to produce a smooth finish, sharp lines and rigid construction. See Sweet's 1954 Architectural File 20/Pi (A.I.A. File No. 26-D).
we just want you to GET THE FACTS!

You can give the home owner a lifetime, STREAMLINE all-copper drainage installation for less than 1% of the total price of the entire house.

It's no mystery why more and more houses are being built using STREAMLINE all-copper soil, waste and vent lines.

- Copper is not expensive. The typical kitchen-bath installation shown above costs only $4.55 more, including labor, compared to a rustable, ferrous system.
- Construction costs are reduced since the 3" copper stack will fit in a standard 2" x 4" partition.
- Pre-fabricated sections can be assembled at the shop for delivery to the job.
- STREAMLINE all-copper plumbing lasts more than a lifetime — helps sell homes.

There's the evidence — and you can reach your own verdict on the case by writing us today about the comparative costs and advantages of STREAMLINE all-copper drainage plumbing.

Write today for our latest catalog of Streamline Plumbing and Heating Products.

MUELLER BRASS CO. PORT HURON 33, MICHIGAN

June 1954 33
Since even the small homes you plan will have one or more telephones, And since most homeowners want concealed telephone wiring, Isn't it good practice to include conduit for telephone wires in all specifications for new or remodeled homes?

Your Bell Telephone Company will be glad to help you work out economical conduit installations. Just call your nearest Business Office.
Individualize your homes with these distinctive oak floors

Today you can give homeowners delightful variety . . . along with the natural beauty, lifetime wear, and easy upkeep of Bruce Hardwood Floors.

For a beautiful, decorative effect at reasonable cost, use two or three types of Bruce Floors in the same home. For example, Blocks in the living and dining rooms . . . Ranch Plank in the den . . . Strip flooring in the bedrooms. Each floor has its own interesting charm and individuality. All three are solid oak and can be ordered *prefinished* to get the famous Bruce "Scratch Test" Finish . . . and to save time and money on the job.

Write for literature with color photos of Bruce Hardwood Floors. See our catalog in Sweet's.
SEE THE DIFFERENCE: These surprising before-and-after pictures show the crisp new look that can be given to masonry walls in a matter of a few hours... for a matter of a few dollars. Flush vertical joints and tooled horizontal joints give the effect shown.

Here’s a NEW EXPRESSION for masonry faces

Today’s architects are transforming concrete block and other masonry walls to surfaces as handsome as they are durable. With the application of a cement paint even the roughest-textured blocks take on a smooth, clean surface that will resist moisture, dirt and dust in any climate.

The paint forms a permanent bond with the wall—becomes an integral part of it. Economical cement paint is easy to apply to concrete or masonry. On a dampened surface the paint is simply brushed on—first over joints—then over the entire wall.

Color selection is complete. The true white of Atlas White gives full value to the delicate tones of pigment colors.

Cement paint and stucco manufacturers recognize the uniform and true whiteness of Atlas White. That’s why they specify it in their superior products. Whether you use a convenient easy-to-use factory-prepared mix or job-mix your own paint, be sure it’s made with Atlas White Cement.

For further information see SWEET’S Catalog, sections 4E/7a and 13C/5, or write to Atlas White Bureau, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

CONCRETE BLOCK partially covered with cement paint. Note how voids are filled and the rough texture smoothed to form a bright, clean surface.

Cement paint used on job above was made by Penn Crete Products Co., Philadelphia, Pa.

FOR BEAUTY AND UTILITY

ATLAS WHITE CEMENT
FOR TERRAZZO, PAINT, SLABS, STUCCO

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station.
50,000 Sq. Ft. Erected In 5 DAYS —

That's V-LOK

This Interlocking Steel Framing System is an engineer's answer to many structural design problems.

For the typical one-story building such as Schools, Factories, Warehouses, Supermarkets, V-LOK can be light or heavy as the loads and spans for which it was designed.

Erection is so fast—Any Contractor Who Takes a V-LOK Job Will Make a New Record. He will also ask you when you are going to have another one.

The designing time, fabrication and erection with standardized structural members all contribute to the successful bid you can make. Dimensions and loading information will be appreciated in your inquiry.
A DESIGN STANDARD LIKE THIS DEMANDS USE OF MODERN POWER

The standards being set in today's office building design call for full utilization of modern electrical power. It's an important consideration—in view of such necessities as high-speed elevators and modern lighting, the heating, ventilating and air conditioning systems.

These devices, as you know, have placed greater demands on a building's electrical system. More power must be carried. And power quality has had to be improved to minimize outages, assure well-regulated voltage.

Thus, a modern, completely adequate electrical system is extremely vital if the service devices you design-in are to operate at peak efficiency. Literally, it's an integral part of the building's foundation. It should be considered in the study stage... keyed to the services that will operate from it... built with equally modern electrical power equipment.

By so doing, you'll be bringing the power facilities up to the standards you've set for design. And you'll be providing your client with a better building—economically sound and adequately equipped to handle the many functions it must perform.


YOU CAN BE SURE... IF IT'S WESTINGHOUSE

WHAT IS A MODERN ELECTRICAL SYSTEM? It's an integral part of basic design—not superimposed or considered after the building is under construction.

The modern system is planned around requirements for reliability, versatility and convenience. And it stresses electrical characteristics essential to building services. Therefore, system design will vary—based on the type of building involved.

The Spot Network System, left, is an example. It emphasizes "reliability"—an important requirement in large office buildings. Efficient, high-voltage power is brought close to building loads from two or more sources. An electrical fault at one source will not interrupt power to the loads being served.

FOR YOU... 24-page book, covering modern electrical systems and equipment for commercial buildings. Valuable adjunct to your design planning. Write at no obligation for Cornerstone or Tombstone, B-6151. Westinghouse Electric Corp., 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.
AIM:

MATCH PEAK TRAFFIC WITH PEAK POWER

High-speed elevator service—demanded when tenants must be moved quickly during heavy traffic hours—should begin at the electrical system planning stage.

The need for completely adequate power distribution makes this so. Not only do high-speed elevators require more power, but their drives are usually located in the penthouse—far removed from the power source. Thus, the electrical system must carry heavier loads greater distances. Yet, it has to hold voltage and power losses to a minimum.

A typical way: High-voltage distribution—carrying high voltage from power source in the basement close to the electrical center of load in the penthouse. This modern practice stabilizes voltage. It eliminates line losses that result from long runs of secondary lines. It assures adequate capacity for heavy electrical loads.

At the center of load, then, high voltage is stepped down to operating levels with a Westinghouse Dry-Type Power Center. It installs anywhere to feed the elevator equipment and other local loads. No need for a vault. And the dry-type transformers and air circuit breakers minimize maintenance.

WESTINGHOUSE DRY-TYPE POWER CENTER . . .

a compact substation that permits high voltage to be carried close to elevator and other remote loads. Comes ready to install.
AIM:

MATCH AIR CONDITIONING WITH MODERN CONTROL

Modern air conditioning is another tenant demand completely dependent on the electrical facilities behind it.

A number of motors and controls is involved in the modern air conditioning system. Thus, early steps should be taken electrically to assure continuous circulation of conditioned air—to the various building services.

In many modern buildings, all control equipment is located in one spot. This brings about easier operation and simplifies maintenance.

More complete integration of the controls is possible with a Westinghouse Control Center. It centralizes motor starting and protective devices in a compact enclosure that installs easily in any convenient location. Then, operating personnel can check operation of all motors at a glance.

In addition, Westinghouse Control Centers meet future requirements. This flexibility is due to standardized design and modular construction of the units.

YOU CAN BE SURE...IF IT'S Westinghouse

WESTINGHOUSE CONTROL CENTER centralizes electrical control for building air conditioning systems in a single enclosure. At right: Secondary control for wound rotor motor drives... typical of the Westinghouse complete line of air conditioning compressor motor control.
AIM:

MATCH FIXTURES TO FUNCTIONS

Effective illumination demands this consideration: Lighting systems must be matched to functional requirements, yet blend harmoniously with building design.

This is particularly difficult in general office areas where sharp contrasts must be minimized. Thus, to keep contrast between fixture and ceiling down—to prevent specular reflection from shiny surfaces—indirect lighting is required.

When you select the fixture, you must balance the desirability for comfort—obtained with indirect lighting—with the requirement for efficiency, realized through direct lighting.

Other factors also affect the selection. Fixture design and proportion and the ultimate lighting layout must blend with interior design.

Above is an outstanding example of how these considerations have been met. A Westinghouse CD-80 Luminaire was selected. It assures both comfort and efficiency by providing direct and indirect lumination. It blends well with room proportions...gives quality light for detailed office work...maintains the same high level of balanced design that exists throughout the building.

Architecturally, complete advantage was taken of the 10’ ceilings. Fixtures were suspended approximately 2’. This permitted installation of a comfortable system of continuous semi-indirect lighting. Today, it still maintains a desk-top lighting level of over 40 footcandles.

YOU CAN BE SURE...IF IT’S Westinghouse
AIM:

PROVIDE MAXIMUM RENTAL SPACE

The heavier electrical loads elevator, air conditioning and lighting systems place on a building's power system make selection of its component parts a vital consideration. This equipment must have adequate capacity for increased loads. Yet, it should be compact to release maximum space to your client.

Modern distribution equipment answers these requirements. Example: Westinghouse Bus Duct—a highly efficient way to distribute low-voltage power. Up to 5000 amperes, in fact, it packs more power into less space than any other method of secondary electrical distribution.

Westinghouse Bus Duct comes in standard, prefabricated sections that adapt perfectly with building plans. It can be installed in elevator shafts or wireways. When exposed, its neat appearance blends well with interior design.

The inherent flexibility of bus duct is another "plus". It provides adequate reserve capacity to handle future loads. Expensive rewiring is eliminated.

MATCH LIGHTING INSTALLATION WITH MODERN PANEL-BOARDS to give your clients both adequate protection and the convenience of circuit breakers. Westinghouse NPLAB-type lighting panelboard, here, features the compact Quicklag® P AB De-ion® circuit breaker. It enables you to design circuit protection into a smaller panelboard . . . and saves valuable closet space.
Re: Door Closers for Recessed side of Doors

AT LAST No More of This

LOCKWOOD'S new parallel arm allows closer to be attached to door—completely eliminates problem of headroom interference.

NO LOSS of spring power, either—new leverage principle provides adequate closing power!

LOCKWOOD has complete line of parallel arm closers—non-holders, 135° holder arm, 180° holder arm and fusible link holder arms.

Best door closer news yet! LOCKWOOD

The mark of superior quality
LOCKWOOD HARDWARE MANUFACTURING COMPANY
Fitchburg, Massachusetts
Brighter beauty is built-in and protected by the impervious resin surface that dirt and soil can't penetrate. It's a tougher surface that resists mars, and scratches. It's far easier to keep clean. Acids, alkalies, and scores of other chemicals are strongly resisted. Grease, oils, cleansers, spilled foods do not damage. Beauty for years is assured by this unusual cleanability... beauty that stays "true to color."

Specify flooring "made of BAKELITE Vinyl Resins." You have greater freedom for colorful styling without service worry. You have a bright work-saving attraction for home purchasers. And you provide lower maintenance costs and greater in-service economy for users in every type of building.
Curved Foldoors are often used to follow the architectural contours of a room. A smart installation, it folds neatly into a graceful curve and operates just as smoothly on a curved track as on a straight one.

The Foldoor Glide Switch allows graceful and versatile use of the door as well as out-of-the-way storage. Designed exclusively for curved track and recessed-type construction. Safety bar stops door from slipping off.

The Foldoor Pivot Switch permits door to be switched to a wall stacking position. Provides unusual flexibility of room arrangement and convenient storage of door. Safety features prevent door from leaving track.

Cloth-Textured vinyl-coated fabrics are a Foldoor exclusive! Developed to meet today's trend toward subdued colors, they combine the softness and hang of draperies with the washability and strength of plastic coverings.

Foldoor's Four-Way arrangement divides a large room into four smaller ones. Use of floating post permits any combination of the four doors. A crossover switch enables space to be divided into two or three rooms rather than four.

A Three-Way Foldoor installation is primarily used to break a room into ½, ¼ and ⅛. This application allows many different divisions of a room to accommodate groups that fluctuate in size. Ideal for church, school or funeral home.
NOW, AN IMPRESSIVE BROCHURE FOR ARCHITECTS CONCERNED WITH CHURCH SPIRE ARCHITECTURE

"Pointing to God" now available with over 35 illustrations of ancient and modern spires

Church spires have played a noble part in the spiritual history of Western Man. For 15 centuries, they have been powerful symbols with which man has expressed his desire to commune with God.

Believing that a survey of spire architecture is of special interest to architects and churches today, when lightweight metals and new techniques are so wonderfully reviving the form, Overly Manufacturing Company presents a 28 page brochure on spires.

Over 35 illustrations illuminate the text. All the great schools of spire architecture, from the 6th century through modern times, are presented. Problems of lateral stress, leakage, corrosion and buckling are discussed. Materials and techniques are covered.

Overly's brochure, "Pointing to God," is offered without charge to registered architects and churches. (The price is $1.00 per copy to all other interested parties.)

Write on your firm or church letterhead to . . . OVERLY MANUFACTURING COMPANY, GREENSBURG, PENNSYLVANIA.

Wren's City Steeples

Two Fine Modern Spires
You can solve more problems with

**MOBILEX** ...less expensively...

than with any other recessed lighting fixture

How many times in your experience have you wanted to use the good design advantages of recessed lighting—only to see your plans go by the boards because over-all ceiling costs got out of line?

You have an answer to that bottleneck now. MOBILEX. It fits more types of ceilings—without the need of expensive custom made adapters than any other recessed lighting fixture on the market.

That means MOBILEX gives you a broader range of price, ceiling, and recessed lighting combinations than you've ever had to work with before. And that means a far greater opportunity for you to deliver good design and de luxe lighting—even to clients who must limit you to a modest budget.

Because we know you are always interested in new products that really help you do a better job, we think you'll want to see and hear more about MOBILEX. We'll be happy to arrange a MOBILEX demonstration any time you say. We promise you this: you'll find it well worth-while.

CALL OR WRITE YOUR NEAREST DAY-BRITE REPRESENTATIVE

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**MOBILEX FITS GRID-TYPE SUSPENDED CEILINGS.** Fixture is inserted into grid opening, rests on "tee" rails, locks into place. Reduces installation costs up to 50%. Acoustical ceiling boards, MOBILEX units are interchangeable, permitting quick, low-cost revisions of lighting pattern whenever desirable. WRITE FOR BULLETIN OD-567.

**MOBILEX FITS EXPOSED SPLINE SUSPENDED CEILINGS.** Fixture hooks onto universal 1 1/2" ceiling carrying channels. Multiple use of same supporting members saves material and labor costs. Acoustical tiles, MOBILEX units may be re-arranged any time after initial installation. WRITE FOR BULLETIN OD-606.

**MOBILEX FITS CONCEALED MECHANICAL SUSPENDED CEILINGS.** Flange type MOBILEX for acoustical ceilings using concealed metal spline, screw or adhesive methods of supporting mineral tile. This MOBILEX unit is listed with simple-to-install Day-Brite suspension straps which clamp to ceiling carrying channels.
This is **MOBILEX** with molded plastic panels. Also available with Ribbed Skytex glass panels and BOXCO® louvers. **MOBILEX** can be supplied in 2, 3 or 4 lamp arrangements for 2' x 2' fixtures or 2' x 4' fixtures. Enclosing element frames have separable hinges and can be hinged from either side or completely removed for quick maintenance. **LOOK AT MOBILEX...** **FEEL THE DIFFERENCE...** **BEFORE YOU SPECIFY.**

**MOBILEX FITS SNAP-IN TYPE ACOUSTICAL CEILINGS.** Fixture snaps into the same "Tee-bar" rails that receive metal pan ceiling tiles. Day-Brite designed spring retaining clips snap "home" above the Tee-bars for added security.

**MOBILEX FITS PLASTER CEILINGS.** Simple, rugged Day-Brite plaster frames and suspension straps frame the opening and support the MOBILEX for plaster and acoustical tile-on-plaster installations. Extra long studs in suspension straps allow maximum adjustment for positioning fixture.

**DAY-BRITE LIGHTING, INC.**
5405 Bulwer Avenue, St. Louis 7, Missouri.
In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.
How Ceco methods saved materials

When architect Victor Gruen developed the original concept of Northland Center, world's largest shopping district in suburban Detroit, he had an eye for beauty and function. Beauty that would make the center a pleasant and even inspiring place to shop. Function that would make shopping as convenient and effortless as possible.

J. L. Hudson Company's branch department store is the core of the development—and here one of the major requirements was providing the greatest amount of usable space by keeping interior columns few in number and small in size. Typical spans were 29'-1" each way, and a waffle design using 14" deep Ceco-Meyer Steelforms provided a ceiling clear of beams, and kept steel, concrete and dead weight to the minimum. The saving in steel alone was 16% when compared with solid flat slab construction.

In other areas of the Hudson store and in the tenant and the service group buildings, one-way Ceco-Meyer Steelform floor
construction accounted for similar steel savings, eliminated "lazy, non-working" concrete, and kept dead load low.

Overall result in all buildings: wide areas of uninterrupted space —clear ceilings—a pleasing effect—highly functional. Ceco Engineering Service detailed placing plans for Ceco-Meyer Steelforms and reinforcing bars. This was a big project—5,000 tons of Ceco reinforcing steel delivered by truck to the job site—1,000,000 square feet of steelforms placed and removed by Ceco—a job requiring the service of a company skilled in its field and geared to deliver as the need dictated.

Here is another example of Ceco performing on the architect-owner-contractor-supplier team. On your next project call Ceco Product Specialists. They will help you save through product engineering. Consult Sweet's File for address. (CECO)

Two-way waffle design using Ceco-Meyer Steelforms permits longer spans, resulting in larger uninterrupted floor areas.

One-way Ceco-Meyer Steelforms also save steel and concrete, thus reducing dead load.
HOTEL NACIONAL DE CUBA
Shopping Plaza
HAVANA, CUBA

Rafael de Cardenas
Architect and Builder

Piers for entrance canopy and store facade are 1\(\frac{1}{8}\)" thick Architectural Terra Cotta in units 19" x 21". Two shades of gray were specified for contrast.

Design in Architectural Terra Cotta to define more character and color

From the first moment you put pencil to project, the versatility of Architectural Terra Cotta will pace your creative planning. Choose any form, color or texture for interiors or exteriors. Architectural Terra Cotta will be custom-made to your precise specifications...in units large or small, plain surfaces or decorative sculpture. Whatever the building type or budget limitation, modern Architectural Terra Cotta offers advantages you'll find in no other building material. Compare...for custom-matched color, texture, price, durability and ease of maintenance. Write us for latest facts today.

Construction detail, data, color samples, estimates, advice on preliminary sketches, will be furnished promptly without charge on Architectural Terra Cotta and Ceramic Veneer.

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PLANTS AT PERTH AMBOY AND SOUTH AMBOY, N. J.
Natural beauty—
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these are the
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Offer clients these benefits by specifying

**ART METAL advanced ELIPTISQUARE**

with clear, prismatic **AMCOLENS**

- Lighted objects reflect their true color value
- Highest light transmission efficiency
- Precise light direction control
- Edge light to ceiling for visual comfort
- Shallow recessed lens lighting

Elliptisquare reflector redirects all box-enclosed light downward through AMCOLENS to multiply lamp light utilization.

Manufacturers of Engineered Incandescent Lighting
Designed and specified by Thorshov and Cerny, Inc., A.I.A. Minneapolis, Minnesota

with The Kawneer Touch

Your design on the drawing board becomes a distinctive fact when it's executed with The Kawneer Touch.

This hotel in Moorhead, Minnesota, stands out because Kawneer products were detailed, specified and installed. The skillful installation of quality Kawneer architectural metals as specified makes designs as close as possible to the way they were conceived.

Kawneer representatives are ready to assist with building front information, to furnish full-size details, etc., and to suggest reliable sources for prompt bids. Factory-trained Installing Dealers are listed under "Store Fronts" in telephone directories. Call the dealer located nearest you or write Kawneer, Niles, Michigan, for complete information.

Ask your Kawneer Installing Dealer for Kawneer Full-Size Details
At the Carey Research Laboratories, this fire test of a conventional-vapor seal, with insulation and built-up roofing over steel deck, showed the dripping of asphalt from the vapor seal igniting as 1800° of heat builds up under the roof construction and melted bitumen flows through the joints in the deck.

Cross-section view of conventional-type 2-ply asphalt vapor barrier, insulation and roof.

Fire test of conventional-type built-up roof with new Fire-Chex 1-ply Vapor Barrier over the steel deck (see diagram). Here you'll note a complete absence of any dripping material and only slight burning of gases. Practically no fuel is contributed to the fire by vapor barrier.

Cross-section view of Fire-Chex type 1-ply asbestos-plastic vapor barrier, insulation and roof.
achievement in Fire Protection...

VAPOR BARRIER

for built-up roofs

Perfected after years of research and testing—now ready to help you plan buildings with a new all-time high in fire safety!

Specify Fire-Chex asbestos-plastic vapor barrier for built-up roofs. Remove all doubt about fire-safety. Fire-Chex vapor barrier does not release excessive combustible gases and melting asphalt.

