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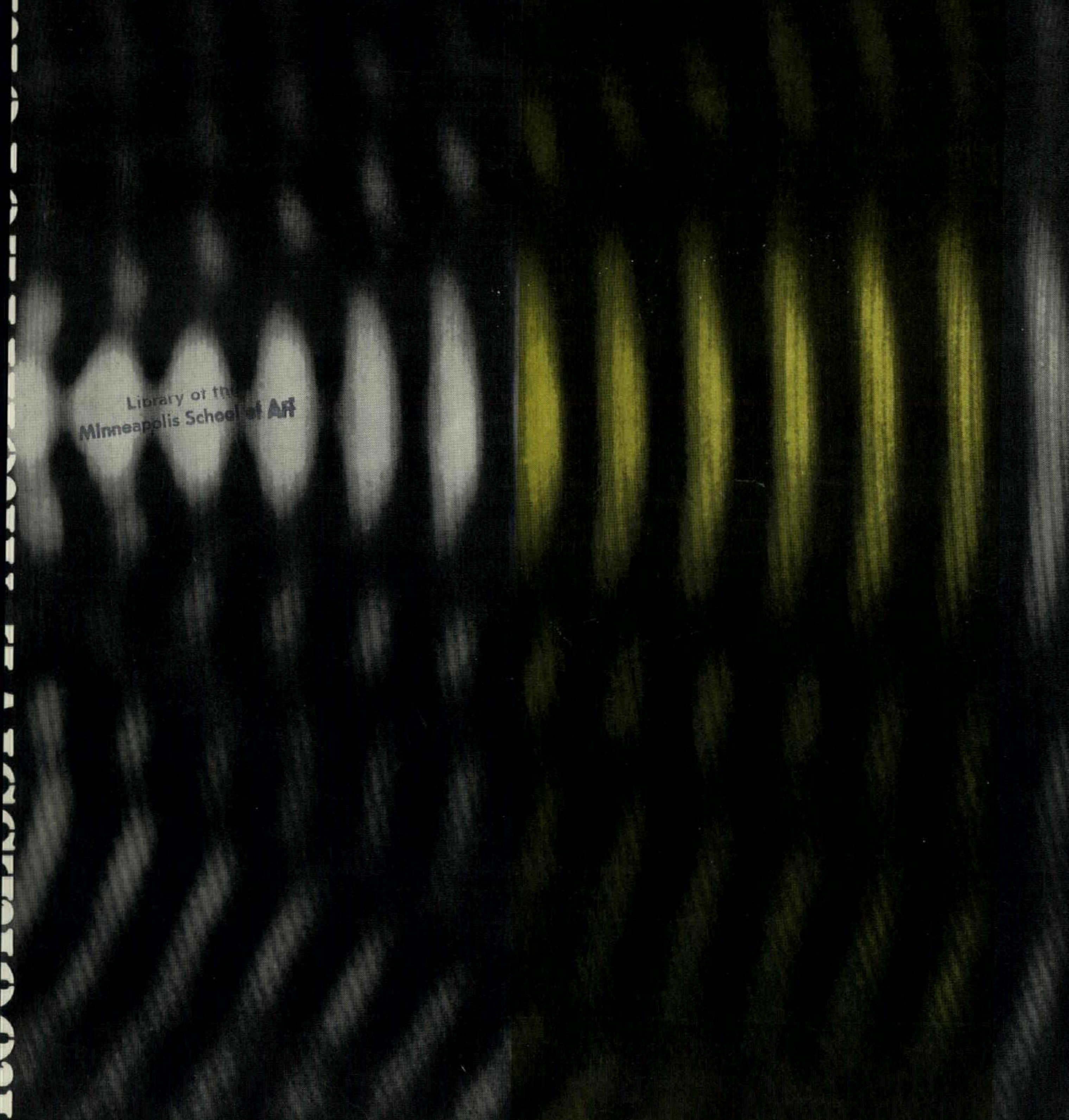