In Carey Fire-Chex, you have a vapor barrier that does not contribute to fire or cause it to spread. Even when installed over a standard steel deck that's heated red hot, Fire-Chex remains intact. Does not release melting asphalt and excessive gases.

And here's more good news. Fire-Chex costs only a few cents more per square applied than hazardous, conventional-type vapor barriers. You can specify its priceless protection within your client's budget.

Mail the coupon below for complete specification details, or to have a Carey Industrial Sales Engineer call without obligation.

Visit the Carey Exhibit at Booth #64, A.I.A. Convention, Boston, Mass., June 15-18
marble when beauty and low maintenance cost must be combined

The brilliance of new materials can be a monotonous thing, unless the softening influence of inimitable nature lends its hand. It can be a treacherous thing, unless means are taken to make it practical, easy to live with, economical to maintain.

Marble does all this. By itself it is beautiful; combined with other fine materials it is unexcelled. But it is always practical, always easy to maintain.

Furthermore, Marble is economical. In fact, the total cost of beautifying the Alcoa Building with Marble — in the main lobby, the elevator lobbies, Board Rooms, floors, etc. — was only 1.7% of the total construction cost. How else could you get so much for so little?

50% Savings!

Lighting installed at half the cost
with UNISTRUT® channel and fittings

New fluorescent fixtures were recently installed on two floors of the Butler Brothers Building, Chicago, Illinois. The savings on this UNISTRUT installation over conventional methods was estimated at fifty percent. How did UNISTRUT reduce installation costs?

By using UNISTRUT channel with its continuous slot to attach fixtures quickly in perfect alignment. And by using the same channel as a wireway. This fast, easy method cut costly installation time in half!

UNISTRUT channel insures true alignment. It provides the utmost in safety because the entire row of fixtures forms a single integrated unit. Fewer hanger rods are needed and a neater, more attractive installation results. Stems or rods may be placed at any point along the channel, permitting installation on irregular ceilings. Fixtures can be fastened in a continuous row or intermittently as shown here.

Get in touch with your UNISTRUT Distributor for the full, cost-cutting facts on light supporting with UNISTRUT framing.
Noteeworthy edifice in downtown New York City is this progressive, functional office building at 90 Church Street...home of Dun & Bradstreet, Inc. Several years in the planning stages, the resulting structure is complete with the most modern equipment for efficient operation.

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June 1954
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Modern appearance and cost-cutting efficiency...you get both in this industrial siding. The lightweight strength of ReynoSide makes possible structural economies...assures low installed cost. Its freedom from rust and resistance to corrosion mean long life with lowest maintenance.

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**INFORMATIONAL DATA ON PERMACOUSTIC**

<table>
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<th>Dimensions</th>
<th>Thickness</th>
<th>Color: white</th>
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<th>Mechanically mounted on special metal supports (mounting No. 7)</th>
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</tr>
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Note: Also available in 7/8" thickness.

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The Johns-Manville Permacoustic Ceiling in this attractive reception room provides quiet comfort and contributes to its beauty.
New Edison Junior High School* takes full advantage of the beauty and utility of STAINLESS STEEL

*West Mifflin Borough
Allegheny County, Pennsylvania

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HERE IS A FINE, spacious, new junior high school building that sets a precedent in design and construction. For the architect has made extensive use of one of today's most beautiful and most functional building materials—Stainless Steel.

On the exterior of Edison Junior High School, insulated panels of Stainless Steel form the spandrels and the head panels. The spandrels are of 20 gage Stainless Steel, one foot wide and four feet high with six-inch face square corrugation. The head panels are one foot high. Panels are insulated with one and one-half inches of Fiberglas and attached to the structural framework with clips.

The combination of Stainless with masonry and glass block makes an extremely attractive building. But the benefit of Stainless panel construction doesn't stop there. Construction with the panels was fast and went forward in all types of weather. More complete utilization of floor space was possible through this curtain-wall type construction. Maintenance on the Stainless Steel will be negligible and life will be long.

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Following are excerpts from the Guide prepared for this month's Convention of the AIA in Boston.

Of 17th Century Boston almost nothing remains except the Paul Revere house of about 1680 and some trace of the original and highly irregular layout of the streets in the district now known as the North End. Boston's growth was long southward rather than westward. All of the remaining pre-Revolutionary monuments, few, but of major individual interest, lie north of Milk Street. After the Revolution, the city continued to grow southward between the Common and the Bay in a district which was to be swept clean by fire in the early 1870's and has since been completely rebuilt. Just at the end of the 18th Century a new development began to the west on the slopes of Beacon Hill; the State House, begun somewhat earlier, provided the apex of a new city turned away from the Bay and toward the southwesterly sloping Common. What still exists of this residential development on the Hill offers Boston's most coherent architectural picture, remarkable less for individual structures (although it includes several by Bulfinch) than for the distinction of the general architectural texture, the picturesque- ness of the topography, and the general level of maintenance. As is well known, Beacon Hill has few American rivals as an example of early 19th-Century urbanism and bears comparison with the best English work of the contemporary Regency period.

Wooden through much of the 17th Century, brick-built through the 18th and into the 19th, Boston began to exploit its finest available building material, Quincy granite, only in the years from 1825 on, chiefly for commercial and monumental buildings in the waterfront district. Coinciding in date with the later granite commercial buildings came the development of a new residence district, the South End, extending along Washington Street to the southwest of Dover Street. This was overshadowed within a decade by the much more extensive and coherent, if less varied and imaginative, planning of the Back Bay area laid out in 1856. Here is concentrated the most of Boston's architectural history from 1860 to 1900. Compared to the distinguished individual monuments by Richardson and McKim, Mead & White that are its highlights, or the earlier Beacon Hill district, the general level of Back Bay building architecture is low, but the houses (which were often built in groups, particularly in the earlier decades), illustrate the changing tastes of the last half of the 19th Century with entertaining variety.

The commercial architecture of these decades is not well illustrated in Boston. The finest things, such as Richardson's Ames Estate Building on Harrison Avenue (1886-87) or the Board of Trade Building by his successors Shepley, Rutan & Coolidge (1890-92) seem almost to belong in Chicago rather than in Boston. Leery of metal construction in its early heyday, Boston architects and builders were slow to accept the skyscraper either as a type of commercial architecture or a method of construction. Restrictions in height long kept out really tall buildings and the Custom House Tower (1913-15) built by Peabody & Stearns for the Federal Government and hence not subject to local restrictions, was the first to challenge Bulfinch's State House as the climax of the city's silhouette.

Restrictions on heights were finally removed in the 1920's and in the last decades Boston has begun to build skyscrapers, but it cannot be said that they
have as yet added much to the architectural wealth of the city. Leaving the few but prominent skyscrapers aside, which generally reflect the taste of the 1920’s, Boston in its metropolitan core has little building of the postwar years that is notable or even conspicuous. It is outside of the areas built up before 1900 and generally outside of administrative Boston that distinguished additions have been made, as notably along the north bank of the Charles River Basin in Cambridge, where the coldly classical complex of the main Massachusetts Institute of Technology buildings erected early in the century are flanked today by boldly designed modern buildings by various architects.

From Boston itself the architectural visitor will naturally proceed to some at least of the inner belt of suburbs. In Cambridge, further out the Charles than the M.I.T. group, there are the extensive buildings of Harvard University, ranging in time from the dormitories of the 18th Century down through major work by Bulfinch and Richardson in the early and late 19th Century, to the new Graduate Center. The presence in Cambridge of two of the country’s leading architectural schools has left its mark already on the architecture of Harvard and the Massachusetts Institute of Technology, not to speak of newer institutions such as Northeastern and Brandeis Universities; it has also produced a Boston group of modern architects whose work in the domestic field has been widely publicized.

Nowhere else but in the Boston area can one see in America so varied a range of buildings in so short a space of time. From the most considerable group of 17th Century buildings in the country, including one of the two churches of that date that have survived, through the mansions and churches of the pre-Revolutionary period and many streets lined with houses and commercial buildings of the late 18th and early 19th Centuries and the late 19th Century masterpieces of H. H. Richardson, and McKim, Mead & White, to Aalto’s M.I.T. Baker House and Eero Saarinen’s M.I.T. Auditorium rising beside it, this region has always made a distinguished architectural contribution. If Boston lacks the drama of New York or Chicago or San Francisco, it none the less rewards in detail.
guide books help public relations

On the preceding two pages are excerpts from the Guide to Boston Architecture prepared under the sponsorship of a Committee of the Massachusetts State Association of Architects, host Chapter to this month's AIA Convention in Boston. This is the third such Guide, prepared by local Chapters, assisted by the AIA Board of Directors, to be published by Reinhold and distributed at the Conventions as a service to delegates and members.

Public relations activity is most successful when it is conducted in a receptive atmosphere. One difficulty in “selling” the value of an architect’s services is the fact that the general public, by and large, is so ignorant of the importance of architecture in daily life, and therefore unheedful of architecture it sees—and uses—every day.

As a basic public relations activity, P/A suggests that more local architectural groups consider the “Guide to Your Town’s Architecture.” It is an activity being at least contemplated by several AIA Chapters that we know of, one that has already been undertaken very competently in some places, somewhat sketchily in others.

A Guide in pictures and text, pointing out historic as well as contemporary structures, relating the architectural achievement of the local area to its region, its time, its own local requirements, is an activity which can be made to attract wide local attention. It is also an enterprise into which architectural schools, local historians, and historic societies, Chambers of Commerce, and many other groups can be drawn.

Some thoughts for the benefit of other groups can be inferred from the experience with the AIA Convention Guides. In these cases, the publishing cost has been donated by the Reinhold Publishing Corporation (the magazine Progressive Architecture and the Reinhold Architectural Book Division)—an expense which otherwise would have to be covered by donations, subscriptions, and the sales price. In addition, the national body of the AIA has made a grant each year, to cover the cost of obtaining photographs—another cost which would have to be met by a group planning a Guide of its own. The research and writing, as well as selection of illustrative material, has been done by someone assigned the job by the local Chapter, and paid in some manner, by the Chapter. In the case of the New York Guide, Huson Jackson was the author, having received an Arnold W. Brunner grant. In Seattle, it was Victor Steinbrueck; now the Boston Committee has utilized the valuable services of Henry-Russell Hitchcock. Something of the sort could always be done in any locality—a Committee could be formed to work with and under the direction of some individual—a teacher in the nearest architectural school, perhaps.

No attempt has been made to sell the AIA Guides on any wide scale to cover these various costs. In New York, The Architectural League and several Museums have copies available, and without any promotion there has been some continuing demand for the booklet. In Seattle several bookstores displayed the Guide during the Convention last year and sold some. This is an aspect of the project that a group considering its own Guide as a public relations endeavor, not as a service to AIA members alone, would want to explore. Sales of a well-prepared booklet could undoubtedly be promoted through bookstores, travel-aid bureaus, hotels, museums, and so on. Why not think about it?
Though the practice of his profession makes him the recognized "organizer of space," the architect rarely is able to maintain an orderly appearing office.

Unlike a typical commercial office where incoming and self-prepared business documents are of a size and nature which may require neither specially segregated storage areas nor multisized file receptacles, in the architect's office filing in itself presents a complexity.

In order to be able to "organize" an architect's office purely from the viewpoint of filing, let us analyze briefly the types of documents and materials involved in his practice. This material falls into two basic categories: "Business and Administration" and "Technical." As the names imply, the "Business and Administration" material, and of course all typed correspondence pertaining to architectural work, is kept in the secretary's office, while the "Technical" material is kept in or near the drafting room. Some of the material kept in the office will of course have to be consulted from time to time by individuals engaged in technical work, but generally this will be confined to persons in charge of jobs, and not the technical staff as a whole.

storage of technical material and supplies

The following is a brief, and by no means all-inclusive, list of headings for the various types of references and materials which generally are kept in or near the drafting room or, in some instances, near the person who may be the most frequent user of the particular material. (To avoid excessive waste motion by men having to use certain references, they should be stored centrally and near the particular group.)

Storage allowances must include provisions for:

- Drafting Supplies and Instruments;
- Drawing files (active and inactive);
- Building Codes, Landbooks, Zoning Maps, etc.;
- Reference and Handbooks (architectural, structural & mechanical);
- Manufacturers' Catalogs & Handbooks (too large for storage in file cabinets);
- AIA File (Manufacturers' Literature);
- Furniture File;
- Source Material File;
- Architectural Magazines and other Subscriptions;
- Library;
- Photo, Publicity, and Reprint Files;
- Color Systems;
- Modeling Supplies;
- Samples Storage;
- Shop Drawing Files;
- Construction Cost Data Files;
- Specification Files (completed jobs);
- Job "Desk" Files;
- Forms, e.g.:
  - Blueprint Order Books;
  - Transmittal Forms;
  - Timecards;
  - Record of Prints Received & Issued;
  - Building Department Application Forms; etc.

This listing of headings of materials which must be kept, though large in itself, unfortunately only represents categories of materials: the volume of actual arrivals will make it increase daily.

filing procedure for major categories

Each office, no doubt, will have its own proven way of filing and/or storing the items listed above. However, no matter how good a filing system an office may develop, a list is kept of the drawing numbers and titles and date. (This same list may be used to record issues of drawings.)

When the job is completed, no-longer-essential sketches, preliminary drawings, and superseded not-official record prints, etc. are destroyed, and job is ready for storing—and hardly any office has sufficient flat-drawer space to store the drawings there permanently—they must be filed in a place where they are out of the way and yet easily found for reference purposes.

The common types of files for drawings are:

a. Drawers—for active jobs (tracings);
b. Coops—for completed jobs;
c. Racks—for hanging of final record sets, and latest prints of active jobs;
d. Filing Cabinets—record prints folded (large jobs).

After a relatively short time, an office will have accumulated a sizable number of rolls of drawings, precluding reliance on memory as to where a particular job is stored. A loose-leaf alphabetic Index Book, giving the following details
Arranged as the table illustrates),

Name or Location; (If a private residence, it is listed under the owner’s name; if a job in the city, it is listed under street address; if some jobs are known by address, as well as by name of building, cross-indexing is necessary.)

Job Number;

Year;

Type of Work; (e.g., Residence; Apartment House, Store Alteration; etc.)

Drawing Location; (If drawings are stored in more than one area, then a group of coops or drawers is identified and marked by a letter, each separate coop or drawer having a number; e.g., Coop B-4=Coop B, 4th Hole.)

Remarks.

2. Building Codes, Handbooks, Zoning Maps, etc.: These are kept near the man whose job calls for frequent consulting of this type of material.

3. Reference-and-Handbooks: Books of this type are kept in a central location to enable all draftsmen to reach them easily. Among others, they include such drafting room “bibles” as: Architectural Graphic Standards (Ramsey & Sleeper); Data Sheets (Don Graf); Time Saver Standards (F. W. Dodge); Civil Engineers’ Handbook (Merriman-Wiggin); Architects & Builders Handbook (Kidder-Parker); Engineers Pocketbook (Trautwine); Mechanical & Electrical Equipment for Buildings (Gay & Fawcett); Steel Construction (AISC); Reinforced Concrete Design Handbook (American Concrete Institute); Structural Shapes (Bethlehem); Design, and Specifications & Costs (Seyely); Numerous Handbooks on Wood Construction, “Parker’s,” specification reference guides and worksheets, etc.

4. Manufacturers’ Catalogs and Handbooks: This material, too, is kept in a central location for use by most men. It includes among others: Sweet’s Catalogs, and other large-size catalogs issued by various manufacturers of their products: e.g. Plumbing, Hardware, Woodwork, etc.

5. AIA File: This material, consisting exclusively of manufacturers’ catalogs and literature, though at times duplicated in Sweet’s, is kept in filing cabinets in the drafting room. This file in particular becomes overloaded frequently, as material constantly comes in by mail or by hand. Unfortunately, not all manufacturers have realized that certain types of catalogs and leaflets are of but little value to the architect. Consequently, a great deal is just glanced at and destroyed. Others have recognized the needs of the architect and have turned out very useful publications. In general, the catalogs worthwhile keeping are those which show the product in detail, give installation details at various scales for different types of construction, a brief specification, and other concise, relevant data.

The best method for filing this material is by using the AIA prepared guide: Standard Filing System and Alphabetic Index for Filing Information on the Materials, Appliances, and Equipment in Construction and Related Activities. (AIA Document #172).

Some manufacturers have realized that this system is most suitable to the architect and have gone so far as to classify each catalog showing the respective AIA file number printed right on the document. This is very helpful.

Another step in the right direction taken by some manufacturers is to have their catalogs distributed via the Architects & Engineers Service (in larger cities). This organization has proved to be very helpful to busy architects’ offices by having a representative visit the office periodically, going over each catalog brought, commenting briefly on the product, and physically file the literature in their proper place, at the same time weeding out superseded catalogs. (The latter being a periodic chore which more often than not is neglected by the busy architects’ staff.)

6. Furniture File: This actually could be part of the AIA file, but it may be found more useful when it is divorced from that and broken down into such subheadings as: Residential Furniture—contemporary; Residential Furniture—antique; Garden Furniture; Lighting Fixtures; etc.

The discussion in this article has been on the general subject of Drafting Room (Technical) files, and specifically on drawings, and technical reference material. Next month, continuing the discussion of filing technical data, we will consider source material, magazines, books, photographs, and the important matter of cost data.
The role of an architect as arbiter under the AIA form provisions was critically examined by the Appellate Division in New York in the recent case, Gold Plastering Co., Inc. v. 200 East End Ave. Corp.

The contractor had entered into an agreement to lath and plaster a building then under construction. The AIA "General Conditions" were incorporated by reference and made a part of the specifications. An action was subsequently commenced by the contractor to recover damages for breach of contract and for the reasonable value of labor and materials furnished.

The owner relied heavily upon a decision rendered in its favor by the architect to whom it had submitted the dispute for determination pursuant to the "General Conditions" of the AIA, Article 39, of the standard form of the American Institute of Architects, which provides, in part:

"The Architect shall, within a reasonable time, make decisions on all claims of the Owner or Contractor and on all other matters relating to the execution and progress of the work or the interpretation of the contract documents.

"The Architect's decisions, in matters relating to artistic effect, shall be final, if within the terms of the contract documents.

"Except as above, or as otherwise expressly provided in the Contract Documents, all the Architect's decisions are subject to arbitration."

Article 40 pertaining to arbitration contains the following clause:

"It is mutually agreed that the decision of the arbitrators shall be a condition precedent to any right of legal action that either party may have against the other."

The Appellate Division, in affirming a judgment for the contractor, denied that the architect's decision had any binding effect upon the parties, particularly since the owner had failed to move to compel arbitration or to stay the proceedings in the instant suit. Thus, the owner had waived any right it might otherwise have had to rely on the architect's decision, by its very participation in the action.

The owner had urged vigorously that Article 39 vested jurisdiction of the dispute in the architect and that, by reason of plaintiff's failure to appeal from the architect's determination and employ the arbitration provisions of Article 40, made the architect's award a final one.

Without so much as an oblique reference to Article 40, which makes the arbitrator's decision a "condition precedent" to a law suit, the Court implied that it was apparently unnecessary to resort to arbitration after the decision of an architect because the architect himself was an "arbitrator." The Court stated:

"While the architect is not referred to as an 'arbitrator' in the 'General Conditions' and his decisions made subject to 'arbitration' thereby, it is our opinion that the proceedings before the architect contemplated by Article 39 of the 'General Conditions' are part of a general scheme for arbitration of disputes, and that such proceedings constitute 'arbitration' within the meaning of Article 84, Civil Practice Act..."

The owner's contention that the architect had jurisdiction to decide the suit was likewise denied. Said the Court:

"However, we agree with the trial court that the dispute involved here, as to breach of contract, was not one which the parties had agreed by incorporation of the 'General Conditions' to submit to the architect for determination. In our opinion, the 'claims of the owner or contractor' which the architect was authorized to determine under Article 39 of the 'General Conditions', must be construed in view of other provisions of those conditions to refer only to claims 'relating to the execution and progress of the work' and not to claims arising out of alleged breach of contract."

The AIA "General Conditions" having been made a part of the "specifications" rather than to the whole contract, the architect could not hear disputes that did not relate to the work (specifications) to be done under the contract. Since the dispute did not concern the "execution and progress of the work," but a "claim arising out of alleged breach of contract," any decision of the architect had no binding effect.

Finally, the Court rejected, as well, the defendant's contention that the architect's decision was final. Said the Court:

"... it is also our opinion that in any event a decision of the architect, standing alone, was not intended to be final or to provide a basis for the entry of judgment, except insofar as it might relate to artistic matters."

This decision points up again the necessity of reconsidering the AIA "General Conditions," particularly with respect to the ethical and legal status of the architect as an "arbitrator." See March 1950 P/A, October 1951 P/A, November 1951 P/A, and February 1952 P/A, It's the Law. See also September, October, and November 1953 P/A, It's the Law.
toward new structural concepts

Most of us live a large part of our lives in rectangular cubes of varying proportions and sizes. Structurally, these are generally reticulated boxes placed either beside each other or piled atop one another in endless monotony. Paradoxically, the post-and-lintel system is neither the most economical of material nor the most expressive of form; yet, by far, this method of framing outnumbers all others. To a great degree, this devotion to building with lineal members has been forced upon us by custom, by building-material production methods that are most suitable for lineal members, and by the fact that man’s ingenuity has not yet developed for him other choices that are, in a practical way, any more acceptable. There is evidence, however, that mankind may be entering a new era of great creative activity in all arts and, looking forward to such an epoch, we may anticipate that more suitable, more economical, and less imitative structural concepts will surely evolve.

In this review we see a geodesic structural frame, rather modest in size, being used expertly to enclose a motel restaurant at Woods Hole, Massachusetts (page 100). Extending the possibilities of this method considerably, R. Buckminster Fuller, father of geodesic structures, contends that we possess the technology to enclose similarly the city of Chicago! Yet one must feel that such a system is not a panacea nor would such a state of structural design be desirable—even though geodesic construction offers maximum advantages for prefabrication, speed of erection, and lightness of material. Eero Saarinen, for example, found in his search for the most suitable structural system for the M.I.T. Auditorium that lightness of structure was actually incompatible with the essential purpose of an auditorium—good hearing conditions (page 120). Felix Candela advances another point of view in his article “Stereo-Structures” (page 84) wherein he analytically arrives at the concept that “doubly-curved surfaces are most appropriate from a structural point of view if a material like concrete, molded at the site, is to be utilized.” Although doubly-curved surfaces are appropriate roof forms, we must recall that we shall probably always have need for multistory structures and that as man has evolved two legs of equal length, he exerts the least energy when walking on level surfaces. Louis I. Kahn envisions that a tetrahedron floor-ceiling system is best suited to integrate the diverse functions required of structure (page 103).

Regrettably we are denied the knowledge of what lies ahead. However, in this issue the Editors have selected a cross-section of current structure and suggest that within it one may recognize many of the principles that point toward new structural concepts for tomorrow’s architecture.
The essential purpose of structure, that property which defines it as such, is to transform external loads into internal stresses and to transmit these, distributed along the structural members, to convenient locations. When considering the manner in which external loads are transmitted, two basic classifications may be established: passive structures conduct loads directly without changing their course, like bearing walls and columns which are merely elements interposed between the loads and the ground; active structures are those capable of changing the direction of loads and forcing them to move throughout the structure enclosing a certain space. The latter group may then be subdivided into plane structures in which the transformation of loads into internal stresses takes place in one plane (as in a conventional roof truss), and stereo-structures (or space frames) where in load transformation can develop stresses in any or all directions (as in the dome).

Realizing that linear and plane frames have been used almost exclusively for the past two centuries, it would seem evident that during this period some atrophy in structural ingenuity has not only occurred but also has continued to this day. At first glance, such an atrophy seems paradoxical and inexplicable, especially as its presence coincides with the emergence and evolution of the so-called structural science that was brought about by Augustin Louis Cauchy’s development of basic equations for the Theory of Elasticity at the beginning of the 19th Century. Yet is it too much of a coincidence to be a true paradox? Upon closer analysis it might be discovered that this pseudo-scientific vogue is one of the principal causes of this atrophy.

As the emergence of steel as a building material brought standard, linear sections, it became customary to consider all structures, including monolithic ones, as simple juxtapositions of linear members. The difficulties encountered in analytically visualizing and solving the full frame encouraged such an ideal subdivision into easily analyzable members, although in most cases the simplication was both artificial and imaginary! When the divergence between reality and invention would become intolerable, it was customary to fall blindly to the totally illogical process of forcing the design to approximate the ideal conditions established by calculations, instead of attempting to rectify the initial misconception. Thus the mere tool became an end in itself and the unchallenged effects such a procedure may have on the ultimate stability of a structure were ignored. Hardy Cross’ statement—"We must always remember that what we want is a structure, not merely an analysis"—is easily forgotten. Whether due to limitations of the human mind, to routine, or to structural mimeticism, the outstanding fact remains that we are, almost exclusively, building frames composed of networks limited to three perpendicular planes. Although no other solution to the monotonous problem of building piled-up boxes may be readily available, it seems advisable to thoroughly aware of the basic defects of this type of structure—its essential lack of economy—so that new solutions may be explored. In the organic structures of nature—where design progresses by natural selection and by survival of the fittest—the plane rarely occurs, the rectangular dihedral even less frequently.

Let us then analyze the simplest case of an active structure: two inclined members forming a triangle with the ground (Figure 1). An external force (whatever its direction) lying in the same plane, will be conducted to the points of support entirely by direct stresses parallel to the axes of both members. The analytical problem is then resolved simply by breaking the force into two components. The magnitude of these components, and consequently of the stresses acting in both members, increases as the subtended angle widens. Ultimately, when the two bars are horizontal, the stresses become infinite and the imagined structure impossible. It has been transformed into a simply-supported beam in which its structural function depends upon the bending resistance of the member. In the first case—ignoring the weight of the bars—as all fibers in each cross-section and all cross-sections of each member are working under the same stress, full advantage is taken of the material’s properties. In the second case, the distribution of stresses on the cross-section follows a triangular law (Figure 2) with some fibers acting in tension, others acting in compression, but only the extreme fibers working at their full capacity. Furthermore, as the magnitude of the moments vary along the beam, the stresses become smaller as the supports are approached, and result in a still greater waste of material.

In the design of a reinforced-concrete beam, no allowance is made for the part in tension, due to the low tensile strength of concrete, and all of the tensile stresses are considered to be resisted by the steel reinforcement (Figure 3). In this manner, approximately two-thirds of a concrete section acts only as dead load, performs no structural function, yet increases the necessary size of the beam as well as its supporting columns and foundations. As a result, more than two-thirds of the material employed in a conventional reinforced-concrete structure will be perfectly useless, superfluous, and—in the end—prejudicial to its stability.

A fundamental principle of economy is thus established: bending stresses must be avoided by judicious selection of appropriate structural shapes. The basic contradiction in today’s buildings is that the functional requirements seem to demand the presence of these bending stresses in their frames. In other words, the structural function depends essentially on the form. But not having the liberty to select form on a structural basis—the shape of a building being determined by other con-

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* Architect, Mexico, D. F., and Professor, Escuela Nacional de Arquitectura.
considerations—it is most unlikely that correct structures can originate through this design procedure. In fact, we are not using materials properly—rather, we abuse them.

Consider the simple but unstable post-and-lintel frame found in most structural compositions today (Figure 4). Ignoring (again) its weight, the structure will collapse if a force—either in its own plane but with a horizontal component or outside its plane—is made to act upon it. Its stability is entirely dependent on the rigidity of the joints and on the effective fastening of the columns to the ground or, in other words, on its resistance to bending. But if we transform the rectangle into two triangles by introducing a diagonal member (Figure 5), its stability will no longer depend upon the flexional strength of the joint members. It is not intended to rediscover here the simple and intuitive principle of triangulation, but rather to point out that its economy depends mainly on the fact that its application entails the reduction of bending stresses.

As a plane figure the triangle is indeformable; it cannot, however, resist forces outside its own plane. It is necessary to turn to the tetrahedron (Figure 6) to attain the basic figure of any lineal composition indeformable in space—a stereostucture capable of resisting or transmitting, by direct stresses only, forces of any direction acting at its vertex. (Pages 100 through 102 show structures that follow this principle of spatial triangulation.)

Up to this point, we have dealt only with reticulated frames composed of straight bars that form the resisting skeleton and that are able to support the superimposed covering material. When this covering material is a concrete slab, to consider it as dead load only without fully exploiting its resisting properties constitutes an inadmissible waste. The tetrahedron can also be imagined as being composed of four triangular slabs. In this case, the resisting bars at the com-
Common edges can be eliminated, substituting for them the intersection of the contiguous slabs which forms an angular member able to resist forces in any direction (page 103).

The common type of pitched roof is composed of a series of triangulated trusses bearing purlins that in turn support roofing sheets (Figure 7). It is common knowledge that these structures require bracing unless the roofing material is a concrete slab and the structure can profit from the stiffness of the slab in its own plane. In such a case, the triangulated trusses can even be omitted, letting the slab support itself. Thus we are arriving at the concept of surface structure or self-supporting lamina, following a process already experienced in more advanced technical fields. In automobile and aircraft construction, for example, stressed skin has almost totally displaced the initial supporting skeleton frame. To understand surface structure more fully, the traditional concept of the concrete slab—a structural element that resists loads perpendicular to its plane by bending—must be augmented to include its much greater capacity to withstand forces lying in its own plane.

Imagine a horizontal-plane slab supported continuously along two parallel sides (Figure 8). Its reactions are vertical and the bending moment acting at mid-span will increase rapidly with the square of the span. If we increase the thickness of a slab in order to resist a greater bending moment, we concurrently increase its own weight which, due to the unfavorable weight-strength ratio of concrete, is usually the most significant load. We thus enter a vicious circle which quickly limits the length of span for this type of structure. However, let us fold the slab to form two inclined slabs with a contiguous edge (Figure 9). The bending moment now becomes subdivided and the upper common edge acts as an intermediate support for the slab resisting only the normal components of the load in bending. The tangential components will be transmitted to the supporting edges by direct stresses contained in the planes of the slabs, producing oblique thrusts which will be enlarged by the forces which result from breaking up (along the planes of both slabs) the reaction at the intermediate common edge.

It is not necessary to have continuous support at the lower edges. As in the structural action of wall-like girders, the lower part of each slab may be considered as a deep beam bridging the oblique thrust between convenient points of support, where they may be counteracted. As the distance between the isolated supports becomes greater, the depth of the slab section acting as a beam also increases. Ultimately, when the distance is unusually large (Figure 10), the folded slab will act as two slender beams joined by their upper edges, or rather as a single hollow beam having tie-rods or buttresses at its end cross-sections.

By introducing a simple variation of form (without an appreciable increase in volume of material employed) we have now progressed from a plane to a threedimensional structure. The theory of shells or stressed-skin construction is based on this simple principle—despite the awe of its advanced mathematical theory.

Polyhedral or “hipped-plate” structures (Figure 11), which the Germans call “Faltwerke” and the French call “toits plisés,” are, however, subjected to considerable transverse bending when supporting uniform loads; and a substantial thickness is required for the slabs. They are only appropriate for concentrated loads at the joints or the vertex. Although the carrying capacity of the structure has been increased by means of inclination, the introduction of curvature will be necessary to further reduce the value of the transverse moment and the thickness of the slab. For uniform loads, the funicular shape or its inverse appears to be the most efficient form.

It is a mystery that this latter principle,

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1 If you suspend a flexible cord from two points, the shape is described as “funicular.” If you freeze it in this shape, invert it, and apply the same loads, you have an “antifunicular” shape (now having compressive rather than tensile stresses).

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Figure 11—Hipped-plate roof for an exhibition car-porch at Mexico D.F., 1952. Overhang: 10'; thickness: 1½". F. Candela, Architect.

known and utilized in arches for centuries, was not extended by the pioneers of reinforced concrete to cylindrical vaults of this material. On the contrary, in the earliest reinforced-concrete vaults, and even in some vaults designed today, the main resistance to loads has been assigned to a series of closely spaced arches. In a manner similar to conventional trussed roofs, it was assumed that the weight of the intermediate vaults was transmitted directly to these arches and that the vaults acted in bending as though composed of a series of horizontal strips (Figure 12). This design procedure resulted in massive slabs which, although contributing to the spiritual tranquility of the owners (prone to mistake mass for safety), were definitely detrimental to their pocket-books. The materials themselves, obviously incapable of following the designer's fancy reasoning, continued to perform in the natural way—the direct stresses following the line of maximum slope.

The principle of economy of effort is universal in nature and in the theory of structures has a mathematical interpretation in the form of certain theorems having to do with strain energy. At this time, however, it would be preferable to base our discussion on purely mechanical and intuitive reasoning.

In the type of structure described immediately above, the vault itself is the main resisting element and as long as it has an antifunicular directrix (or cross-section) it will transmit the loads directly to the springers by means of small compressive stresses. Therefore, the thickness of the concrete not only may be but also should be reduced to the practical minimum (say 1" or 1½""). The arches will then act merely as stiffening ribs capable of absorbing, in bending, those stresses not in equilibrium which are formed in the structure by deviations in the pressure line due to irregular or unexpected load conditions. It should also be noted here that it is not necessary to have continuous support at the spring lines. Following a reasoning similar to that outlined in the discussion of polyhedral structures, the lower part of the vault, acting as a slightly curved beam, will transmit the vault thrust to convenient points of support (Figure 13) without intervention of other structural elements. When the longitudinal distance between these points is
smaller than the vault span, such a structure is called a short-cylindrical shell (Figure 14). As this length increases, the depth of the shell section contributing to the bridging action between the supports also increases. When the length becomes two or three times the transverse span, the structure is transformed into two curved beams joined at their upper edges. Or (which amounts to the same thing) the structure is transformed into a single beam of hollow-cylindrical cross section (Figure 15). We are now dealing with a long-cylindrical shell or barrel vault which can be defined as a hollow beam supported at its end cross-sections where it is necessary to counteract the horizontal thrusts always produced by curved structures. (Figure 16; this type of structure is also demonstrated in the factory presented on page 114).

In the barrel vaults, it is no longer necessary to have an antifunicular shape since the local disequilibrium between vertical loads and shear stresses, caused by the curvature of both deep beams which form the barrel, will always create transverse bending moments. These transverse moments can be maintained within reasonable values by means of certain devices such as the use of longitudinal edge beams (Figure 17), vertical supports along the springers, or the consideration of the transverse continuity between adjacent vaults (Figure 18). Although these details may be important for practical design, they do not affect the general thinking concerning the working action of these structures.

In short-cylindrical shells, the possible asymmetry of live loads causes changes in the basic pressure line, which then cannot coincide with the directrix of the vault for all possible load conditions. Although the vault is capable of channeling these eccentric forces by means of shear stresses contained in the shell surface, it is nevertheless necessary to absorb the bending moments created by this eccentricity at some locations. This leads to the use of closely spaced stiffening arches. The size of these arches, when used for large spans and unusual accidental-load conditions, becomes so great that the characteristic lightness of this type of construction is nullified. Besides, as we increase the span, the radius of curvature of the directrix also increases, producing an almost flat shell exposed to instability by buckling. This further justifies the presence of stiffening arches. To avoid the
Figure 16—CIBA Pharmaceutical Laboratories, Mexico D.F., 1953. Sawtooth roof with long-cylindrical shells. Span: 52' x 20'. Thickness: 2'. A. Prieto and F. Candela, Architects.

Figure 17—PISA factory at S. Bartolo Naucalpan, Mexico, 1951. Long-cylindrical shells with edge beams. Span: 56' x 26'. Thickness: 2½'. R. Fernandez, J. L. Certucha, and F. Candela, Architects.

Figure 18—Factory for electronic appliances at S. Bartolo Naucalpan, Mexico, 1952. Long-cylindrical shells of cycloidal cross-section with glass blocks for illumination. Span: 45' x 15'. Thickness: 2". L. Claudin and F. Candela, Architects.
inherent waste of material that the use of these arches entails, it again becomes necessary to turn to the principle of curvature by substituting the cylinder for a doubly-curved surface. The vault will then act as antifunicular for the permanent loads, while the considerable inertia of the "waves" thus formed will permit it to act in bending as a non-funicular arch for the live loads. The transition of the curved "wave" to the necessary straight line at the springers produces esthetically interesting solutions (Figure 19).

It has now been shown how the successive application of the principle of curvature gradually eliminates the bending stresses in the slab and how its logical and intuitive employment leads to the full transformation of external loads into direct "membrane" stresses. Contained exclusively in the shell middle surface, these stresses allow its thickness to be reduced to a minimum. During the course of this article, we have gradually arrived at the conception of doubly-curved surfaces which are the most appropriate from a structural point of view if a material like concrete, molded at the building site, is to be utilized.

A classification of these structures can be made that distinguishes synclastic surfaces, in which the two principal curvatures are convex (as in the example of the dome on page 120), also called elliptic surfaces after the type of equation that represents them, from the anticlastic surfaces, also called hyperbolic, where both main curvatures have opposite signs, as in the hyperbolic paraboloid (Figure 20).

It is not pertinent at this time to present the mathematical theory for the stress analysis of these surfaces (which may be found in several books and many technical papers), but it does seem appropriate to mention a few intuitive principles not usually found in the aforementioned texts, that form the basis for the theory.

It is a phenomenon in technical literature dealing with shell structures that the authors are extremely liberal in their presentations of integral and complicated
differential equations—especially since these mathematical procedures are so complex that they are beyond the grasp of the average practitioner. At the same time, the authors seem equally zealous in concealing the static principles on which the analytical methods are based. Thus a curtain of mystery and obscurity has been effectively drawn over these matters which, in effect, presents the handful of initiates as eminent scientists and tends to scare off the daring few who attempt to join the inner circle.

Take, for instance, the familiar statement (usually given without further explanation) that “the membrane theory is especially appropriate to picture the stress condition of doubly-curved surfaces.” At most, it is advanced as a tentative explanation of the pseudo-axiomatic principle that shells, being very thin, are unable to withstand bending stresses and therefore must work by direct stresses only. This reasoning is totally erroneous, since the minimum thickness is not a cause but a consequence. However thin a shell may be, it always has some resistance to bending. Further, if these bending stresses could be present, the structure would break by bending as excessive deformations occur. The real justification of the membrane hypothesis is the impossibility of such deformations existing when doubly-curved shells are built of the relatively unextendible materials used in construction. The misunderstanding of this fact has led to the frequent mistake of applying the membrane theory to stress investigations of such inadequate cases as developable surfaces—and especially long-cylindrical shells.

Perhaps an example will clarify this point. Consider a revolution dome loaded symmetrically with respect to the axis of rotation. Substantial extensoral strains or variations of length of the parallel circles must necessarily exist before...
changes of curvature and consequent bending may appear along the meridian lines. Similarly, for a concentrated load to produce a dent at any given point on a spherical dome, it will be necessary to have significant elongations in the circles immediately around the considered point. Such a condition is easily obtainable in a rubber ball built of very extensible material, but virtually impossible in a concrete dome until the direct stresses along the immediate circles have attained the unusually large values corresponding to the strains discussed above.

In the case of anticlastic shells, the intuitive analysis is not as easily visualized as in the dome, but the same principles, well known to the builders of automobile bodies, are involved. Consequently, it is inconsistent to extend funicular reasoning to surfaces. The behavior of a membrane is substantially different from that of a chain or a thread. The latter will bend under load seeking the curve of equilibrium; the former, as long as it is a doubly-curved surface built of unextensible material, will always be in equilibrium without bending, whatever its form or load condition. It is permissible, therefore, to consider direct stresses only, and to apply membrane equations to obtain the stress condition corresponding to the internal equilibrium.

There is another intuitive consideration worth noting. It is related to the distribution of support reactions and to the manner in which the surface may prefer to rest along its boundaries. Its consideration determines the arbitrary constants that appear in the process of integrating the equilibrium equations cited above, and is closely related to the characteristic internal hyperstatic nature of these surfaces.

A statically-indeterminate or hyperstatic structure is one in which the support conditions are redundant. It is a structure in which the manner of attaining external equilibrium and, consequently, the way it behaves under loads are multiple, depending upon the support conditions. In general, the value and distribution of the reactions will depend on the strains of the structure itself and on the loading capacity and deformability of the supporting elements.

This characteristic of an indeterminate structure constitutes its greatest advantage for, profiting by it, the structure is capable of redistributing the excessive stresses from the over-strained components to the less loaded ones, following the natural transference called metastasis. This property enables these structures to survive changes in anticipated loading conditions and to withstand various support failures that would produce automatic collapse in statically-determinate frames. In the majority of cases, what actually goes on within these frames is difficult, if not impossible, to calculate. To attempt an analysis, it is necessary to assume certain simplified and arbitrary hypotheses covering the manner in which the materials deform. (These same hypotheses constitute the basis for the Theory of Elasticity.) The application of these hypotheses, however, makes it impossible to ascertain that the results of calculations will have any relation to what actually occurs in the structure.

In spite of these facts, and since it has been required to calculate everything in recent times (a requirement not essential to builders of other and less scientific years), not only are the properties of materials arbitrarily simplified for the pretentious and vain sake of fitting them into mathematical schemes, but the building art is itself impoverished by the unforgivable abandon of curved and spatial structures whose mathematical analysis at first seems difficult to undertake. The ideal and artful subdivision of monolithic frames into isolated elements by means of real or fictitious hinges, and other similar contrivances are bound to be detrimental (when they really exist) to the final stability, although they may expedite calculations.

An example will illustrate such an hyperstatic condition. Imagine a plane, horizontal slab limited by a rectangle. We may consider it as being simply supported or as rigidly clamped on all four sides; we may consider it to be supported on two opposite sides; or we may assume that it is cantilevered from one of its sides. All of these hypotheses—and many others—are compatible with the total equilibrium. They condition subsequent calculations, but are not previously influenced by them. The slab, which is highly hyperstatic, may be supported in
any one of the above ways, as long as it is reinforced according to the finally adopted criterion.