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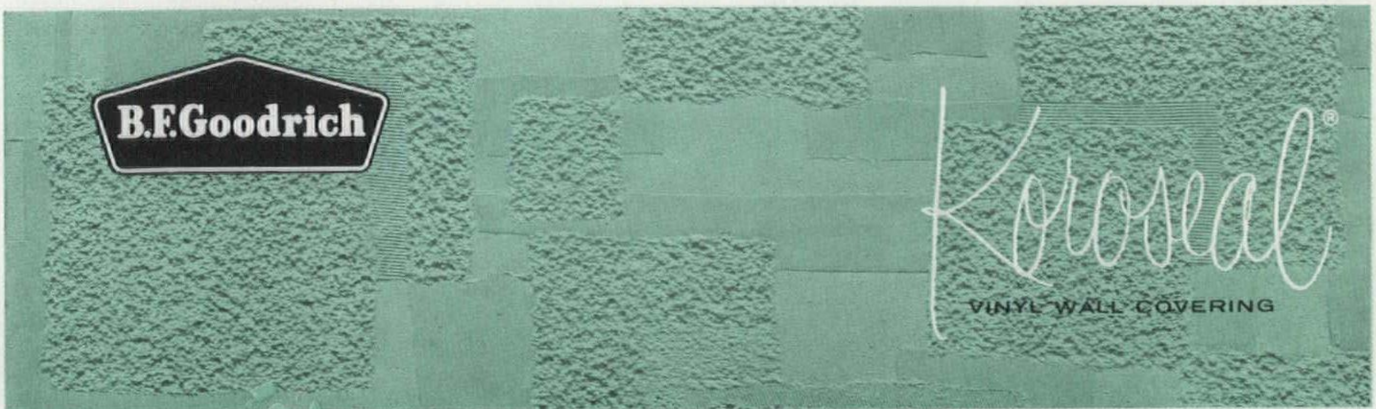

Spatio pattern actual size (Pine Frost color).

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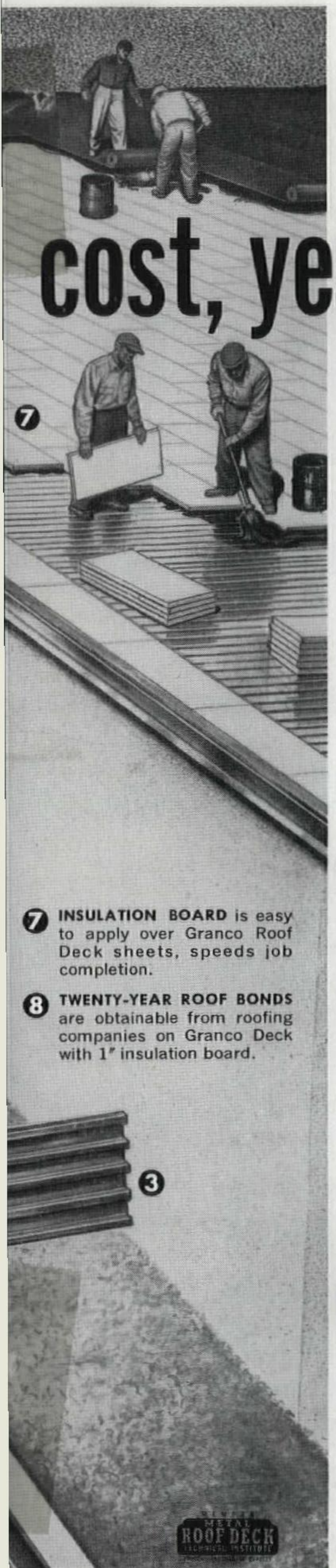

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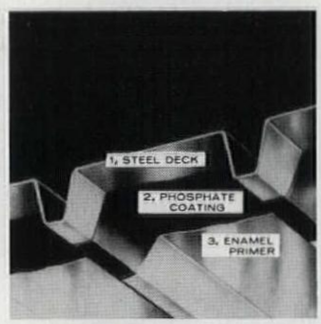
7 **INSULATION BOARD** is easy to apply over Granco Roof Deck sheets, speeds job completion.

8 **TWENTY-YEAR ROOF BONDS** are obtainable from roofing companies on Granco Deck with 1" insulation board.