The same is true, to a still higher degree, in doubly-curved surfaces. In these three-dimensional structures, the internal equilibrium, free from bending, can be attained in many different ways. In other words, the distribution and magnitude of membrane stresses will vary according to the manner that we choose to support the surface, with the inviolable condition that the choice of the supporting reactions be compatible with the static equilibrium of the whole. Although the mathematical interpretation of this variability may lead to complex analytical considerations, there can be no doubt about the justification of the method since—direct stresses being generally low—it is not necessary to take into account (as with elastic methods) the uncertain strains of the material.

The imaginative use of structures of this type (Figures 20 and 21) produce unsuspected interior and exterior forms. These may enrich the intolerably limited present vocabulary of cubical masses and spaces, pending new fields of thought for the architect. Throughout this discussion, several causes of the prevalent atrophy in structural thinking have been suggested. Added to these could also be the absurd dismemberment of the craft builder into the existing professions of architect, engineer, and contractor—a condition that leaves structural design practically out of the range of these three fields. Moreover, this separation requires that accurate plans be drawn of every detail in a building. Such a requirement will eventually prove unconstructive, following the general law of economy of effort, as it results in the abandonment of space frames in favor of plane and linear frames that are more easily represented on paper.

It is a curious phenomenon that this disregard for stereo-structures or, rather, the incapacity to comprehend them, appears periodically in the history of building or, which amounts to the same thing, in the history of the roof. The Chaldeans and Sumerians with their mud-brick architecture (a natural consequence of the scarcity of wood and lack of stone) were forced to use the dome and vault, thus creating the oriental architectonic tradition that later extended throughout the Mediterranean world. Greek and Egyptian architecture, on the other hand, ignored these constructive forms in favor of the post and lintel, using at most plane, wood trusses of a rather primitive type. Stereo-structures grew again with the combinations of Byzantine domes, the groined vaults of the Gothic cathedrals, and the vaulted compositions of the Renaissance and Baroque periods. Yet, they again disappeared in a cycle that extends to the present time—one that coincides with the emergence of iron and steel structures. Following a helicoidal development, the art of building seems to degenerate in certain periods, only to get back in step with a greater impetus in the next era of this cycle.

A parallel may be established between this cyclical succession and the periods of analysis and synthesis which characterize the progress of science and, in general, of every activity of the human mind. In the creative periods of synthesis, new ideas originate (although based on past experience) revolutionize habitual mannerisms. Creative spirits, euphorically uninhibited, give birth to original theories and extraordinary artistic works, provoking alarm and indignation in the serious and bored reticulated minds which consider it inadmissible that one might want to enjoy the exploration of new paths. Eventually, the waters return to their shores. The journeyman of science recovers the momentarily lost control and proceeds to assimilate and carefully mill new ideas, until they, in turn, are exhausted. These are periods of analysis, sad and boring but apparently necessary for the normal evolution of human thought.

In the field of construction, we fortunately are ending a long, analytical period. The ideas that nourished it are fully developed and to continue exploiting them would be senseless. If the symptoms are to be believed, we are on the verge of a new creative epoch. Architects should be pleased with this situation, especially if they manage to regain their lost role as "master builders," since in order to build at such a time it perhaps will not be necessary to master so much science, but to have some talent.

Figure 21—"Paraiso" textile plant at Mexico D.F., 1953 (acrosspage and right). Rectangular domes formed by four hyperbolic-parabolic tymans. Span: 40' x 33'. Rise: 5' 1/2. Thickness: 1/2". Lighting aisles hang from the dome edges. J. Gorbea and F. Candela, Architects.

For comment on this discussion by members of the architectural and engineering professions, see views (page 16).
David Crockett Elementary School of Harlingen, Texas, designed by Cocke, Bowman & York, and built by the Parker Construction Company, was completed in September, 1950, at a cost of $8.27 per sq ft. Rectangular in plan, this school consists of two rows of classrooms flanking a central corridor. However, the rectangular aspect is reduced greatly by the use of a truss-like ceiling and roof system which lights and ventilates the school in a most unusual way. In elevation (above) the building would seem to have a butterfly roof, when actually it has two butterfly roofs—one over each row of classrooms.

Under certain load conditions the angular frames could work as trusses, but their primary function is to open the center of the building would seem to have a butterfly roof gutter light the corridor adequately in the daytime, and clerestory windows light and ventilate the classrooms. Notice how clerestory windows on both sides of the classrooms can be opened to release warm air at the ceiling height (section acrosspage). At the same time these windows are louvered to eliminate excessive direct sunlight.

Occurring 7’ 5” o.c., these quasi trusses are supported by 5” WF steel columns at the corridor walls and at the clerestory windows. The columns at the clerestory windows also provide partial support for the low flat roof beneath the windows. Here, the built-up wood beams—similar in concept to the large butterfly beams—are met at the exterior walls also by 5” WF steel columns. Between these exterior columns is a continuous line of casement windows over a brick curtain wall. The meeting of brick with steel is handled in a manner often admired in the work of Mies van der Rohe; i.e., the steel columns are left exposed, while the brick is used only as filler (acrosspage top).
Thin fluorescent lights along bottom of trusses augment abundant daylight. Partitions between rooms are plywood over wood framing and are filled with glass insulation for sound.

Covered passageway (top) employs built-up beam which is different from other built-up beams only in size of members used.

Photos: Ulric Meisel
Architects and engineers are being pushed now, as never before, to come up with new and imaginative concepts of structure and design, in order to keep pace with the demands of contemporary life. To meet the challenge of housing eight of Lockheed Aircraft Corporation's giant Constellations, The Port of New York Authority's Department of Engineering designed this cantilevered-steel-truss hangar (above), built at Idlewild International Airport by the Lasker-Goldman Company and the Lehigh Structural Steel Company.

Designed to provide two enormous covered areas—133' x 400' each—for airplane maintenance, all but 120 ft of one side of the hangar was built under the initial contract; thus, the hangar now accommodates seven Constellations at one time. When space is needed, Lockheed not only can complete this side but also can continue both sides for another 100 yds.

Several aspects of this structure are markedly outstanding. First, it required only $11.89 and 15 lb of steel per usable sq ft of floor space to build, which is alone enough to set it apart from most similar building types today. In addition, each side of the symmetrical structure acts independently of the other (section below) in an ingenious system of cantilevering and suspension. Members A, B, C, and D are in tension, while members E and F are in compression. (Compression component in B, as a result of tension in B' and C' is not as great as its tension component resulting from tension in A and C.) Notice how trusses in foreground (above) are not balanced by any opposing trusses.

The core of the structure will be used by Lockheed for shops and offices.
Smaller trusses, under roof line, were pre-fabricated at the shop and brought to the site in two parts. There the parts were joined, lifted into place, and pinned (above). Jacks at the bases of tall columns were used to align outside ends of small trusses, but, not entirely pleased with this, the Port Authority Engineers have designed another jack (below left) which will be used at the tops of the same columns in the construction of a similar hangar.
Construction stages: Truss sections positioned on site and assembled for lifting. Columns raised and bolted to anchorages. Rear-end wall assembled and raised into position. Two rear trusses of each bay assembled in four sections on ground with rod bracing and purlins installed. Intermediate truss sections assembled on ground, joined into half trusses, and lifted. Next, two trusses assembled in four bridge sections. Front truss completely assembled; erected as one unit. Bridge sections lifted; joined with splice plates.

Photos: Gottscho-Schleisner

Bowstring wood trusses

The largest timber trusses on record span the 250-ft width of each of the three, 150-ft-deep bays of the new hangar for New York's Westchester County Airport. Both top and bottom chords are of glued, laminated timber, the top chord, in section, being 9" x 19\%"; the bottom chord, 9" x 17\%". Web members are structural-grade, sawn fir. The trusses were fabricated in four sections at the site from members precut in the shop and joined in assembly with steel splice plates.

Timber purlins, 6" x 14" in section, were bolted to purlin hangers attached to top truss chords with bolts and shear plates. Purlins are spaced 5' 8\%" o.c. Roof sheathing is 2" T & G white pine installed over the purlins. The trusses rest on glued, laminated columns, 11" x 17\%" 30' tall, with timber knee bracing. Inclusion of a deluge sprinkler system, plus the fact that timber members below bottom truss chord line were pressure-treated with fire retardant, result in a structure with insurance rating equal to that of exposed steel framing.

Julian K. Jastremsky was the architect; Hall & Paufve, consulting architects; Tuck & Eipel, consulting engineers; Thompson-Starrett Company, Inc., general contractors. Fabrication and erection of the clear-span trusses were handled by Timber Structures, Inc., with Larry Winkleman erection superintendent.
Mies van der Rohe's design for Chicago's proposed Convention Hall would provide 500,000 sq ft of exhibition and assembly area without a single interior column! Square in plan (700' x 700'), the hall would seat 50,000 persons. Roofing such an immense, unobstructed area is considered feasible by means of a space frame composed of all-welded, intersecting-steel trusses 30 ft deep and spaced 20 ft on centers. Exterior columns are spaced 100 ft apart. Where trusses intersect, vertical members are common to each truss. The entire network would be made up of 14 in. wide flange sections and the total weight of the steel has been estimated to be approximately 30 lb per sq ft. Trusses would be properly cambered during fabrication. Construction plans propose the use of only two temporary erection columns, for each erection crew, to be removed and reused as the structure progresses. Frank J. Konracker was the structural engineer.
During construction, the student-builders camped in the shelter of a portable dome (top) erected on the motel site. Man reading a good book in his rocking chair (above) is R. Buckminster Fuller, himself.

On the concrete-block foundation wall, a subassembled hyperbolic diamond frame is put in place (below left). Note the splayed shape of the 1" x 8" perimeter of the frame. Further assembly (below right) begins to define the dome form.

Photos: Sam Rosenberg

geodesic wood dome Restaurant
Woods Hole, Massachusetts
E. Gunnar Peterson of Falmouth, Massachusetts, is an extraordinary architect. Not the least of his distinctions is that for 20 years he has conducted a progressive architectural practice almost exclusively on Cape Cod and the neighboring island of Martha's Vineyard, one of the most tradition-minded areas of the country. Since many of his commissions are for sites near the ocean, his trips from job to job are frequently made by boat. He calls himself “the eel-grass architect.”

Last year, as a personal enterprise, he decided to build a modern motel in nearby Woods Hole, where steamers leave for the Vineyard and Nantucket Island. He acquired a lofty site adjacent to the village, with eye-filling seascapes seen through the trees in many directions. The motel, now open for operation, he designed himself. For the dining room, however, where he wished to span a large area economically, he tells us that “it suddenly occurred to me that a ‘Bucky’ Fuller dome would be the solution. It was my desire that this whole composition should be noteworthy and significant.”

So, R. Buckminster Fuller engineered the dome shown here, and it was built by a group of students garnered from architectural schools in the U.S., Canada, Australia, and New Zealand.

“I consider ‘Bucky’s’ research of historical importance,” Peterson remarks, “and, as I have told him many times, I think he is developing in his dome structures and what-have-you, highly useful tools for the profession at large. To my knowledge, no one has as yet performed the feat of enclosing large areas as lightly, as economically, and as beautifully as he has succeeded in doing.”

Fuller describes the Woods Hole dome as follows: “It is 54 ft in diameter and comprised of 1” x 3” and 1” x 8” Douglas fir struts subassembled into 90 hyperbolic diamonds.... The students processed the engineering fabrication of parts during July and moved to the site August 1, living in a small portable dome (small photos acrosspage). The parts were subassembled in jigs in two weeks and finally assembled as a dome in one week. Components of the dome weigh 3½ tons and were moved to the site in one 3-ton truck. The principles of its structuring were evolved for later fabrication of corrugated stainless-steel diamonds, as an atom-bomb shock-wave-proof enclosure. . . . Peter Floyd and William Wainwright, M.I.T. graduates who acted as leaders of the student group, have contracted with Mr. Peterson to enclose the structure with . . . a new polyester-plastic clear film.”

When assembled, the diamond-shape frames of the dome structure form a series of 5-pointed stars. Obviously the members will remain visible after the transparent-plastic surface is applied. “I propose to paint the structure in bone white and gold,” Peterson reports, “in such a manner as to bring out the star forms.”

As the frames go together, they tilt ever more inward (below left).

Five frames create a giant star shape (center) which will be painted gold.

“Bucky” Fuller and the E. Gunnar Petersons (he is the architect who commissioned the dome for the motel he designed for himself) anticipate the opening of the restaurant and bar (right). The exterior surfacing will be a transparent plastic film.
"The spaces defined by the members of a structure are as important as the members," says Louis I. Kahn. Carrying this principle into design, Kahn, with Anne G. Tyng as Associated Architect, developed the proposed City Hall for Philadelphia (above) and, associated with Douglas Orr, designed the new Yale Art Gallery and Design Center (May 1954 P/A and acros(s)page).

The City Hall's space-frame tower exploits structural potentials of reticulated triangulation. Triangulated frame: precast, prestressed concrete struts coming to a point every 36 ft. Floor construction: 3-ft deep, composed of precast, lightweight concrete tetrahedrons, within the voids of which are run air-conditioning ducts and wiring conduits. The three-dimensional exterior network: light tubular frames for glass-panel enclosures.
Though building codes did not allow a true space frame in the Yale Art Gallery and Design Center, some of the principles of triangulation maintain, and the “building with hollow stones” theory is employed. Within the hollows of the tetrahedral ceiling construction are harbored round, air-distribution ducts and trolley duct for attachment of lighting fixtures. With these out of the way, the floors can be subdivided at will by means of portable partitioning. Some refer to such three-dimensional structures as “aedicular.”

Yale Photos: Lionel Freedman
City Hall model Photo: Edward Gallob

three-dimensional concrete floor system

University Art Gallery
and Design Center
New Haven, Connecticut
The Montana State University Field House, at Missoula, boasts the largest three-hinged laminated-wood arches in the world. Designed by Architects Brinkman & Lenon, with Structural Consultant Charles E. Kitchin, it was built by Hightower & Lubrecht, General Contractor, and was dedicated December 18, 1953.

The university needed an enclosed arena that would serve a multitude of activities—meetings, concerts, plays, athletic events, military drill, an occasional circus, rodeos, farm and livestock shows, and ice and water shows. Because of these varied functions, it was necessary to use a structural system that would eliminate interior columns. The architects made studies of many such systems, including some in which the roof was to be suspended from masts, but this three-hinged-arch scheme proved the most economical, structurally feasible, and handsome.

With a clear span of 201' 6", and a cross section of 3.46 sq ft (11" x 45"), these laminated-fir arches are supported at each end by reinforced-concrete A-frames (bottom, across page) which carry the weight and thrust of the arches to the ground.

Since these arches are unusually large, purlin and decking sizes are comparably oversized. The purlins measure 4" x 12" and are spaced 6' 7" o.c.; they are braced by 2" T&G decking, over which asphalt roofing has been rolled. With a square footage of 49,480 and a cubic footage of 2,895,500 the cost per cubic ft was the low figure of 25.1¢.

To handle lighting for all of the various functions of the field house, a 1000 amp bus duct was installed around the entire perimeter. This is in addition to the fixed lighting system, which will cast 70 foot-candles on the arena floor, for television.
After the first arch was pinned in place, subsequent arches were tied in by the purlins (below).

Size of arch segments against size of rail car dramatizes the scale (left); best indication of scale is seen at footing detail (left, bottom).

All concrete work was left unfinished.

Photos: Ingvar Eide
Spanning the 224-ft width of the convention-exhibition hall for Corpus Christi is an arched steel-lamella roof. Both the purlins and the circular steel arches that span on a skew between the sill beams are 24-in.-deep, open-web members, the skewed-arch arrangement forming a bold structural pattern of diamond shapes. Except for the first few members, the arches were erected without scaffolding, cantilevering until joined; high-tensile bolts were used in erecting the arches; all other joints are welded.

The continuous, reinforced-concrete spring-line beams, supported on reinforced-concrete buttresses, occur 13 ft above floor level. The arched roof, laid out on a 224-ft radius, soars to a 42-ft clear height at the midpoint.

In commenting on the selection of this system for the huge building, Richard S. Colley, the architect, states: “The most logical solution for this large free space was the barrel shape. This building lies just back of the sea wall, which is merely another horizontal line just below the horizon. . . . There are no large buildings in the immediate area. . . . A box-like, conventional-type building would look like hell here. The barrel shape offers the most contrast with the ground. The least expensive framing for this sort of span is some type of space frame.”
The continuous roof that covers a 65,000-sq-ft area contains 260 tons of steel and was erected in but 25 working days. Engineering for the lamella roof was worked out by G. R. Kiewitt, Chief Engineer of Roof Structures, Inc., and Hale & Harvie, Consulting Engineers; concrete and foundation work was engineered by Blucher & Naismith.

Photos: Sammy Gold
thin-shell concrete vaults  
Night Club  
Havana, Cuba
A more glamorous night club than "Tropicana" could hardly be imagined. Located on a beautiful, parklike site with magnificent trees and planting, it is partly outdoors and partly in. But so subtly and imaginatively was the air-conditioned, indoor portion contrived by the architect, Max Borges, Jr., that an almost magical illusion is created of still being in the open.

Secret of the illusory quality of the enclosed portion is use of five, thin-shell concrete vaults, for which Max Borges, Sr., also an architect, designed the reinforcement. These great arches, ranging in span from 40 to 90 ft, are placed eccentrically with respect to each other—what the architect terms "the principal artifice of the entire design"—and they decrease in height (from 33 ft to 16 ft) as they step back to the orchestra stage. Openings between the staggered vaults are glazed with clear glass, and the entire front of the tallest vault is also of glass, with sliding doors across the base. Hence, as one dances around the room, there are endless and unexpected shifts in the views of outdoors, the trees, foliage, and activities outdoors.

The vaults are only 2¾ in. thick. For inside finish, an acoustical plaster was applied, thrown through a steel screen and perforated with a spiked pallet "to produce a cool, velvety look and obtain maximum acoustical properties." Local tile is the exterior surfacing.
One side of the vault nearest the orchestra shell stops short of the ground and is supported on concrete ribs; walls of glass at this point reveal particularly lush planting.

Seen from above (left) the vaults and service lines constitute an astonishing instance of untrammled expression. (Ed. Note: Only birds and energetic photographers ever gain this vantage point.)

The enclosed portion of the club (below) can accommodate up to 650 customers on the three tiers that surround the dance floor. The great glass wall of the rear vault makes all outdoors a visual expansion of indoor space. Photos: J. Alex Langley
"I thought of the vault device," Borges tells us, "because one cannot say where wall ends and ceiling begins, as in the celestial sphere... Besides," he continues, "it proved to be the cheapest enclosure and provided an area uninterrupted by columns." Night floodlighting is designed to produce a moonlight effect. Interior surfaces of the vaults are painted dark purposely — "making the glass invisible... The outdoors seems to invade the indoors."

One of the most remarkable aspects of the design—possible because of the mild climate—is the casual way in which air-conditioning ducts, lighting fixtures, and wiring conduit occur on the outsides of the vaults. Here and there, further enhancing indoor-outdoor relationships, holes are left in the vaults so that trees with roots indoors emerge to spread branches skyward. Outdoor facilities step down on three levels to the round dance floor.
night club, Havana, Cuba
Considerably larger than the enclosed area, the outdoor portion of the night club has a bar, tiers of platforms for dining tables, a dance floor, and an orchestra stage. In connection with the latter, which performers reach by a ramp, is an elaborate, decorative stable (across page) made up of \( \frac{3}{4}\)-in. galvanized water pipes bound in a frame of 5" x \( \frac{3}{4}\)" steel plates.

**Construction**

Foundation, walls, roof shell: reinforced concrete—Compañía Cubana de Cemento Portland; reinforcing steel—The Youngstown Sheet and Tube Company. **Wall surfacing:** exterior: local Spanish red tile; interior: acoustical plaster—Tuckahoe Stucco Corporation; rest rooms: structural glass—Pittsburgh Plate Glass Company. **Floor surfacing:** rug—A. M. Karagheusian, Inc. **Ceiling surfacing:** acoustical plaster—Tuckahoe Stucco Corporation. **Roof surfacing:** local system employing Spanish red tile with mortar over concrete slab. **Waterproofing and damp proofing:** Truscon Laboratories, Devoe & Reynolds, Inc. **Insulation:** thermal: Spanish tile. **Roof drainage:** local cast-iron and cement pipes. **Partitions:** interior: folding—New Castle Products, Inc.; toilet: structural glass—Pittsburgh Plate Glass Company. **Windows:** fixed plate-glass—Pittsburgh Plate Glass Company. **Doors:** heat-tempered glass entrance door—Pittsburgh Plate Glass Company. **Hardware:** lock sets—Independent Lock Company; hinges—The Stanley Works. **Paint and stain:** local water paint.

**Equipment**

**Kitchen:** stainless-steel tables and sinks—Jack Conkle, Inc. **Curtains:** Ben Rose. **Public seating:** dining chairs and bar stools—Thonet Industries, Inc.; bar chairs—Herman Miller Furniture Company. **Stage lift:** Globe Hoist Company. **Lighting fixtures:** adjustable recessed ceiling fixtures—Swivelier Company, Inc.; arc spotlights and dimmers—Kliegl Bros., Universal Electric Stage Lighting Company, Inc. **Electrical distribution:** local equipment. **Plumbing and sanitation:** siphon-jet water closets—Crane Company. **Air conditioning:** 80-ton unit, compressor—Chrysler Corporation, Airtemp Division; refrigerant—Freon 12; diffusers, cooling coils—Marlo Coil Company; blowers, ventilators—American Blower Corporation; filters—Glasflo; controls—Minneapolis-Honeywell Regulator Company.
prestressed-concrete girders with long-span vaults  
Factory  
Heidenheim of Brenz, Germany
This blanket factory at Heidenheim o/ Brenz, near Ulm, Germany, demonstrates an imaginative use of prestressed concrete. Designed by Engineer K. A. Kippenhofer, with Structural Consultant Dr. F. Leonhardt, it was built last year by Contractor K. Kübler—all of Stuttgart. It was necessary for the weaving room to occupy the second floor of this two-story structure. Lighting had to be strong and rather constant; temperature and humidity of the air had to be well regulated; and the floor space had to be free from columns to allow for flexible arrangement of machinery. All of these requirements were met with a ceiling-roof system that is as attractive as it is functional. There is complete freedom from interior columns, vertical support being furnished by the wall columns and by the prestressed-concrete elevator shafts in the center of the floor.

Over the elevator shafts, running the whole length of the room, is a hollow prestressed-concrete box girder, approximately 10' x 12' (section below right). A diagram (below and across page) shows the placement of prestressed reinforcement bars through half the length of the girder.

Intersecting the box girder is a series of prestressed beams and shell sheds (above) which span a distance of 72' each; they are supported by columns at the wall. Each of these beams is hollow at the valley, providing built-in conduits for conditioned air.

Ceiling surfaces are nonporous cork painted white. Photos: Otto Benner
About 13 years ago, Architect Wallace Neff invented a system of concrete construction that uses a large inflated balloon in place of costly and complicated wood forms. Since then, The Airform International Construction Company, New York, has employed this system in building concrete bubbles for everything from residences to ammunition magazines.

Seriously viewing the American house market, the Airform Company recently put Architect Eliot Noyes to work on the bubble to give it a shape and a plan attractive enough to compete with popular low-priced builder houses.

Noyes' first design (above) is a 30-ft-wide shell, 14 ft high at the center, in which he has made two rather deep segmental slices to let in light and air. Planned for one and two bedrooms (acrosspage), two of these bubbles were built recently at Hobe Sound, Florida, on an experimental basis. The Murphy Construction Company, contractor, quotes the price of $5.35 per sq ft for foundation, floor slab, double shell, vapor seal, insulation, and paint. (After the first two-in. gunnite spraying has set, vapor seal and glass-fiber insulation are applied, and another two-in. shell is sprayed over that.)

On the basis of this experiment, the Airform Company hopes to build a number of such houses to sell for $6000.

But while this possibility is being considered, Noyes is going on to "new and better" bubble designs. He has discovered, for example, that one 60-ft wide will provide about three times the space without being any higher or thicker than the 30-ft bubble. Also, he increased the segmental slices to four large ones, bringing the load down to four small bearing points, and adding greatly to the bubble's appearance.

In this form, the bubble can serve well not only for a house but also for school classrooms. Several school boards are already considering its use to cut costs.
Bathroom in one-bedroom house (above) has been covered with corrugated plastic; problem of sound and light transmission from living room to bedroom still remains.

Balloon (below) is inflated, covered with chicken-wire reinforcement, given wire skirt, sprayed, and, after several days, deflated. Hose from compressor maintains constant volume during temperature and air-pressure changes. Scaffolding is used only to support workmen while spraying, which is done in one day.

Two-bedroom house (below) sacrifices kitchen and storage space. Partitions—gypsum wallboard on wood framing set by power nails—divide about 600 sq ft of living space.

Photos, except as noted: Eliot Noyes
air-formed concrete domes

Model of 60' bubble house (above) shows enlarged openings. Further development (not shown) brings footings down to steel pins. Although footings seem to turn inward, they are actually vertical and receive the four corner posts of the frame (acrosspage, left). Bathrooms and closets are covered, and bedrooms have adjustable louvers to control light and sound.

Notice the amount of sunshade provided by projected lip of shell (above and left).

Three intersecting shells (below) cover two private areas and one open living area. Open shell in background makes attractive carport.

Photos of model: E. J. Cyr
Classrooms about 48' square can be housed under 60' shells. Noyes believes that the cost of school construction can be reduced with the bubble method.

Kindergarten or elementary classroom (above) is planned for 15 desks, a work table, toilet room, coat rack, sink, and supply storage.
What is the correct shape for an auditorium? Should it be designed according to the best knowledge of acoustics or should the architect provide a straightforward structure and implement it with baffles and other methods of acoustical control as the situation dictates? In the early design stages of the M.I.T. Auditorium, Eero Saarinen & Associates felt that some solution would be found within thin-shell concrete which, in principle if not in form, would follow the second of these two dicta. Their study also reflected a preference to consider acoustics more as a servant than as a dictator. Today, it is fascinating to view at Cambridge, where the auditorium is still under construction, what is emerging from these primary considerations.

After a thorough period of investigation—preparation of models and sketches, discussions with engineering consultants, and meetings with the client to reconcile program requirements with actual budget conditions—a dome (112' radius) on three pendentives evolved. Elimination of unneeded dome surfaces between bearing points provided desired window openings (27' high) and a form (one-eighth sphere) which happily simplified structural calculations.

In the final design, the average thickness of the dome, including haunches and edge beams, is 4.8". To the typical 3½" shell thickness has been applied 2" of rigid, glass-fiber insulation, a second layer of concrete 2" thick, and lead-coated copper roofing. Although these constitute a double shell, actually the outer shell has no structural function and its mass was added for the sole purpose of reducing outside noise that would otherwise be transmitted to the interior of the auditorium. (The site is relatively noisy with large trucks passing on nearby Massachusetts Avenue and airplanes frequently flying overhead.)

For the typical portion of the shell, the total design dead load—including ductwork, acoustical baffles, catwalks, etc.—was 83 psf. Of this amount 25 psf or 30 percent is due to the outer shell. A total live load of 30 psf included wind allowance. The effect of lateral wind forces of 20 psf on the side window walls was investigated, as was the effect of normal wind pressure, including negative pressure. On the typical areas of the dome, therefore, the total design load was 113 psf—the outer shell representing 22 percent of this amount. The reaction at each of the three bearing points is approximately 1200 kips under dead plus full live load—horizontal and vertical components being approximately 850 kips. Though this unusual form necessitated an involved analysis, it followed established principles and theory.

The shell was designed for a temperature range of plus or minus 30 degrees. A lack of expansion joints is, of course, a problem encountered in any long-span structure; however, as the M.I.T. dome is relatively flexible, the deformations that can result from temperature changes will not induce excessively large forces.

Given the dome form, it would have been quite possible to frame this structure with other materials and methods—rolled-steel shapes or light-steel trusses; geodesic construction or wood or steel lamella systems. However, according to D. R. Pierce of Ammann & Whitney, New York Consulting Engineers for this project, it seems entirely improbable that any of these systems would have proven less expensive. Saarinen himself feels that compared to conventional methods, the shell dome added nothing to the cost—except for the more durable copper covering that was specified. The dome, as designed in concrete, is very nearly as light as can be tolerated acoustically. As noted before, mass actually had to be added to reduce sound transmission. Other structural systems would have had to carry the same load on the same span, whether or not they might be inherently lighter than concrete.

Although the ribs at the three cut edges of the dome superficially resemble arches, they actually are not, in the usual sense. They are necessary, however, to stiffen and stabilize the shell along its discontinuous edges and must deliver the reactions for the dome’s stresses which exist along these edges.

In addition to the control of outside noise, there was also the question of control of noise from the small theater below the auditorium and the two rehearsal
West elevation (acrosspage) shows dome, plaza, and receiving entrance. Plaza was raised to elevate auditorium basement because of high water level. Esthetically, the raised plaza was also desirable in order to set it apart from surrounding flat land.

View of formwork for stage and orchestra pit (right) is from east end of auditorium.

All photos (unless otherwise noted): courtesy of George A. Fuller Company.
rooms adjacent to the small theater. It had to be anticipated that on occasion all of these facilities would be used simultaneously. As they are “shoe-horned” together, it was necessary to employ a rather elaborate scheme of resiliently-hung plaster ceilings over the lower halls and to separate them by means of double walls. Ductwork also required special consideration.

In the main auditorium, it was realized that a domed ceiling inherently produces some unusual and undesirable effects. It was equally appreciated that good performing conditions have to be provided for orchestral or choral groups on the platform. (For musical performances, it is essential that the musicians have an adequate sense of mutual support.) Therefore, Bolt, Beranek & Newman, Cambridge consultants in acoustics, suggested that a canopy made up of many surfaces be suspended over the stage areas—some of the surfaces to reflect sound into the seating area and some to return sound to the performing area (ARCHITECT’S DETAILS, page 130). Sound is also reflected concurrently from the main ceiling overhead.

Analysis of the dome shape indicated that there would be focusing of sound in certain seating areas from the ceiling overhead. For this reason, reflecting sur-
faces similar to those used above the platform cover a large portion of the rear ceiling. Conveniently, supports required for these baffles will also provide the attic necessary for air-conditioning ducts and catwalks for servicing most of the downlights and some of the spots. Even with the presence of these “floating clouds,” the audience has the pleasure of being able to see the domed ceiling beyond.

To control echo from the curved rear
The auditorium, Cambridge, Massachusetts, features wall surfaces, the acoustic consultants have proposed the application of a deep sound-absorbing material with an extremely transparent facing. For the control of reverberation, the audience itself will provide the major sound-absorbing factor. Robert B. Newman reports that the "fabric-upholstered chairs, when empty, will 'look' much like people in chairs" and the auditorium will have a reverberation characteristic which is relatively independent of audience size. In addition, the sound-absorbing material placed on the rear wall for echo control will lend additional reverberation control. Sound-absorbing material will also be placed above the reflecting surfaces at the rear of the auditorium. This material can easily be removed in part, if it should be considered necessary to increase the reverberation time of the auditorium after it has been finished. (The apparent reverberation time in an auditorium is often quite different than that which was calculated by classical formulas.)

Architects for this structure were Eero Saarinen & Associates; associate architects: Anderson & Beckwith. The George A. Fuller Company, Boston office, acted as the general contractors.
Detail photos and drawings of buttress (acrosspage). Bed of sand and gravel underlying area has good bearing capacity and can adequately carry both vertical and horizontal thrusts. Because of basement depth, footings carried to this stratum are only slightly deeper than would otherwise have been required. Little or no movement of buttresses is anticipated. Since the dome is relatively flexible and is supported at only three points on spherical bearings, small differential deflections could be tolerated if they occur.

Workman prepares chase before pouring of outer shell (above).

Photos (except far left):
J. Alex Langley

Design of cantilever frames supporting upper part of auditorium (above right) was complicated by heavy concentrated loads from the projection booth at extreme end of cantilever. Resulting frames are very heavy.

In photo of small theater (below right) carpenter shop and greenroom flank audience seating on left and right, respectively.
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Written Dept. PA-6
seismic science
Here’s a new wrinkle in subsurface exploration work. It is called the seismic method. With the proper use of the seismic refraction method and modern equipment, the depth to media of certain velocity differentials can be accurately determined. When these data are plotted, a graphic cross-section of the earth (up to a limit, dependent upon the application) can be determined. This makes it possible to conduct a survey over any kind of terrain and under difficult conditions such as river crossings, metropolitan areas, open country—or, in fact, anywhere. This seismic method for determining thickness of overburden and depth to bedrock is based on the measurement of the time for the advance of a wavefront, usually generated by exploding a small charge of dynamite. Following the explosion, the arrival of a wavefront, both horizontal and refracted, is picked up by the seismometer. This in turn emits an electrical impulse or signal, which is transmitted by means of a cable to the amplifier. Here the signal is amplified and transmitted to the galvanometer where it is recorded. The galvanometer consists of a mirror attached to a coil and suspended in a permanent magnetic field. A beam of light is focused on the galvanometer and reflected by the mirror onto moving photographic paper. This produces the oscillogram. The timing lines are projected in the same manner from a disc-type light interruptor driven by a synchronous motor. These are focused on a separate mirror and then onto the moving paper; thus the recorded data and the time lines will appear on the paper as black lines on a white background. Understand? No? For more details, write Institute of Industrial Research, Syracuse University, Syracuse, New York.

pizza payoff
I’ll be hornswoggled if it didn’t happen again! My faithful readers (mother, father, wife, two small children) will recall that last year a building product representative dramatically opened before me a jewel case exposing in all its resplendent glory a corner of an aluminum refrigerator. The other day, in comes a guy from Hillyard Chemical Company and pulls the same gimmick. This time it was a king-sized velour-lined leather case housing a section of maple flooring, finished with his “Trophy Gymnasium Finish.” After the shock wore off, the conversation got around to a variety of resilient and nonresilient flooring materials and maintenance materials such as waxes, varnishes, and finishers. That night I had a vivid dream, somewhat intensified by a pizza pie dinner, wherein varnish (represented by a stick of chewing gum—probably because varnish is made with damar and copal gums) and a swarm of bees (because of their intimacy with wax) were performing. Just as the pizza wended its weary way, I concluded hazily that it was pointless fretting about the selection of appropriate flooring materials since the maintainers wax or varnish the very wax and avoid pizza. Incidentally, while it was pointless fretting about the selection of appropriate flooring materials since the maintainers wax or varnish the very wax and avoid pizza, it may interest you to know that more than 65 manufacturers make wax in liquid and paste form, slippery and nonslip; some apply it hot and some apply it cold. About 20 manufacturers sell wax applicators, brushes, pads, and sprayers, both hand and electric, about 5 manufacturers sell wax removers and, for the fastidious, there is insecticidal as well as germicidal wax. More than 29 manufacturers make varnish and more than 15 make varnish removers, and that’s the unavoidable truth. If you are still not impressed, you can purchase liquid combinations of hard waxes and varnish gums. See what you started Hillyard?

shiny nosing
Perhaps you had better watch your step on this one—and I do mean step. Do you know the difference between a good non-slip metal tread and a poor one? Can you predict how long it will last before those busy little feet wear it down to its slippery, naked metal? How much nonslip aggregate is enough? Do your lovely buildings have shiny nosings? Here am I writing specifications for, lo, these many eons, and didn’t rightly know until Mr. Feralun brought me up sharply, I don’t expect to get the world afire with my brilliant little discoveries but details like these prevent embarrassing slip-ups. Maintainers are the first to howl about nonslip treads that quickly lose their non. Replacing treads about three to five years on centers cannot begin to justify the initial cost-saving (about 30 percent) in buying poor treads. A good nonslip tread should look dirty when new and perfectly lousy thereafter. You should see more nonslip aggregate than metal. Rub it down with an iron bar until your blood pressure is over 200, to see if you can free an appreciable amount of aggregate from the base metal. Bite through the tread to see if the aggregate is more than skin deep—say ½”. Bon appétit!

structural steel defined
Fred Severud riveted me against the wall and challenged me to define “structural steel.” I said it was, well, er—yes, you know, hard goods commonly used as columns, beams, and stuff like that there. He politely suggested that the moment my eye becomes unglued from the television set, I peek at the AISC code for the answer. I did. Here is what it said:

“The term ‘structural steel’ comprehends only the following categories of parts: Anchors for structural steel; bases of steel or iron; beams, purlins, girts; bearing plates for structural steel; bearing shoes for bridges; bracing; brackets; bridge pins; bridge railings of steel; columns of steel, iron, or pipe, or cement filled pipe; counterweight boxes for bridges; crane rails and stops; door frames constituting part of the steel framing; expansion joints connected to the steel frame; floor plates (checkered or smooth) connected to the steel frame; girders of steel; grillage beams and girders of steel; hangers of structural steel, if attached to the structural steel framing and shown on the framing plans; lintels shown on the framing plans or otherwise enumerated or scheduled; marqueses (structural steel frame only); monorail beams of standard structural shapes; separators, angles, tee, clips and other detail fittings essential to the structural steel frame; suspended ceiling supports of structural shapes three inches or greater in depth; shop rivets, permanent shop bolts, bolts required to assemble parts for shipment and shop welds; struts; tie, hanger and sag rods forming part of the structural steel frame; and trusses.”

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structure determines interior design

There is an almost automatic inter-relation of the architecture and interior design in good contemporary examples. The two are integrated, if the designer thinks of them as an entity. When it is necessary for the architect to divorce himself to a degree from the actual mechanics and execution of interior design, the interior designer must always work in close accord with him from the conception of the structure. It is not enough to have good architecture, if the interior design is not sympathetic. The moment the design thoughts are separate, the finished product will suffer. But the ideal is achieved when the architecture is the interior design. Structure is design and design is structure. This, of course, need not lead to bleakness and coldness.

The beauty of many materials in their natural state precludes any chance of ugliness. Here we have design not for design's sake, but for design's usefulness and beauty. Walls, ceiling, and flooring should accomplish their purposes without benefit (if that term is applicable) of extraneous elements—meaningless weakeners of the original concept. All that need be added are the necessary tools of comfort—furniture and fabrics that complement the scheme and make it workable, at the same time contributing to the building's personality, color that is sympathetic, lighting that sets the stage, and humidity and temperature control for complete ease. A variation in textures and proper space division complete the picture.
By using materials in their natural state, and by creating a private view of a patio area to each room, the designer has achieved a home-like atmosphere in a building which is combination office and residence. The partitions have been cleverly planned to allow rearrangement of rooms whenever necessary, without having to make any structural changes. The simple lines of the house lend an ease and grace normally found in a much more elaborate plan. Reliance on texture for the only ornamentation has proved successful.

_Nothing:_ Rada Photography
data

doors and windows
Windows: glass and wood jalousies/
Wagner Distributors, Miami, Fla.

equipment
Heating: "Typhoon Prop-R-Temp"
Heat Pump, Tampa, Fla.
Thermostat: Minneapolis-Honeywell
Regulator Company, 2753 Fourth Ave.,
So., Minneapolis 8, Minn.
Ceiling Exhaust Fans: Pryne & Co.,
Inc., N. Towne & Railroad Ave.,
Pomona, Calif.

furnishings and fabrics
Cane-Back Chairs: Ed Hoffman, Clearwater, Fla.
Furnishings: supplied by owner.

lighting
Recessed-Ceiling and Wall-Mounted
Fixtures: General Lighting Co., Inc.,
1527 Charlotte St., New York, N. Y.

walls, ceiling, flooring
Walls: used brick, painted plywood,
vertical paneling.
Ceiling: ¾" "Fiberglas"/ Owens-
Corning Fiberglas Corp., 1833 Nicho-
les Bldg., Toledo 1, Ohio.
Flooring: monolithic terrazzo on 4" slab/
lime brick on patio.
structure determines interior design

location: Tropicana night club, Havana, Cuba
architect: Max Borges, Jr.

recessed lighting
serpentine bar
mobile
The epitome of melding of architecture and interior design is reached in this structure. The ceiling and walls are the shell of concrete and glass. The structure itself is the design. Rough-textured concrete in dark color makes the glass areas seem invisible, and the surrounding glamorous plantings and tropical sky become the decor. The feeling of being out-of-doors is accomplished without sacrificing the comfort of an enclosure. Simplicity of furnishings keeps them exactly where they belong. Had the designer tried to do them in a larger scale, or in a more dramatic way, he would have destroyed the effectiveness of the building itself. Small Photos: J. Alex Langley
Large Photos: Muñis, Havana
structure determines interior design

location | Tower Fabric showroom, New York, New York
interior designers | Designs for Business, Inc.
A fascinating design theory is expressed in the execution of this fabric showroom. The fabrics are well-styled inexpensive ones. The designer decided that the background should be as unobtrusive as possible, yet help to give the fabrics the look of importance. Thus, the cinder blocks which determine space division have been left in their natural state. The lighting is set up in much the same way it might be in a photographic studio. No fabrics are seen in the entrance or reception area, except small squares at the reception desk. The fabrics are shown only in the showrooms. Here elegance is achieved with furniture and fabrics, but still most important are the fabrics being shown. No display interferes with the presentation.

Photo: Ben Schnall

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data

cabinetwork
Reception Closet, Reception Desk, Entrance Wall, Shelving, Desks, and Tables: custom/ executed by Ezra Blank Associates, 117 Lombardy St., Brooklyn, N. Y.

doors
Doors: custom, 9 ft. high/ Jacob Kotler Co., Inc., 8 W. Fourth St., New York, N. Y.


equipment
Musical System: recessed in ceiling/ Allen Communications, Inc., 1415 Broadway, New York, N. Y.

furnishings and fabrics
Bench (in lobby): custom/ executed by Cumberland Upholsterers, 986 Second Ave., New York, N. Y./ upholstery: white horsehair/ Marie Nichols Fabrics, 300 E. 61 St., New York, N. Y.

Seating Units: George Tanier, 521 Madison Ave., New York, N. Y.

lighting
Recessed Pinpoint Spots: Century Lighting, Inc., 521 W. 43 St., New York, N. Y.


walls, ceiling, flooring

Ceiling: acoustical tile/ Celotex Corp., 101 Park Ave., New York, N. Y.