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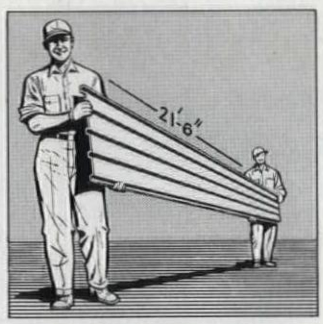

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PROGRESSIVE ARCHITECTURE

May 1959

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Volume XL, No. 5

Here is a cast aluminum facia for one-story buildings that adds a decorative frieze to close in the area between roof and window. Michael's **cast patterned units are a natural** for this intimate type of building which is seen from a close viewpoint. Construction advantages include a cast slot for a weathertite interlocking gravel stop. The same castings **form a wall where screening is needed.** And, the low cost of patterns, availability of polished or colored surfaces permit individual designing. **Let Michaels show you** how new developments in cast wall products may benefit your building. For additional information, complete construction details and technical data request CWA·5-P.

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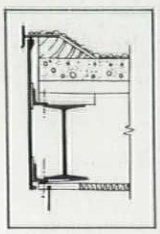
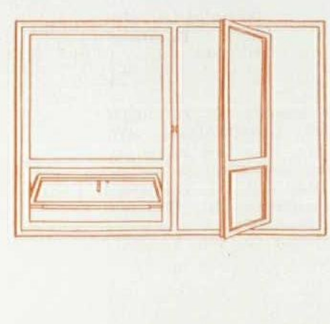


Architects: Design assistance for metal walls now available.



Rigidly pre-tested, this aluminum pivoted window was designed for monumental construction. Write today for complete construction details of VPA-1, see Sweet's Architectural File, 3a/Mic.

The Broadening General-Welfare Doctrine

It's The Law Column by Bernard Tomson

P/A Practice of Architecture *article reports on two recent decisions reached by high courts which are indicative of a continuing trend whereby individual property rights are subordinated to the broadening general-welfare doctrine.*

In a recent decision in the highest court in New York, (*Cities Service Oil Co.* vs. *City of New York*, 5, N.Y. 2d 110), the court considered a regulation adopted by the City of New York, placing bus stops at points where they interfered with access to a gasoline station. The owner of the station instituted suit to obtain an injuction against the City, contending that his rights had been unlawfully invaded, and that he was being deprived of his property without due process of law.

The plaintiffs' gasoline station was located at a busy intersection. City-owned buses stopped to discharge and take on passengers directly in front of the plaintiffs' premises, in an area designated by administrative regulation as a bus stop. Although there were very few passengers embarking and alighting at the bus stop during the morning rush hour, the interference with ingress and egress to the plaintiffs' business was greatest at that time, because of the short headway between the buses, and the short cycle of the traffic light at the intersection. These two factors often resulted in at least two buses standing in front of the plaintiffs' premises, at the same time, for short periods.

The City of New York contended that the location of the bus stop had been designated after taking into consideration the movement of traffic, public safety, and the community interest and concern with safe and unimpeded travel.

The Court of Appeals affirmed the decision of the lower courts which had refused an injunction to the plaintiffs, saying:

"It is the plaintiffs' contention that their right of ingress and egress is a 'paramount' property right and that the maintenance of the bus stops constitutes an unreasonable interference with that right. On the contrary, it is the right of the use of the streets which is 'absolute and paramount'. . . . The establishment of bus stops is indisputably performed in the proper exercise of governmental powers and may neither be regarded as a 'taking' nor serve as a predicate for a cause of action. Any loss resulting from the interference with an abutting owner's enjoyment of his property is *damnum absque injuria* and the owner must bear it. Traffic regulations, promulgated as they are to promote the safety and welfare of the traveling public, may not infrequently entail hardships and difficulties for some individual property owners. But that will furnish no ground for invalidating the regulation, for we deem it fundamental that, in this area of governmental action, what is best for the body politic in the long run must prevail over the interests of particular parties. . . . The interference here complained of must be shouldered by the plaintiffs as one of the inconveniences to be borne of the community and the public in general."