Door Knobs: Series 600/6-pin tumbler lock-set/ “push button” and “turn button” combined for automatic locking/ ½” latch bolt/ reversible for right- or left-hand doors/ Kwikset Locks, Inc., Anaheim, Calif.

Leather Floor Tiles: 8” squares/ vinyl finish and fireproof finish/ may be cleaned with soap and water/ only care required is waxing/ applied with linoleum cement/ colors: white, rust, tan, red, green, black/ may be special ordered in any color or size/ retail: 65¢ per square/ The Upholstery Leather Group, Inc., 141 E. 44 St., New York 17, N. Y.

Bedroom Furniture: “For-Ever Modern”/ steel construction with plastic tops/ includes double dresser, single dresser, double and single headboards, night stand and desk/ finished in limed-oak with chocolate-brown case and white with Gothic-gray case/ designed by John Keal/ The Stor-All Corporation, 1715 W. Florence Ave., Inglewood 5, Calif.

Chairs: #9480, #9481/ tapered legs of U-shaped heavy laminations/ wood stretchers, seat and back of molded plywood, upholstered in fabric-covered 2” rubber filling/ 18” x 18” x 31” high/ designed by Jean Giaconome/ Thonet Industries, Inc., One Park Avenue, New York, N. Y.
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June 1954 141
TV Board – Meeting –
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Hand-Woven Plastic Blinds: available in any width up to 96"/ opaque plastic slats woven with any color yarn to order/ may be used as standing screens, roller-type blinds, space dividers, accordion pleated blinds, or traverse draperies/ designed and executed by Helen Skowronski/ Kneedler-Fauchere, 451 Jackson St., San Francisco, Calif.

Fabrics: "Glacia"/ linen, French wool, and white aluminum/ width, 52"/ retail: $10.50 a yd./ "Ginger Weave"/ yarn-dyed linen, viscose, and colored Metal guimpe/ 54" wide/ retail: $11.25/ Jack Lenor Larsen, 60 E. 58 St., New York 22, N. Y.

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Table Lamp: #3864/ 5-arm brass tubing with pierced-brass shades/ 23" high/ designed by Edmont J. Spence/ retail: $80/ Rembrandt Lamp Corp., Erie at Fairbanks Court, Chicago 11, Ill.

Lamps: #40508 (above), wall lamp with brass pierced shield and Italian white reflector sconce/ 16½" x 11" x 7" deep/ retail: $29.90/ #30703 (right), walnut-stained Korina and polished-brass conical base, Madagascar cloth shade/ designed by Gerald Thurston/ retail: $39/ #40507 (far right), bed lamp/ three-way switch attached to cord for convenient regulation/ 32" horizontal brass bar with two brass shields/ retail: $42/ Lightolier, Inc., 11 E. 36 St., New York, N. Y.
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1-88. Central-Plant Air Conditioners (C-4.22), 6-p. folder with enclosed Engineering Manual describing cooling and heating units for multiroom applications. Horizontal and vertical models also provide ventilating, filtering, humidifying, and dehumidifying. Specifications; cutaway drawings; tables of dimensions, arrangements, nominal ratings, damper arrangements, dry-air friction data, valves and distributors, fan ratings. Drayer-Hanson, Inc., Box 2215 Terminal Annex, Los Angeles 54, Calif.

1-89. Electro-Air Electronic Air Cleaners, AIA 30-D-3 (C-10.4154), 8-p. bulletin giving construction features of electronic air cleaners for homes and smaller commercial and industrial buildings. Data on both horizontal and vertical units including specifications, dimensions, installation possibilities, principle of operation, cutaway drawings, and typical applications. Electro-Air Cleaner Co., 1285 Reedsdale St., Pittsburgh 33, Pa.

1-90. Kewanee-Ray Boiler-Burner Unit, AIA 34-B-1 (1031), 16-p. catalog giving detailed information on boiler-burner unit for heating, power, and process steam using oil, gas, or gas-oil combination. Test data, description of construction and operation of component parts illustrated by cutaway drawing, specifications, ratings, and dimensions. Kewanee-Ross Corp., 101 Franklin St., Kewanee, Ill. and Ray Oil Burner Co., 1301 San Jose Ave., San Francisco 12, Calif.


2-102. The Skyline System of Roof Protection, AIA 12-B-2, file folder enclosing brochures on residential roofing systems. Required materials, application (illustrated) of built-up roofing over wood decks with inclines from 1/2" to 2" per ft; data on emulsion-type roof coating for use over existing built-up roofs, either asphalt or pitch and slag (or gravel); and application details and other information on both custom and standard asphalt-strip shingles for new construction where roof slopes are within range of 2" to 4" per ft. The Flinthkote Co., Building Materials Div., 30 Rockefeller Plaza, New York 20, N. Y.


2-104. The Modern Lightweight Masonry Unit for Walls and Floors, 24-p. brochure giving detailed data on properties of hollow concrete-aggregate blocks. Available shapes and sizes; physical data including fire-retardant rating hours, sound-transmission decibel reduction, and thermal "U" value; description of various applications; exterior and interior finishes, eight pages of construction details. The Waylite Co., 105 W. Madison St., Chicago 2, Ill.

doors and windows


3-80. The Kwikset "400" Line (400 4 PC3), 4-p. booklet giving general specifications for line of locksets for interior, exterior, and closet doors. Data on cylindrical deadlock for use as auxiliary lockset, school room lockset, dummy knob, sliding glass door, and other data on aids. All models illustrated. Kwikset Sales and Service Co., Anaheim, Calif.


3-84. Russwin "Stilemaker" Heavy-Duty Locksets, 12-p. catalog covering line of products.

(Continued on page 151)
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electrical equipment, lighting

4-64. Art Metal Drums with Heat Control Construction, 4-p. folder with data on drum-shaped lighting fixtures available with prismatic glass or tapered or straight-sided opal glass. Description of construction, glass sizes, Electrical Testing Laboratories’ report on lighting performance, installation information, drawings of models. The Art Metal Co., Cleveland 3, Ohio.

4-65. Holophane Lighting: Shopping Centers, Modern Stores, Super Markets, AIA 31-F-2 (SB-1), 80-p. handbook on store lighting design, illustrated with 110 store installation photos, 65 layout plans, and diagrams. Sections cover interior lighting, including selling areas, services, and common areas; exterior lighting, including parking courts, service yards, and walkways; general information on lighting with detailed data for determining lighting requirements; equipment and subject indices. Holophane Co., Inc., 342 Madison Ave., New York 17, N. Y.

4-66. Smithcraft Architectural Troffers (430B), 16-p. catalog on line of recessed troffers. Data on aligner hanger, shallow troffers, spot boxes, glass frames for troffer pattern lighting, plaster frames, trim flanges, ceiling suspension system, and deep troffers. Performance curves, wattages, cutaway drawings, dimensions; typical ceiling layout using ceiling suspension system; troffer installation details; and specifications. Smithcraft Lighting Division, 217 Everett, Chelsea 50, Mass.

4-67. Far-A-Matic Electric Clock and Program System, 8-p. booklet listing features of master clock and program unit with two-wire automatic reset and 24-hour spring reserve. Also, information on flush, surface, double-dial, and skeleton clocks; control boards for program system; and program signals. Wiring diagrams, dimensional drawings, and specifications. Sperti Faraday Inc., Adrian, Mich.

4-68. Swivelier Universally Adjustable Dextra-Lites, AIA 31-F-23 (134), 8-p. bulletin describing new line of adjustable incandescent and fluorescent lighting units designed for industrial and commercial use. Data on parts, available finishes, and shade dimensions of clamp and bracket units. Photos, drawings, and charts. Swivelier Co., Inc., 43 34th St., Brooklyn 32, N. Y.

finishers and protectors


posts, explanation of pressure treatment; photos showing use of treated lumber in industrial, farm, residential, and other types of construction. Specifications. J. H. Baxter & Co., San Francisco 4, Calif.

5-20. Floor Finishing and Maintenance, AIA 25G (2414), 6-p. folder describing line of cleaners, sealers, and waxes for various types of commercial, industrial, and institutional flooring. Recommendations for application of cleaners and finishers by company’s three-step process over terrazzo, rubber tile, linoleum, concrete, asphalt tile, and wood. West Disinfecting Co., 4216 West St., Long Island City 1, N. Y.

6-30. Effect of Edge Insulation upon Temperature and Condensation on Con-

(Continued from page 152)
Dissatisfied with the traditional hinges that were pockmarked with fastenings and short on durability, our designers went to their drawing boards.

It couldn't be bought...
so we made it

This was the result — a new concept in hinge design — our exclusive Butt Hinge.

Requiring only half the usual number of fastenings, the Amarlite Butt Hinge is 50% thicker and more than double the strength of the old style hinge.

The ultimate in simple beauty, it is an integral part of the Amarlite assembly. No other entrance has it.

This is another of the exclusive features found only in the Amarlite Trimline Entrance.

For full details and the 1954 Amarlite Catalog, write American Art Metals Company, 433 Bishop Street, N.W., Atlanta, Georgia.
Put your windows where you want them

Solve the Sun Problem with CANVAS SHADING

By 5 o'clock on a summer afternoon a 3’ west overhang will be so nearly useless that an 8’ x 12’ picture window will let in almost as much heat as it would without the overhang —about 24,000 Btuh. Canvas Awnings are better than overhangs east and west because they can roll down lower when needed and give complete protection for a fraction of the cost.

Every good idea that makes it easier to keep a house cool without air conditioning will also make it easier to cool a house with air conditioning. And of primary importance in both of these is keeping the sun off glass areas, for glass lets in 35 times as much heat from the sun and 10 times as much heat from the outside air as insulated wall.

Your answer? Outside canvas shading...flexible, colorful, economical! With this heavy fabric effectively screening out 75% of the sun’s rays, interiors stay degrees cooler. Air conditioning equipment costs less and works at maximum efficiency.

So if the nicest view is to the west, put in a big window and enjoy it. Simply shade the area with canvas. You’ll find it does more than reduce heat gain...at little expense, it adds a distinctive note of color, grace, and texture to attract your potential customers.

See our catalog 18/Ca in Sweet’s Architectural File or write for a free copy. It contains original and practical ideas, plus helpful instructions for specifying canvas.

Canvas Awning Institute, Inc.
and National Cotton Council

P. O. Box 1851
Memphis, Tennessee
An important feature of the restoration of Monticello, home and monument of Thomas Jefferson, is the thorough treatment of all exterior masonry with a silicone water repellent.

Silicone treatment protects the entire masonry walls of this modern woodland residence exposed to high humidity, rain, and sub-zero weather.

On new construction or restorations, leading architects agree: above grade masonry walls are made more weatherproof, and retain their original beauty longer when treated with water repellents made with Dow Corning Silicones. Completely invisible and non-plugging, silicones do not change the color or porosity of treated surfaces. Water washes dirt off, not into, the surface. Staining, streaking, spalling and efflorescence are minimized or eliminated entirely. And the treatment costs very little; remains effective for years.

Dow Corning silicone-based water repellents are now available from formulators and their distributors in every part of the country. Write Dept. EC-18, for more information and a list of suppliers. Dow Corning Corporation, Midland, Mich.
Panel-type air diffuser fitting into metal suspension ceiling is interchangeable with both acoustical tile and lighting fixtures. Flexible tubing (can be twisted, stretched, or compressed) connecting diffuser to duct permits the unit to be located as desired. A damper, controlled from the floor with simple device, regulates air volume supplied by each diffuser at point of discharge. Position of damper has no effect on diffusion pattern, an important feature where variable cooling loads may be anticipated. Connor Engineering Corp., Shelton Rock Lane, Danbury, Conn.

This powder-actuated tool can drive heavy shank fasteners into structural-steel plates up to one-in. thick (with a holding power up to 10,000 lb) and into the hardest concrete. Weight: less than eight lb; length: 15". Ramset, 12117 Berea Road, Cleveland, Ohio.

Andersen’s new Flexiview picture units are combined with Flexivent ventilating units on this porch. There are three available sizes of the Flexiview: 3’ 5”, 3’ 8”, and 4’ 1” wide, all in a 4’ 7½” height. Removable double glazing will be furnished for these units. A few of the possible combinations are shown (below left). Andersen Corp., Bayport, Minn.
Simple, practical ventilation for many kinds of buildings

Swartwout-Dexter Heat Valve

The original continuous ventilator

The Heat Valve as developed and improved by Swartwout has proved to be one of the most adaptable ventilator designs. Originally applied principally to ridge peaks, its use on slopes or flat roof surfaces has become common. Popular uses in the smaller sizes include saw-tooth construction and skylights.

Heat Valve is designed for maximum capacity with lowest friction, and greatest assistance from outside air currents. It provides practically any area of roof opening desired, at economical cost. Can be quickly and easily installed. Always weatherproof, with fully adjustable damper for exhaust control when needed. Various damper operating methods are available.

Swartwout-Dexter Heat Valve is made in 10 throat sizes, in standard 10 ft. lengths. Can be made of special materials when acid or fume conditions prevail... Get the full story — write for Bulletin HV-E.

Low overall height of Heat Valve enhances appearance — is an advantage structurally.

York-Shipley Homeaire: new air-conditioning system for homes up to 1000 sq ft with 1 1/2 hp air-cooled condensing unit (using Freon 12) and hermetically-sealed refrigeration system. Center section of unit devoted to refrigerant circuit and evaporator section; one end section includes fan for circulating cool air while other contains fan for handling condenser cooling air. Dimensions: 19" high, 25" deep, 69" long. York-Shipley, Inc., York, Pa.

construction

No. 155 Elastic Compound Tape: new nonstaining fibrous mastic, composed of synthetic resin base and asbestos and inert extenders, for sealing metal seams and joints, glass and rubber channels, and other uses. Furnished in ribbons from .0040" to 1/8" thick and 3/4" to 2" wide, in beads as small as 1/4" diameter. Sealer has high resistance to water and to temperatures from 375 F to -50 F, has no softening or crazing effect on plastics. Prestitite Engineering Co., 3798 Chouteau Ave., St. Louis 10, Mo.

Neo-Grips: new blind expansion fasteners designed to secure objects to many types of building materials, including plaster and plaster board, gypsum products, fiber material, asbestos cement, cork, plastics, glass, ceramics, masonry, and metal. Fasteners do not require firm interior support and in many cases eliminate need for penetration of material. Cushioned expansion action of fastener sleeve exerts pressure without tearing soft materials or shattering glass, tile, or ceramics. Minimum material thickness: 1/4". Star Expansion Products Co., 147 Cedar St., New York 6, N. Y.

doors and windows

Tuf-Flex Door: heat-tempered polished plate-glass door now available in 1/4" thickness; weighs one-third less than standard heat-tempered door. Designed for stores and commercial and public buildings, doors are tempered to provide three to five times greater strength than conventional plate glass and greater resistance to physical and thermal shock. Initially furnished with aluminized-aluminum fittings, 1/4" model will be available with bronze fittings in various finishes. Same locks, bolts, floor checks, door holders, and other accessory equipment as 3/8" model. Libbey-Owens-Ford Glass Co., Nicholas Bldg., Toledo 3, Ohio.

Pedestrian Walk-Up Window: new exterior bank window with bullet-proof glass, steel sash, and steel customers' shelf and teller's counter. Shelf provides writing space; for after-hours protection, shelf pulls flush with wall and covers depository unit. Features: insert holding pen, deposit and withdrawal slips, two-way audio system, double door on depository unit, inside dropped ceiling or plenum in central hall, or in false chimney with side louvers to permit free air intake for cooling coils. Muncie Gear Works, Inc., Marvair Div., Muncie, Ind.
The new low-cost Trade-Wind Axial Flow Ventilator now makes it possible to use either wall or ceiling installation with the same unit of this revolutionary new ventilator. The unit can be installed between joists in the ceiling or between studs in the side wall. The Trade-Wind gives you straight-through axial air flow plus super-powered suction. And it sells at a low, f-o-w price which makes kitchen ventilation a must even in the most economically designed house. And it's so good looking! Styled by a top industrial designer, the Axial Flow adds a new distinctiveness to every kitchen.

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5725-FS. MAIN ST., LOS ANGELES 37, CALIF.
counter space and cash drawers. Mosler Safe Co., 320 Fifth Ave., New York 1, N. Y.

electrical equipment, lighting

Holophane Outdoor Unit 415: exterior lighting fixture for public areas, industrial buildings, and other locations has glass assembly composed of small glass prisms directing light downward and outward. Weatherproof bracket hood, die-cast aluminum parts with lacquered finish, double-thick prismatic refractor. For relamping glass assembly swings open on concealed hinge. Holophane Co., Inc., 342 Madison Ave., New York 17, N. Y.

Recessed Fixtures: new line of recessed fixtures for homes and commercial buildings are self-locking, screwless, and range in size for 60, 100, and 150 watt lamps. Ready to install with ordinary house wiring, units are also available with either prewired or unwired recess boxes. Standard finishes: polished chromium, baked white enamel, and polished brass. Adjustable all-position hangers, specially-engineered light seal. Markel Electric Products, Inc., Buffalo, N. Y.

P&S 8672 Receptacle: new three-wire grounding duplex receptacle (surface type) with two current-carrying contacts and third contact to accommodate U-shaped grounding blades on special three-wire caps. For use with nonmetallic cable, receptacle is designed to mount on 2” x 4” studs. Current-carrying parts mounted in arc-resisting Urea base; knockouts for No. 12 or No. 14 standard nonmetallic sheathed cable. Rating: 15 amp, 125 volts. Pass & Seymour, Inc., Solvay Station, Syracuse 9, N. Y.

finishers, protectors

Satinwood Rez: low-luster finish for color-toned, natural, or blonded wood surfaces. Also for use as refinishing coat, finish accent color and grain qualities of wood, protects it against water or alcohol stains. Addition to line of wood finishes which includes clear sealer, blending sealer for interior use, interior rubbing finish, and pigmented sealers for interior and exterior use. Monsanto Chemical Co., St. Louis 4, Mo.

insulation (thermal, acoustic)

Acoustilite-Random: random-pattern tileboard added to line of drilled wood-fiber acoustical tileboards with noise coefficients of .40 to .75. Available with Class F flame-resistant treated surfaces, perforated tiles have coated beveled edges. Thicknesses: %”, 3/4” tiles may be painted without affecting sound-absorption qualities or flame-spread resistance.

Clow Cast Iron Pipe—...the pipe that never needs to be replaced

The long life... and long lengths of Clow “IPS” Cast Iron Pipe made it the choice of the architect for all downspouts, vents and waste lines 3” and over in this handsome new school building. The non-corrosive characteristics of “IPS” assure trouble-free service for the life of the building. Its 18-foot lengths permit trim, attractive installations.

Clow (threaded) Cast Iron Pipe has same O.D. as steel pipe, is available with plain or threaded ends, in 3, 4, 5, 6, 8, and 10" sizes in 18" random lengths. Also available with integral end pipe hub on one end (other end plain) in 18" random lengths in 4, 6, and 8" sizes.

*Iron Pipe Size O.D.

St. Patrick’s Academy, Chicago, Illinois
Architects & Engineers: Belli & Belli
Plumbing Contractor: L. G. Keefe

Fiberglas Acoustical Form Board: new glass-fiber board provides thermal and acoustical insulation, permanent form for poured-in-place gypsum roof decks, and interior ceiling. Strong enough to support spacing of 32%” without intermediate support, boards have .75 noise-reduction coefficient, average thermal conductance (1” thickness) of .25 Btu/sq ft/hr° at 75°F mean temperature. Installed in same manner as gypsum board. Owens-Corning Fiberglas Corp., Toledo 1, Ohio.

specialized equipment

Automatic Washing Machine Tee: ridged dual tee for automatic washing machines, designed for in-the-wall installation. Makes up corner valves to approximately 8” centers. Supply lines drop down from supply tee, pipe to hose connectors join to washer. Designed for ½” threaded pipe and ½” copper tubing, tees have solid center to prevent water from by-passing. N. O. Bakken Co., P. O. Box 2014, El Monte, Calif.
PRODUCT NEWS from AMERICAN-Standard

A review of products in the news and important features worth remembering

LAVATORY-DRESSING TABLES by American-Standard will add beauty and convenience—and client appeal—to the homes you plan. Each fixture combines dressing table and storage cabinet in one compact unit. Shown here are the New Dresslyn, left; the Highlyn, left below; and the Merrilyn, at right below. The New Dresslyn and Merrilyn have genuine vitreous china lavatories... the Highlyn has enameled cast iron lavatory. Cabinets and lavatories come in a variety of color combinations. All units are available in straight front or knee-hole models.

HEATRIM PANELS are the modern way of providing comfortable, even, convected warmth throughout an entire room. They are specifically designed for forced-circulation hot water heating. Taking the place of conventional wood baseboards, Heatrim panels save floor space, leave walls unbroken, permit greater latitude in designing and decorating. They can be installed against existing walls or recessed to the depth of the plaster. They are perfect for use under picture windows... are also much in demand for premium-space installations.