The language of the Court of Appeals above quoted, is reminiscent of the United States Supreme Court's discussion in 1955 in *Berman* vs. *Parker* (discussed in this column in July and August 1955 P/A). In the *Berman* case, the owner of a department store located in an area which was being redeveloped and cleared of slums, objected to the taking of his property by the government on the ground that his commercial building was in good condition and not contributing to slum conditions. The Supreme Court ruled that property might be condemned for redevelopment purposes even though standing by itself, it was innocuous and unoffending. The Court said:

". . . Miserable and disreputable housing conditions may do more than spread disease and crime and immorality. They may also suffocate the spirit by reducing the people who live there to the status of cattle. They may indeed make living an almost insufferable burden. They may also be an ugly sore, a blight on the community which robs it of charm, which makes it a place from which men turn. The misery of housing may despoil a community as an open sewer may ruin a river.

"We do not sit to determine whether a particular housing project is or is not desirable. The concept of the public welfare is broad and inclusive. . . . The values it represents are spiritual as well as physical, aesthetic as well as monetary. It is within the power of the legislature to determine that the community should be beautiful as well as healthy, spacious as well as clean, well-balanced as well as carefully patrolled. In the present case, the Congress and its authorized agencies have made determinations that take into account a wide variety of values. It is not for us to reappraise them. If those who govern the District of Columbia decide that the Nation's capital should be beautiful as well as sanitary, there is nothing in the Fifth Amendment that stands in the way."

Traditionally, the courts refused to allow esthetic reasons to provide the base for zoning regulation. However, the United States Supreme Court in the *Berman* case, by recognizing esthetic considerations as an integral part of the "public welfare" significantly broadened that concept. This decision, and the determination of the New York Court of Appeals in the *Cities Service* case discussed above, are indicative of a continuing trend whereby individual property rights are subordinated to the broadening general-welfare doctrine. The architect's role in planning for the public welfare should accordingly increase.

another case history of

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Cites Advantages of New Products Survey

Specifications Clinic by Harold J. Rosen

P/A Practice of Architecture ***article describes new annual*** **Building Products Register,** ***sponsored by AIA, which will be available shortly.***

A new service of interest to architects and specifications writers will be soon available. This service will consist of a *Building-Products Register* to be compiled annually by American Institute of Architects. The building-products survey will contain a listing of building products and equipment by type, with properties tabulated to allow direct analysis for preselection.

The need for such a reference guide should be self-evident. There is at present no manual or guide which lists the thousands of materials used in the building industry in a manner which permits preselectivity based on certain requirements. It is necessary for the specifications writer to cull the information required from each of the various manufacturers' catalogs and compare their important details to determine which products are to be used and which may be cited in the specifications as being equal.

American Institute of Architects, after six years of study by various committees, has determined that an AIA Building-Products Registry Service appears to be a logical solution to this problem. The Institute has found that architects need a reference guide to building products and equipment, updated annually. Architects and specifications writers need reliable records of product performance and descriptions of installation conditions. Manufacturers' products literature and the catalog services make valuable contributions in this area, but are inadequate because of lack of uniformity in printed presentation, lack of uniformity in technical standards cited, and because of other reasons. Product salesmen are helpful; however, they cannot always supply required data without reference to others in their organizations, and product salesmen are not always available when the information is required.

The Institute first solicited members' help in the creation of this register. The need for such a service was so apparent to architects that the response for pledges (at $25 each) was very satisfactory. The Institute is now seeking the support of manufacturers.

The Institute lists the following as advantages, to producers, of the publication of a *Building-Products Register:*

1 Factual listing of product data to which architects will constantly refer.
2 A printed "salesman" to remind architects of product characteristics, at the time specification selections are made.
3 Reports on product installations from AIA's national clearing house for architects.
4 Information about the need for new products.
5 Information about new uses for existing products.
6 Assistance in development of product literature, better product use, and "limitations of use" statements.

Architects will receive the following benefits, according to the Institute:

1 The *Register* itself, with its time-saving, helpful compilation of technical data by type of product.
2 Reporting Service on completed installations. Exchange of practical experience and information about behavior. Separately published general reports designed to improve product use and installation by the architect. These general reports will be published as official AIA documents.
3 Field Inspection Service. Experienced building technicians will visit architects' offices to collect installation information.
4 Reporting Service of new products and uses presented prior to next publication in the *Register*. All available performance and descriptive data to allow basis for evaluating use of new product; summaries of available performance tests will be included.

The *Register* will eventually contain about 600 pages with approximately 25 listings per page of products of similar use. Each manufacturer registering his products will provide specific information to permit direct comparison by properties and technical specifications. The data will be determined by AIA for its value as criteria for the architect's selection. To assure proper technical presentation, a Panel of some 300 architects will assist the technical staff and AIA committee. This group will review criteria with manufacturers on all existing and new product types.

The following example is cited by the Institute to indicate the manner in which the *Register* is used:

"Assume a project to be built of brick-veneer on wood frame. The project is to be on an exposed site in a temperate zone with above-average annual rainfall and winter winds. Assume further that rigid fibrous sheathing is less costly and more readily available than wood and felt in the local markets. As the architect runs down the listings of sheathing in the register, the first criteria will be such structural qualities as thickness, edge, and fiber strength. Asphalt impregnation rather than a coating might be preferred because of nonmodular cutting. And again for structural reasons as well as labor costs, the small horizontally applied 2'x8' board, ¾" thick with T-and-G or V-joint, might be selected. By comparison of the products of 13 producers under "T-7, Sheathing," the field is narrowed quickly to the products of four manufacturers. This group can be further narrowed if certain tests or features are taken into account. Having preselected these four, the architect turns to Sweet's or other product literature for installation details, specifications, and some statement of possible limits of use. Availability of the latter is indicated in the *Register* tabulation. Time has been saved in initial selection and pinpointing of important details. By means of the listing, the manufacturer's product is presented to the architect at the precise time when he wants to be told about it. Later, should a claim of equality for another product come from a contractor or manufacturer's representative, it is an easy matter for the architect to check."

To obtain additional information on this new service write: Theodore W. Dominick, AIA, Building Information Service, The American Institute of Architects, 1735 New York Ave., N.W. Washington 6, D.C.

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1/4			16-25
3/8	14-22		16-25
1/2	14-22		14-25
5/8	13-22		14-25
3/4	13-22	13-16	12-25
7/8	13-22	13-16	12-25
1	11-22	11-16	11-25
1 1/8	11-22	11-16	11-25
1 1/4	11-22	11-16	11-25
1 3/8	11-22	11-16	10-23
1 1/2	11-20	10-16	10-23
1 5/8	11-20	8-16	10-23
1 3/4	11-20	8-16	10-23
1 7/8	11-20	7-16	10-23
2	11-20	6-16	9-23
2 1/8	11-20	6-16	9-22
2 1/4	11-20	5-16	9-22
2 3/8	11-18	5-16	8-22
2 1/2	11-18	4-16	8-22
2 5/8	11-18	4-16	8-21
2 3/4	11-18	4-16	8-21
2 7/8	11-18	4-16	8-20
3	11-18	4-16	8-20
3 1/8	11-18	3-16	8-20
3 1/4	11-18	3-16	8-20
3 3/8	11-18	3-16	8-20
3 1/2	11-18	3-16	8-20
3 5/8	11-18	3-16	8-20
3 3/4	11-18	3-16	8-20
3 7/8	11-18	3-16	8-20
4	11-18	3-16	8-20
4 1/8	11-16	3-16	8-18
4 1/4	11-16	3-16	8-16
4 3/8	11-16	3-16	8-16
4 1/2	11-16	3-16	8-20
4 5/8	11-16	3-16	8-18
4 3/4	11-16	3-16	8-18
4 7/8	11-16	3-16	8-18
5	11-16	3-16	8-18
5 1/2	11-16	3-16	—
6	11-16	3-16	9-20

*Intermediate sizes, also larger and smaller sizes and heavier walls are available. Square, rectangular and other tubing shapes are also available in peripheries from 1" to 20" inc.