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Mississippi Glass Used In Outstanding New Skyscraper Offices of U. S. Steel

The rhythmic pattern of translucent, light diffusing Structural Corrugated Glass highlights the modern interior of the 525 William Penn Place Bldg. in Pittsburgh. Used in partitions, doors, foyers...figured glass floods offices with copious quantities of "borrowed light"...yet protects privacy completely. Interiors look larger, brighter, more pleasant, with the glass that promotes working efficiency and builds employe morale.

And figured glass is as practical as it is beautiful. It never wears out, never warps, rots...never requires repainting or refinishing. Glass wipes shining clean, is extremely easy to maintain, always looks new. That is why more and more interiors reflect the pattern of progress with extensive use of the modern material—figured glass by Mississippi.

Structural Corrugated Glass is being specified by architects everywhere for its beauty and utility...offers new scope for talents...suggests numerous ways to handle design problems. Mississippi figured glass is manufactured in a wide variety of patterns and surface treatments and is available wherever quality glass is sold. Select glass by Mississippi and add sparkle to your ideas.

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Write today for free booklet, "Figured Glass by Mississippi." Contains many ideas on ways to utilize diffusing glass in modernization or new construction.

ARCHITECT: Harrison & Abramovitz
ASSOC. ARCHITECT: William Y. Cocken
GEN. CONTR.: Turner Construction Co.
GLAZING CONTR.: Pittsburgh Plate Glass Co.
CONSTRUCTION AND MANAGEMENT: John W. Galbreath & Co.
Before introducing Robert Woods Kennedy as this month’s guest lecturer, I have a few comments to make to this year’s graduating class of architectural students.

It has been my custom each June, for the several years we have been talking to each other, to address you directly with a valedictory, to speak words of fatherly advice, to wave a benediction, and also to drop a tear for my long departed youth and the brave victories I was to win in the depressed world of my own launching day—June 18, 1931. Graduations are much alike but as in birth, marriage, and death, it is not the common experiences but the personal ones that provide the meaning to the act. What meaning then is to be found in the milling crowd in hot, black, rented gowns and mortar boards? In the fake parchment “sheep skins”? In the handing out of a blank page, rolled in a red ribbon, to an embarrassed clod while the names are blared automatically by a Dean through loud speakers? What is this mass gift of accolades? What meaning to these clumsy and vestigial rituals?

Yes, this is the weaning, these are the vestigial rituals, the tribal circumcision rites, the coming of age. These are the gifts of the first communion with adulthood. You stand, doff the mortar board, sing the college song, toss the black tassel from left to right, and lo—a man! Silly!

This is no childish atavism, you young architects. This is the curious final magic moment of the transmittal of certain knowledge when the teacher closes the exit door to the classroom and turns around to open the entrance door once again for the next comers. Such moments in each person’s history have a meaning which time alone can interpret.

For you, the change is very abrupt. You are no longer within the benevolent despotism of the architectural school. There are new disciplines and new standards and unfamiliar personalities with which to cope. The most unfamiliar personality will be your own. What will it do outside the bomb-proof shelter of the school—the shelter which did not and could not simulate the facts of life? Can you meet an employer face to face—office drudgery—the unexpected political tangles of the job? These are no different from the drudgery and political tangles of the design studio, lab., or college drafting room. You are booted out into the night. Can you take it?

This is, in part, what commencement means to you. But more important, it should mean that it is the first of many tests which you will face, tests more arduous than the final exams, the thesis, the orals, and the rest. These are the tests of convictions hardly formed, of talents scarcely fledged, of temper, humor, and of whatever personality you may have.

(Continued on page 162)
achieved. The most trying test of all which can be survived, but only by a few, is that of true genius. The talent scouts can be wrong. The talent imitators can be wrong too. And the admirers of the talent imitators can be the wrongest of all.

I am not trying to sow the seeds of personal mistrust in you. You cannot go back through the closed door and relive the last five years. You can evaluate what these years have done for and to you, only as you thread together the course of your career—a year—ten years from now. So you can neither go back nor hang back. This is the commencement of adult life. See that you grow up. The world needs mature architects and planners as never before.

Robert Woods Kennedy talks here this month about the social situation in the schools. You know Kennedy as an architect and an author. His The House was discussed in Tom Creighton's P.S. in April P/A and you will be seeing reviews right and left. Here he ventilates the internal atmosphere of the architectural school and raises again, but in different form, some of our questions in earlier issues—in particular the one of this last February. Can anyone answer the questions he raises? Here he is:

Can one generalize about the social situation in architectural schools? Do the students, the staff, and the administration of schools nearly always behave towards each other in about the same way? Or is each school unique? These are tricky (to use a euphemism for unpopular) questions. But they are, perhaps, rather important, both to the schools and to the profession. If the social situation in each school is unique, then it can only be altered and improved on the basis of its own merits. Experience gleaned in other institutions would have but little general applicability.

On the other hand, if architectural schools do tend to create typical social situations, the knowledge gained from
comparative studies of all of them could be applied to individual cases. We could, presumably, predict that certain actions, or sequences of actions, would cause joy or trouble. We could also predict, given a troublesome situation, that certain measures would be successful in ameliorating it, while others would not. More fundamentally, intimate knowledge of typical dynamic patterns might lead us to beneficial changes in the educational process.

My own belief is that the schools of reputation actually are, socially speaking, all more or less alike. But this is pure hypothesis. We can not know whether they really do share common social attributes until they have been thoroughly studied. In the meantime, it seems to me that certain situations are typical of architectural schools and these I shall essay to describe.

We know that, at the present moment, schools of reputation limit their enrollment to students of the highest average of previous education who have applied to them for admission. No concerted attempt is made to find out whether applicants have any specific talent for architecture. The curriculum of the school into which these students enter is established, and it is based on custom, the supposed needs of graduate professionals, and on past experience with students thus selected.

The standards of the school and the abilities of the students are fitted together in such a way that there turns out to be a modicum of students really unsuited to the profession, a large number of average students, and a very small number of talented students. The school regards these students as all of the same breed; their variations are not conceived to be of kind, but rather of innate ability. In theory they are to be treated exactly alike, given exactly the same chance at a standardized education which, in its turn, is conceived of as the best. In fact, average and talented students seem to vary in many and significant ways, not only in school, but also throughout their lives.

The average student tends to approach architecture as an important, useful, and

(Continued on page 166)
You are cordially invited to see our exhibit at the 86th Annual Convention of the A.I.A. at the Statler Hotel in Boston June 15-18, Booth No. 39.

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Light from a huge "glass wall" floods into the new engineering building at Howard University, Washington, D.C., shown above. The Kinnear Rolling Door centered in this glass wall can be operated or left open without blocking off a single inch of glass area. The rugged curtain of interlocking steel slats— originated by Kinnear— coils compactly above the opening. All surrounding floor, wall and ceiling space remains clear and usable all the time.

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rewarding craft—to be learned. His attitude toward school can be summed up in a remark often directed at his professors: "Please show me the best thing to do. I am willing and eager to learn, and will do it exactly as you want me to." The attitudes implicit here are unwillingness to think, passive acceptance of authority, and good will. Such students form the great majority. In later life they do the great majority of buildings. This is by no means solely because of their relative numbers. They are characteristically better adjusted socially than their more talented brethren, have less far to go in order to reach maturity, and thus reach it sooner. As architects they make only the most minor "practical" improvements on what they have learned in school. Thus, because they are the ones chiefly responsible for the quality of our manmade environment, what they learn in school is of the most tremendous importance and significance.

The talented student seems to approach architecture as a challenge to his ingenuity and creativity. His attitude towards his professors is more often than not, "Tell me what you think if you must, but don't expect me to believe a word of it." In short, he tends to be quite disagreeable, or as we say nowadays—poorly adjusted socially. The fact that he is "ahead" in school, and that he can keep ahead in less time, thus creating for himself the opportunity to branch out in directions closed to average students, is deceptive. He has farther to go both emotionally and intellectually. His general development after school tends to be slower than that of his average classmate. During his apprenticeship he will wear out more jobs. His first commission will be slower to materialize. His first solid success will not be achieved until he is over forty. His ability to slap the Chamber of Commerce on the back may never catch up with the average architect's. But, even in the beginning, his fame will spread as the average student's never will. And, in the long run, he will make relatively large contributions to the main stream of architecture.
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(Continued from page 166)

The average student would seem to need an education conceived of as a relatively durable set of precepts, reinforced by as many principles as he is able to absorb. The talented student will not accept precepts. Indeed he will systematically destroy and discredit them. He looks upon principles with the greatest of skepticism and distrust. He is happy only in the realm of theory. He needs and is willing to absorb more theory than the average in such areas as electricity, sanitation, acoustics, and design. Particularly he needs theory in architecture itself—the whole complex—a subject which is, today, in a sad state of neglect. And finally, he needs insights into his problems in social adjustment. The fundamental contrast is that talented students tend to need insights into how, with more speed and less destructiveness, they can bring their peculiar gifts to bear upon reality.

In schools of reputation, the staff tends to come from both groups. But while those from the talented group may represent a cross-section of their adjustment, those from the average tend to come from the top of theirs. Thus the average of ability and training for school staffs as a whole, and in general, is very much higher than the average for the profession as a whole. In the light of the average student's need for principles and precepts slightly ahead of his time, in order that they may last him well, this is exceedingly fortunate.

The tendency is for the majority of the staff to identify with the talented students, because they come from the same group, and thus tend to sympathize with their values and to understand their problems in adjustment. The administration of the school on the other hand must, for important administrative, educational, and financial reasons, support the cause of the average. The schools are in every administratively controllable sense geared for the majority, while in those areas where human nature has its way, the minority is favored. Average students nearly always feel that the professors play favorites, are only interested in brilliant

(Continued on page 174)
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out of school

[Continued from page 176]

talented students can force the highest average on the average students. One learns from and tries to please one's professors, for obvious practical reasons. But one competes with, emulates, is stimulated or depressed by one's contemporaries. Interaction in the individual class is the nexus of the school situation. The same sort of interaction, less personally but no less generally competitive, occurs in the school as a whole. Talented students of all ages seek to discover each other. The various classes compete. It is not uncommon to have a particular class recognized as tops, both socially and in terms of standards, from the day it enters. By the same token one often hears some such remark as, "Our class is dull and always has been. We just don't seem to have the stuff the third year has."

To separate talented students from average students would thus be to forfeit the importantly constructive effect that they have on the latter's standards of accomplishment. But these same high standards are not an unmixed blessing. Because the staff tends to set the best available work as the standard, a rat race can develop. This occurs in class hours. When marks are given, the reality of variations in ability forces on the staff a sudden lowering of its sights. They appear to contradict themselves. This saddens the professors, disgusts the talented students, and maddens the average students.

Average students with emotional difficulties, despite the fact that they are graded realistically, can see the competitive situation as hopeless, with devastating results to their morale.

In addition, the talented students (often known as "wild men" to the average) usually tend to take a systematically critical approach to teachers, to the curriculum, and to the way courses are presented. Within the confines of the talented group this barrage of criticism is not fundamentally destructive. It is counterbalanced by the ability, when it comes right down to it, to see the things despised in a much larger perspective, where they may have quite favorable values attached to them. But the average

(Continued on page 178)
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out of school

(Continued from page 176)

students can not place finite criticism in
this perspective. As a result, the talented
students sometimes persuade them that
they are wasting their time and money in
a criminally mediocre institution. A small
group of talented and neurotic students
can destroy the morale of a whole school.
Quite obviously in a situation where
artyness, or pseudoscientism, or a rupture
in the staff has been allowed to go too
far, a wealth of material is available to
them and is ably used to further the
conflagration.

These factors do not entirely explain
the wide and sudden swings in morale and
in standards typical of architectural
schools. In order fully to account for them,
three other typical situations would have
to be explored. The first of these has to
do with the parent institution to which the
school is attached. Its sympathy or scorn
for its architectural school must have a
significant effect on morale. The second
has to do with the degree to which incom­
ing students are oriented, both socially
and professionally, to the school. At the
moment new students are, in most schools
of reputation, more or less abruptly
switched from traditionalism to modern­
isim. The circumstances surrounding this
weaning process would seem to have a
profound effect on the students’ adjust­
ment to the profession. The third has to
do with professionalism in the architec­
tural and other staff. Architects tend to
think of themselves as professionals first
and as teachers second. It is subject which
is of first importance to them, not the
educational process, or the morale of the
school as a whole. No one could quarrel
with this emphasis. On the other hand it
behooves the architect-teachers to broaden
their interests in the educational process,
and in the dynamics of the school situa­
tion. On such scores, almost any architec­
tural school has a lot to learn from almost
any progressive elementary school.

If these hypotheses are anywhere nearly
correct, it would seem that the schools and
the profession have everything to gain
and nothing to lose by a concerted study
of education. The whole subject is fraught

(Continued on page 180)
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out of school

(Continued from page 178)

with questions. How can we develop a method of testing incoming students for architectural talent? How can talented students' problems be ameliorated without undue expense, specialization, and penalties for the average? How can students in general be eased out of traditional myths without losing a sense of professional security? There are, of course, dozens of other such questions now being asked. Is it too soon to start the lengthy task of answering them?

ROBERT WOODS KENNEDY

p/a views

(Continued from page 22)
tial of creative engineering and the logic and behavior of the nondevelopable thin shell. In the spirit of this premise, may I comment on the one point where perhaps over-simplification may lead to misunderstanding. Candela states:

"Whether due to limitations of the human mind, to routine, or to structural mimetism, the outstanding fact remains that we are, almost exclusively, building frames composed of networks limited to three perpendicular planes."

The fact is very true; the primary reason, however, is that architecture of modern times is most often called to provide shelter in terms of multiple overlapped layers rather than to simply make a roof over a cleared patch of ground. As long as man will prefer to move on level surfaces—which nature has furnished him with many a convenient example—the premise to most problems of contemporary architecture and engineering is set by the predominance of the multiple horizontal plane; furthermore, the force of gravity, for which nature is also responsible, strongly suggests the introduction of the vertical support. These are premises that one cannot disregard without arbitrary or eclectic license. Yet, for all the limitations that they may impose, they still do not prevent a successful response to the challenge of architectural and engineering design.

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The success does not necessarily rest with the design of a few corrugated surfaces to cover the penthouse of a multi-story building nor by the introduction of nondevelopable eyebrows as main entrance canopies.

As much as we must wholeheartedly concur with Candela about the need for deliverance from the strait jacket of mathematical conformism and for the development of confidence in intuitive imagination, so we must be aware that—in our time of easy and rapid communication—the forms derived by the engineer’s creativeness risk being translated with facility into clichés or abused in exhibitionism.

EDCARDO CONTINI
Chief Engineer
Victor Gruen Associates
Los Angeles, Calif.

Dear Editor: Anything that is conducive to thinking in other than straight lines or planes is welcome and important. I like Candela’s simple approach, taking the mystery out of doubly-curved structures. Even though the construction field at present may not be equipped to produce them efficiently and economically, the press for new shapes and forms is becoming more and more urgent day by day. When this pressure has been sufficiently built up, the newer construction methods will certainly emerge to afford the necessary relief.

For effect, Felix Candela has emphasized the importance of his subject. It is true that in nature, and the structures built within the animal world, flat surfaces are practically nonexistent, but since we are not equipped to walk on the ceiling, life within a modern community of necessity requires that most living functions be exercised on horizontal planes.

The importance of the principles expounded is therefore limited somewhat by the necessity to provide shelter against the elements. The impression left is that such a shelter can always be most successfully provided by double-curved members. This line of reasoning is of value only when the functions of the structure require relatively large, unobstructed areas. I think it would be well, therefore, to make the architects realize that this construction method offers its best potential in large spans.

(Continued on page 182)
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p/a views

(Continued from page 181)
and under unusual conditions, so that
the impression is not left that "stereo-
structures" have a proper place in any
type of building.
Another point I would like to make
is that very drastic over-all economies
cannot be hoped for, since the total cost
of a roof is not a big item. Inversely,
it is also true that even if doubly-curved
structures, under many circumstances,
may be more expressive than conven-
tional types, they can be obtained at a
small increased percentage cost of the
whole budget. It is therefore possible
to express the functions of the building
by the more correct distribution of ma-
terials involved in "stereo-structures,"
and where the conditions are favorable,
at a substantial cost saving, insofar as
the roof structure itself is concerned.
I can't say that I am too much im-
pressed by Candela's emphasis on
mathematical analysis as a handicap in
developing doubly-curved structures. For
the job of any magnitude, the analysis
part is not too serious, and I don't know
of any case, where the proper form has
been discarded on that account. I also
question his implication that an analysis
is not required, and for that reason
the architects can get back to the
position of "master builders." I don't
believe an architect would feel very
comfortable under a structure whose
dimensions he has picked out of thin air.
It is true that newer methods such as
photo-electric analysis will certainly
become more and more important, but
Man is not as yet equipped with the
instinct of a spider, or an oriole.
I don't believe that the "architect"
will ever regain his position of being
the sole "master builder," but I do
believe that the tendency is to create a
"master builder" through a more inti-
mate teamwork of the various profes-
sions. Anything that can be done,
therefore, to broaden the team's under-
standing of structural principles is all
to the good, and from that standpoint,
Candela's article is interesting and
valuable.
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p/a reviews

books received


The Castles of Great Britain. Sidney Toy. Published in the United States by the British Book Centre, 122 E. 55 St., New York 22, N. Y., 1954. 276 pp., illus., $5.50


technology v. sensitivity

Contemporary Architecture of Japan. Shinji Koike, Shokokusha Publishing Company, Inc., Tokyo, Japan. 119 pp., illus., $7

In many ways, the opening of Japan's door, in 1886, was unfortunate for Japanese architecture, for that event marked the beginning of the end to a design tradition which must be recorded as one of the world's finest. The tide of technical and social advancement was not to be held back, nor should it have been; it is deplorable, however, that Western architects were unable to illustrate these advancements for the Japanese with anything better than the unimaginative eclecticism with which they defaced the Ginza. Nevertheless, the Japanese, who had been tied too long to prescribed materials and forms, welcomed the influx of Western ideas, regardless of their expressions.

There followed a period of experimentation with new forms—a period exemplified by the Machine Pavilion of Peace Exposition (1922), K. Sakurai's Marunouchi Building (1922), M. Yamada's Telecommunication Office (1925), and even by Frank Lloyd Wright's Imperial Hotel (1922), all in Tokyo. This movement was similar to that in America during the latter part of the 19th Century, when Richardson, Sullivan, and others

(Continued on page 188)
The Knoll Planning Unit, design consultants to the architect. New ideas in hotel equipment, furniture and planning have introduced many remarkable low maintenance features for hotel lobbies, lounges and offices.
were seeking to give expression to our rapidly advancing technology. But the rise of extreme nationalism in Japan during the '30s had much the same effect on that architecture as the Columbian Exposition of 1893 had on ours; both halted the progress of architecture.

Following World War II, during which so many of Japan's buildings were destroyed, design activity began again, perhaps too quickly and nervously, for much of what has been built in this postwar period has been grossly Western, to the exclusion of much of the native Japanese sensitivity and good judgement.

Shinji Koike's *Contemporary Architecture of Japan* is a collection of what he believes to be representative of the best postwar work. Several of the architects whose work is shown here have retained the unique Japanese touch, even when working with the plastic and heavy forms of concrete—but this is not the case often enough. It is interesting that some of the buildings most Japanese in feeling have been designed by an American architect, Antonin Raymond—Reader's Digest Tokyo office building, for example.

In residential design, however, there is evidence that the Japanese have not lost their touch, if the houses shown in this book can be taken as a fair representation. The characteristic cleanness of detail, the simplicity of plan and structure, the logical use of materials—all these features of traditional Japanese architecture are still there.

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**reviews**

(Continued from page 184)

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**choice of furniture**


This is not a history of furniture, but a picture book of furniture particularly interesting to the author, shown in photographs and detailed drawings, complete enough to be used in reproduction of the pieces.

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June 1954 100
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Prefabricated Wascolite Skydomes and Wascolite Ventdomes are used in combinations to achieve maximum, efficient daylighting and ventilation in buildings of every type. Skydome-Ventdome patterns reduce exterior wall perimeters, permit functional use of space — thus cut over-all building costs. Lightweight Wascolite Skydomes and Ventdomes require only simple roof construction — are easy to install, leakproof and economical in use.

TYPICAL SKYDOME-VENTDOME INSTALLATIONS

**Schools** — For a classroom 30’x30’x9½’, with 30 occupants, using 15 CFM of air per occupant and 5 air changes per hour for room requirements (and to provide adequate daylighting of approximately 30 ft. candles) — use 1 Wascolite Ventdome (Catalog No. HV3652) with 1 air exhaust (total 900 CFM) and 2 Wascolite Skydomes (Catalog No. R3652).

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**Homes** — For a bathroom 5’x6’x8’, to provide 12 air changes per hour — use 1 Wascolite Ventdome (Catalog No. LV2020) with 1 air exhaust.

**FREE WASCOLITE ENGINEERING SERVICE** — Send floor plan and elevation of your project with lighting and ventilation requirements. Wasco Engineers will make recommendations without obligation.