CARBON GRADES

Grade Designation	Carbon %	Manganese %	Phosphorus % Max.	Sulphur % Max.
MT 1010	0.05/0.15	0.30/0.60	0.040	0.050
MT 1015	0.10/0.20	0.30/0.60	0.040	0.050
MT X1015	0.10/0.20	0.60/0.90	0.040	0.050
MT 1020	0.15/0.25	0.30/0.60	0.040	0.050
MT X1020	0.15/0.25	0.70/1.00	0.040	0.050

HIGH CARBON GRADES

Grade Designation	Carbon %	Manganese %	Phosphorus % Max.	Sulphur % Max.
C 1025	0.21/0.28	0.30/0.60	0.040	0.050
C 1026	0.21/0.28	0.60/0.90	0.040	0.050
C 1030	0.27/0.35	0.60/0.90	0.040	0.050
C 1035	0.31/0.39	0.60/0.90	0.040	0.050

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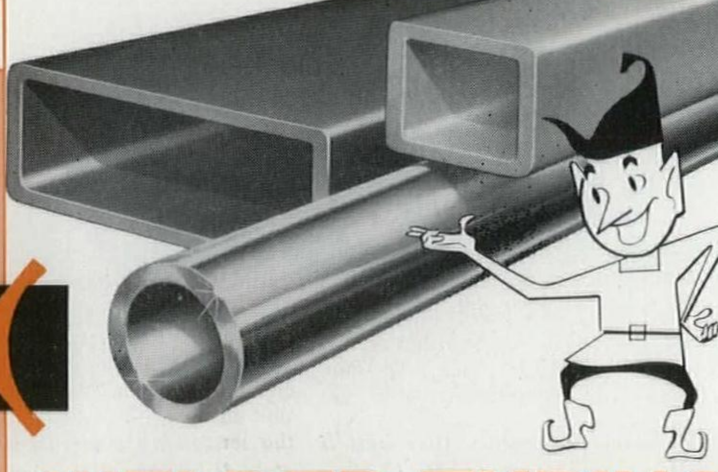
STAINLESS GRADES

Type No.	Carbon (*)	Chromium	Nickel	Other Elements
302	.15	17-19	8-10	....
304	.08	18-20	8-12	....
304L	.03	18-20	8-12	....
309	.20	22-24	12-15	....
309S	.08	22-24	12-15	....
309SCB	.08	22-24	12-15	cb10XC Minimum—1 Maximum
310	.25	24-26	19-22	....
310S	.08	24-26	19-22	....
316	.08	16-18	10-14	Mo. 2-3
316L	.03	16-18	10-14	Mo. 2-3
317	.08	18-20	11-15	Mo. 3-4
321	.08	17-19	9-12	Ti 5 X C Minimum
329	.20	23-28	2 1/2-5	Mo. 1-2
330	.15	14-16	33-36	....
347	.08	17-19	9-13	Cb-Ta 10 X C Minimum
348	.08	17-19	9-13	CB-Ta 10 X C Minimum Ta .10 Maximum
430	.12	14-18	....	....
442	.20	18-23	....	....
443	.20	18-23	....	Cu .9-1.25

(*) Maximum—unless otherwise indicated.

LC-592



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Quieting Air-Conditioning and Ventilating-Duct Noise

by Lewis S. Goodfriend

The rapid increase of the use of air conditioning in all types of buildings has brought with it increased noise problems. Not only is there the problem of noise intrinsic to the system, but also there is the additional problem of the transmission of noise from one air-conditioned space to another through the ductwork.

There is a number of satisfactory techniques for solving both types of problems, the three basic devices being lined plenums, duct-lining material, and sound traps. Variations on the last two include splitters and eggcrate silencers. Pressure on architects and engineers from salesmen for duct- and plenum-lining materials, and for prefabricated duct silencers, is great. Each claims that his product is unparalleled in its field and by far surpasses any other quieting technique. A study of both types of product, their respective areas of application, and comparative costs on a practical basis will show where each technique can be best applied.