See Sweet's Catalog or write WASCO FLASHING COMPANY, 90 Fawcett Street, Cambridge 38, Mass.
Sanymetal "Porcena" (Vitreous Porcelain on Steel) is a material, not merely a finish. It is in every aspect unlike paint enamel or lacquer finished steel because it is fused to steel at a temperature of 1350°-1550°F. This impregnates the steel with vitreous porcelain enamel to the extent that it cannot be hammered out. Sanymetal "Porcena" (Vitreous Porcelain on Steel) is incomparable with any other material commonly used for toilet compartments. It is a lifetime material that stays new two ways: (1) in appearance; (2) in structure! This newness is the result of a correct combination of the desirable qualities of the hardness of glass and the natural structural strength of steel. Sanymetal was first to utilize vitreous porcelain on steel for toilet compartments. Ask the Sanymetal Representative to demonstrate the unusual and exclusive features of Sanymetal Vitreous Porcelain on Steel Toilet Compartments.

Refer to Sanymetal Catalog No. 91 for complete range of types of compartments and colors.

THE SANYMETAL PRODUCTS CO., INC.
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GLIDE offers more economies in the initial building cost...

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Architects who specify "GLIDE" recognize that GLIDE gives them maximum flexibility of plan and design. The architect and builder have both come to know that there are no finer windows made than GLIDE...in cost, performance and beauty.

GLIDE aluminum sliding windows are engineered with precision and are made of the finest extruded aluminum alloy with stainless steel weatherstripping and rollers for better performance and endurance.

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Without any exaggeration, this specification manual will mark a milestone in building design and construction. It is, we believe, the first complete handbook ever compiled on lightweight insulating concrete roof deck construction.

In the 300 pages of this volume (which was three years in preparation), architects and structural engineers will find complete, accurate data on lightweight, insulating, fireproof concrete for roof decks and roof fill. Every type of construction is covered, with necessary factors worked out in full tables, and all data is triple-indexed for instant reference. For example, there are whole pages of tables showing the thermal conductivity of Permalite insulating concrete in every slab thickness for each type of roof construction, with six different types of suspended ceiling. We have made every effort to make certain that all technical data in this working handbook has been tested and checked by competent authority. And this manual will never go out of date, because it is loose-leaf to permit the insertion of new material.

The Permalite Roof Deck Manual will be available through Permalite franchisees: for the name and address of the one serving your area, write:
If you've ever been bound by a budget limited to ordinary tile nailed or screwed to wood furring, this is important news for you. It's the “Ful-Spline” System for Fiberglas tile—the installation method that makes Fiberglas Acoustical Tile your lowest cost non-combustible ceiling!

FIBERGLAS BEAUTY ON LIMITED BUDGETS

By slashing installation costs as much as 53%, the “Ful-Spline” System for Fiberglas tile brings the finished cost of beautifully textured Fiberglas ceilings down to the ordinary tile level and, in many cases, even lower! It allows you, even with the most limited budget, to specify ceilings of Fiberglas Acoustical Tile—rated “incombustible” under Federal Specification SS-A-118a, dimensionally stable as a window pane (will not sag, warp, or buckle), acoustically equal or superior to fiberboard tile...and the perfect complement to fine design.

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With Fiberglas tile applied by the “Ful-Spline” System, no building paper is required, no nails, no screws. Instead, aluminum splines are inserted in the kerfed edges of 3/4", 24" x 24" Fiberglas TXW Tile. The splines are then stapled to the wood furring strips. Staples are not driven into the tile, so the finished job reveals no fasteners or supports. Application is fast and foolproof, even in hard furring such as long leaf yellow pine. Of course, 12 x 12 or 12 x 24 tile may be used, but the 24 x 24 size is preferred. First, because it increases the economy of the system by reducing application cost. Second, it overcomes slight irregularities in level of furring strips. And third, it has better scale in classrooms, corridors and other large areas.

FACTS FOR YOUR FILE

Learn more about Fiberglas tile applied by the economical “Ful-Spline” System. We will be glad to supply you with further information on this revolutionary new installation method. Simply contact your nearest Fiberglas Branch Office, or write: Owens-Corning Fiberglas Corporation, Sound Control Products Division, Toledo 1, Ohio.
NEW FIBERGLAS* INSTALLATION METHOD

gives non-combustible acoustical ceilings
at the low cost of ordinary tile
nailed or screwed to wood furring

1 Aluminum spline is inserted in kerfed edge of Fiberglas Acoustical Tile, 24" x 24" x 3/4".

3 Supporting splines (A) are parallel to furring, and continue through tile joints. Fiber cross splines (B) are used for leveling. They are not stapled, making installation still more economic.

2 Modified hand or air tacker with special attachment holds spline away from furring strip, drives 9/16" staples flush with face of spline, and into furring strip. Staples do not pierce tile!

SOUND CONTROL PRODUCTS
FIBERGLAS TEXTURED, PERFORATED, SONOFACED* & STRIA ACOUSTICAL TILE, FIBERGLAS TEXTURED & SONOFACED CEILING BOARD, FIBERGLAS SONOCOR* PADS FOR METAL PANS, FIBERGLAS NOISE-STOP BARRIERS,

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Here at low cost is filtered, natural daylight from overhead

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Toplighting is the easiest way to bring daylight into low, one-story buildings where lighting of the inner areas is a problem. And of all the toplighting methods, Skytrol blocks stand alone in their ability to give the highest quality daylighting, good insulation value and a trouble-free, low maintenance installation.

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Consult our section under “Skylights” in Sweet’s, or write for more information. Pittsburgh Corning Corporation, Dept. AC-64, One Gateway Center, Pittsburgh 22, Pa.
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Administrative offices, conference and dining rooms, library and cold room areas, one for temperatures down to 34° F. and others down to 0° F. —are all maintained at whatever constant temperature and humidity is required.

Experience gained by Powers here and in many other important small and large buildings will be helpful to you. Why not contact Powers nearest office the next time a temperature and humidity control problem arises? There's no obligation.

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Over 60 years of automatic temperature control
Architectural Concrete
is ideal for churches of any design

These photos illustrate the versatility of architectural concrete for churches. No other material offers architects more freedom to translate the wishes of building committees into structures that please congregations aesthetically and economically. It combines distinctive beauty, rugged strength and proved economy.

Beauty can be imparted by forming materials, by a finish treatment or by ornamentation. Ornamentation is economical because it can be cast integrally with structural elements.

Architectural concrete is exceptionally durable because it can be designed to resist weathering in any part of the country. And it can't burn or be damaged by rats, rot or termites.

With its moderate first cost, low maintenance cost and long life architectural concrete serves at low annual cost.

For more information about designing churches and other structures in architectural concrete, write for free, illustrated literature. It is distributed only in the United States and Canada.
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The second colorful Briggs Beautyware bathroom can sell your homes first!

You really get a prospect’s attention when you start talking two bathrooms of glamorous Briggs Beautyware in color! Many a builder is using that fact to beat his competitors to the punch.

Folks love the fresh, modern look of these handsome fixtures. Four popular pastel tones—Coral, Sky Blue, Sea Green and Sandstone... blend harmoniously with an endless variety of color schemes. What’s more, all Briggs Beautyware is acid-resistant. Colors won’t fade. Users can depend on Briggs fixtures to keep right on looking brand new for years.

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Any electrician recognizes Youngstown rigid steel conduit the moment he starts to bend it. He'll tell you that Buckeye is easier and faster to bend than any other kind. This means you save hours of labor with Youngstown Buckeye Conduit.

WHY YOUNGSTOWN BUCKEYE CONDUIT IS BETTER

Youngstown is the one manufacturer who makes rigid steel conduit from ore to finished product. This enables Youngstown to control the complete manufacturing process—your insurance that each length of "Buckeye" is made of top-grade steel.
CEILING MOUNTED Type BF Cabinet, connected to duct with inlet at floor level, replaced a bulky, unattractive cast iron radiator that formerly was located below show window.

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SEE YOUR HEATING JOB HERE?
Then Modine Cabinet Units are your low-cost answer!

Yes, for the steam and hot water heating applications pictured above—and hundreds of others—versatile Modine Cabinet Units provide economical comfort. Quiet blower fans assure positive yet gentle circulation of heated air. Some models have provision for cooling with chilled water.

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Please send me immediately a free copy of Bulletin describing Modine Cabinet Units.

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Firm ..................................................
Address ............................................
City .............................................. Zn ........ State .............

June 1964 203
Window Versatility in Contemporary Architecture

Gate City Wood Awning Windows are outstanding in the trend toward simplicity and functional beauty. Versatile, they can be used in almost limitless combinations. Their smart design and clean horizontal lines give any dwelling a distinct, modern appearance. And they provide the home-owner with advantages for year 'round comfort.

During warm weather, the full-vent area of Gate City windows permits complete ventilation control... invites fresh air from three directions. And the patented "Fixed Hinge" affords maximum rain protection. On colder days, the tight wood sash and complete weatherstripping keep all the warm air in... the cold weather out!

Perma-Treated for long life... designed for economical installation and maintenance, the Gate City Wood Awning Window is steadily gaining favor with home builders everywhere. Complete information will be promptly furnished upon request.

See our Catalogue in Sweet's.

GATE CITY SASH & DOOR CO., Dept. PR-36
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Gentlemen: Please send complete information on Gate City Wood Awning Windows.

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"Window Craftsmen for over 40 years"
The great and growing popularity of Waylite Masonry structures is due to the combination of its several desirable qualities.

It is masonry. With all of masonry's desirable qualities . . . substantial . . . time- and fire-resistant . . . architecturally accepted throughout man's entire history.

But at this point the masonry characteristics of Waylite diverge. In Waylite Masonry, walls have a high thermal insulative quality that gives equitable room climate. The exposed surface of the units eliminates need for acoustical treatment. Decorative effect is easily achieved with varying sizes of units, laid in patterns; joint treatments; texture; colors. (See 24 pp. in Sweet's)

The low cost of Waylite Masonry comes in part from exclusive features of the raw aggregate material and large volume processing economies; and also in part from modern high-speed machinery and methods in the products plant.

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It's versatile...fireproof...beautiful!
It's Gold Bond Corrugated Asbestone!

Gold Bond Corrugated is made of asbestos and cement, making it an especially valuable material in industrial construction. It's strong, fireproof and resistant to corrosive alkalies and acids.

And the corrugations make possible a wide variety of smart, distinctive designs...inside and out...for industrial, commercial and residential buildings.

Specify Gold Bond Corrugated Asbestone "Standard 400" for application over steel framework. The lighter weight "Economy 250" goes over regular wood frame construction. Both materials are of the high quality of all Gold Bond Building products.

Write Asbestos Architect Service Department, National Gypsum Company, Buffalo 2, New York for complete information.

<table>
<thead>
<tr>
<th>Weights and sizes:</th>
<th>ECONOMY 250</th>
<th>STANDARD 400</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Width</strong></td>
<td>42&quot;</td>
<td>42&quot;</td>
</tr>
<tr>
<td><strong>Lengths</strong></td>
<td>3' to 10' (in 1' increments)</td>
<td>1' to 12' (in 6' increments)</td>
</tr>
<tr>
<td><strong>Thickness</strong></td>
<td>1/4&quot; approx.</td>
<td>Approx. 1/3&quot; at the crests and valleys, 1/3&quot; at flanks.</td>
</tr>
<tr>
<td><strong>Pitch</strong></td>
<td>4.2&quot;</td>
<td>4.2&quot;</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 2.25 lbs. per sq. ft.</td>
<td>4 lbs. per sq. ft.</td>
</tr>
<tr>
<td><strong>Color</strong></td>
<td>Natural Cement Gray</td>
<td>Natural Cement Gray</td>
</tr>
<tr>
<td><strong>Depth of Corrugation</strong></td>
<td>1 1/2&quot;</td>
<td>1 1/2&quot;</td>
</tr>
</tbody>
</table>

Engineering Services. Send us your plans. We'll make a quantity take-off and send a material estimate for the job. When order is placed, we'll furnish erection diagrams for your approval. Personal services of our sales engineers also available.

Erection Services. If you wish to have Gold Bond Corrugated Asbestone applied, we'll gladly send you names of Approved Asbestone Erectors in your area. These firms are highly skilled in all types of Asbestone applications.

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Gold Bond Corrugated sheets make simple, strong partitions. They can be painted for decorative effects.

More than just a "plain old fence." And there's no maintenance problem on this Gold Bond Corrugated fence!
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No matter what the requirement...you'll have a client-satisfying answer to any along-the-wall radiation job with attractive Dunham Fin-Vector®.

That's because I-B-R rated Fin-Vector offers such a wide choice of sizes, capacities and styles. For example, Sloping Top, Flat Top and Expanded Metal Covers—one, two or three tiers high; heating elements supported either by simple wall brackets, adjustable hook and link hangers, or ball-bearing roller brackets; two heating fin and tube sizes; an unusually complete line of accessories that conceal all traces of piping.

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June 1954 207
Selected for maximum wear with minimum care

Johns-Manville
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R.D.C. all-stainless
steel passenger cars

Heavy traffic in this Budd Company R.D.C. diesel-powered passenger car has little effect on the durable J-M Terraflex floor. A damp-mopping whenever necessary, will restore it to its first-day color beauty.

J-M Terraflex® needs less care and gives more wear than any other type of resilient floor of equal thickness ... pays for itself through years of low-cost maintenance

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J-M Terraflex is a flooring of time-proved superiority. Made of vinyl and asbestos it is exceptionally tough and resistant to traffic ... defies grease, oil, strong soaps and mild acids.

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Fenestra has developed a method to increase the "lateral diaphragm" action of a building. Fenestra* Cellular Steel Floor Panels in combination with a correct welding pattern provide shear resistance to seismic forces of earthquakes and to excessive wind loads and bomb shock.

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Detroit 11, Michigan

Please send immediately
the 1954 Fenestra Building Panels Catalog.

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(Lefl) Motor-Operated Valves provide control of steam, hot water, or chilled water.

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Barber-Colman Control Motors provide proportioning operation of dampers on multiple-zone blow-through heating and cooling units. Actuated by proportioning Room Microtherms. Heavy-duty, oil-submerged mechanism—lasts for decades.

**LITERATURE KIT!** Based upon research and experience with multiple-zone air conditioning systems, Barber-Colman has assembled a kit of literature visualizing several control systems possible with automatic electric controls. Shows how flexible, high-quality, electrical controls . . . with the guidance of nearby Barber-Colman application engineers in laying out systems . . . can provide the ultimate in year 'round comfort. Write for your copy!

**BARBER-COLMAN COMPANY, ROCKFORD, ILLINOIS, U. S. A.**

Barber-Colman Control Motors provide proportioning operation of dampers on multiple-zone blow-through heating and cooling units. Actuated by proportioning Room Microtherms. Heavy-duty, oil-submerged mechanism—lasts for decades.
You can often make your plans more acceptable to your clients by including a detailed color program.

- **Almost everyone** who owns or operates an industrial, commercial or service enterprise recognizes the importance of the influence of color upon people. That's why such a detailed program of color recommendations often can be very helpful.

- **Why not let us submit engineered color recommendations to go with your plans?** These recommendations are based upon the principles of Pittsburgh's system of COLOR DYNAMICS. This method of painting has successfully demonstrated its ability to improve productive efficiency, morale and well-being in many fields.

- **We'll be glad** to make such a detailed study for you without cost or obligation. Simply call your nearest Pittsburgh Plate Glass Company branch and arrange to have one of our color consultants see you at your convenience. Or mail coupon at right.

For Additional information on COLOR DYNAMICS see Sweet's Architectural File, Section 14/PI.

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PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

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Over an inch of Insulating Efficiency
plus a positive vapor barrier—all in the
\(\frac{7}{8}\) inch space of a furred out Masonry Wall!

**ALFOL TYPE 1A**
BUILDING BLANKET
INSULATION

THERE'S AN ALFOL TYPE EQUALLY
EFFICIENT FOR EVERY INSULATION NEED

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Four reflective air
spaces for the utmost
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ished ceilings.

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spaces—designed to
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Two reflective air
spaces—in mild cli-
mates at lowest cost
and top efficiency.

Alfol Type 1A Insulation is specially made for standard masonry construction. It is the only insulation that provides over an inch of insulation value plus a positive, continuous vapor barrier in the usual \(\frac{7}{8}\)" clearance available in 1" x 2" furred masonry walls. Refurring expense is eliminated!

Type 1A has proved effective in hundreds of installations in every section of the country. When applied the pure aluminum foil automatically “pops out” to form two reflective air spaces equal in thermal value to more than an inch of insulation. The heavy vaporproof duplex and kraft backing by which Alfol is applied across the face of the furring assures a positive, continuous vapor barrier.

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*June 1954* 213
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June 1954 235
A postscript to this issue might take several forms: it is the month of the AIA Convention in Boston; the issue itself is on an important subject, which could be expanded indefinitely; it is the midpoint of the year, and the midpoint of our year's theme—the influences which produce today's architecture. Fortunately, they can all be tied together, because, much to P/A's gratification, the Convention theme that has been chosen is the same as ours for the whole year.

We announced, last October, the subject matter of each issue for 1954—a series of issues showing how architecture of these changing times is produced by the effects of certain social, economic, and technical factors. We've covered some of them: the effect on architecture of—changing living habits (February) more leisure time (March) changing educational goals (April) obsolescence of buildings (May) ... and now, in June, the influence of advancing structural concepts. Still to come are documentations of the effect of improving health care, greater cultural values, greater mobility, improved materials, expanding commerce and industry, and greater understanding of environmental control.

It becomes more and more obvious that architecture and engineering are not abstract arts—that they are related to and produced by the social, economic, and technological climate in which they operate. Even the few ivory-tower designers who still operate are affected willy-nilly—abstracts in architecture today, fascinating as works of art, are abstracts with modern materials. And almost all the architectural and engineering practices, even those of the more dilettantish type, are possible only because of commercial, industrial, cultural, or institutional developments. The design of buildings is a very objective operation.

We are greatly indebted to Mexican Architect Felix Candela for his article in this issue. It came to hand just as we were trying together various projects that seemed to make important points; and, controversial as it is, it seemed to us the most readable and thought-provoking piece on the subject yet to be published. Note, on the views pages, that some of our engineer friends are already disagreeing in part with his analysis—while admiring his work. When the manuscript arrived, its covering letter intrigued me with a statement of the problem of engineer-architect collaboration. I would like to quote it in part. After saying that the architectural profession was obviously interested in the development of new forms (particularly shell structures), and that the architectural press showed many examples, Candela's letter goes on: "... many of these designs are either excessively conventional, following the already known models, or utterly impractical for lack of knowledge of the simple principles involved in the preliminary steps."

"The second design phase, not shown in pictures, consists of a tremendous battle between the structural engineer and the architect—the former willing to introduce modifications which, although sometimes justified, many other times should be unnecessary (sic)." On the other hand, the architect wants to maintain his preconceived idea, but has no weapons to fight against the scientific arguments of the technician. The dialogue is impossible between people who speak different languages. The result of the struggle is always the same: science prevails and the final design has generally lost the eventual charm and fitness of detail dreamed by the architect.

"This was the case, for instance, with the Raleigh pavilion genially designed in its original stages by the late Novicki, and actually built, but artistically destroyed by other people with the help of perhaps too conservative official regulations."

Candela feels, as does anyone concerned with this problem, that the architect must become more familiar with basic structural considerations, and that "radical and very improbable changes in the curriculum of the architectural schools" are required. With his final conclusion: that "the architect should design his own structures as was usual in other, more integrated epochs," not all will agree.

Certainly, integration and correlation on both the educational and professional levels make a necessary first step which has been fully achieved in very few instances. Even concerted efforts on non-design activities seem difficult to attain—despite some "joint committee" activities. Recently I spoke at the annual meeting of the Cleveland Engineering Society, and chose as my theme the fact that too many nonprofessionals were edging into the design of buildings, from the level of the interior decorator to that of the real-estate entrepreneur. I recommended as a preventive measure a great co-ordinated public relations activity, involving all the truly professional design professions, to educate the public in the difference between what a trained professional can offer and what an amateur meddling in design and construction can cook up. I sensed that this seemed an almost inconceivable objective to both architects and engineers who are more used to being at sword's point or, as Candela says, of "speaking different languages."

Candela speaks the language of Spain, but he writes well in English. Some editing was necessary in his article, but Burt Holmes and I found many of his precise uses of English words refreshingly correct. He also speaks in the language of architecture, but can express himself well in engineering terms. Perhaps engineers will find that his "engineering language" also needs some editing, but I suspect that, as in his use of English, his may be, more often than not, a correct, if unusual usus loquendi.

Come to think of it, our Latin-American friends seem rather to dominate this issue, despite the inclusion of Mies, Saarinen, Noyes, Colley, et al. I can't avoid a sentimental postscript on the Tropicana night club, in which I have spent a number of memorable evenings—beginning with the Pan American Architectural Conference some years ago, when none of the exciting new structure shown in this issue had been even conceived. Another time was during construction, when I pulled the power of the press for once, and got a ringside table on New Year's eve by deciding on the spot that this was a structure we wanted to publish. It's a beautiful place; even the fine, glamorous pictures in this issue don't do it justice. Notice all the U.S. building products that went into it. Max Borges, Jr., came to the States for architectural work at Harvard. Most of the patrons (except on New Year's eve!) are U.S. tourists, I suppose. But it seems to require an atmosphere such as Cuba has, for such a structure to become a reality.

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