First, let's examine the products. Duct lining is usually provided in the form of flexible sheets, or rolls, of fibrous material in thicknesses of ½″ to 2″. Its effectiveness in terms of decibel reduction for a fixed length varies with both the length of the sides of the duct and with the area. For example, a duct 6″ x 28″ will give approximately 22 percent more noise reduction (in decibels) than a 12″ x 12″ duct of the same length, similarly lined. For larger ducts, the variation is considerably less. If one allows some extra pressure drop, a smaller lined duct will provide a higher sound attenuation than a larger lined duct. Thus, an 18″ x 26″ duct yields 25 percent more noise reduction (in decibels), with a five-fold increase in the pressure loss, than a 24″ x 36″ duct. When using a smaller duct, however, care is required to minimize noise due to air velocity at the grill or diffuser. A short table comparing the noise reduction provided by 10-ft lengths of lined duct of various sizes is shown *(Table I)*. Manufacturers' catalogs list the coefficient for each product.

When duct-lining materials are used, the size of the sheet-metal duct must be increased so that the same free area will be provided. Otherwise, excessive pressure drop will occur in the duct. In addition to the loss due to construction which will occur if the duct is not sized for the lining, there is an added friction loss to be compensated for, which is caused by the greater roughness of the duct liner compared to the galvanized-sheet steel usually used for ducts. At 2000 ft per min, the additional pressure drop in a 12″ x 36″ duct lined for 20 ft would be .02 in. of water, or about 6 ft of additional sheet-metal duct. The cost of a duct system lined to control noise is higher because of the cost of the additional sheet metal (2″ per side for a 1″ lining) and the cost of the duct liner itself. For a 12″ x 36″ duct, the additional installed cost would be about $87 for each 10 ft of lined duct. However, for small ducts and modest amounts of noise reduction, duct lining is both economical and efficient.

Commercially available, prefabricated sound traps provide fixed quantities of noise reduction when used in straight runs of duct. They also introduce fixed pressure losses (each model has a par-

(Continued on page 13)

TABLE I: Noise Reduction in Decibels for 10′ of 1″ Duct Lining (Typical)

Duct sizes Inside dimensions	Frequency in cycles per second 125	250	500	1000	2000	4000
6" x 8"	5	25	43	55	54	51
8" x 12"	3	17	29	40	39	36
12" x 24"	2	10	17	24	23	22
24" x 24"	1	7	12	16	15	14
36" x 48"	1	4	7	9	9	9

NOTE: Above values are to be added to noise reduction provided by bends, grills, etc.

TABLE II: Sound Traps Compared to Duct Lining

Frequency—cycles per second		Noise reduction in decibels 125	250	500	1000	2000	4000
Sound Trap A	24" x 24" x 42"	11	19	33	43	42	36
Sound Trap B	24" x 24" x 32"	14	22	33	36	38	37
Lined Duct	24" x 24" x 120"	1	7	12	16	15	14
Sound Trap A	6" x 12" x 42"	11	19	33	43	42	36
Sound Trap B	6" x 12" x 32"	14	22	33	36	38	37
Lined Duct	6" x 12" x 120"	4	22	36	48	47	44

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HEAR THE DIFFERENCE

New tile effectively muffles excessive noise. NRC ratings from .55 to .75 depending on thickness and method of installation.

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Initial cost is comparable to other woodfiber products. Tile can be repainted without appreciable loss of efficiency . . . exclusive Biotox process protects against mold, mildew, termites and dry rot. Sizes and thicknesses for all installation methods.

For more information about this unique acoustical material, see your Simpson Certified Acoustical Contractor (check the yellow pages), or write: Simpson Logging Company, 1004E, White Bldg., Seattle, Wash.

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AC-93

Quieting Air-Conditioning and Ventilating-Duct Noise *(continued)*

ticular loss coefficient). Thus, it is possible to buy in a small package a known amount of noise reduction with a moderate pressure loss. In some instances, it may be necessary to use two or more traps side by side in order to obtain a low-enough pressure loss to meet system requirements. This is especially true where corrective measures are being added to a previously installed and operating system. In other cases, it may be necessary to use traps at the beginning and the end of a system to obtain sufficient attenuation. The prefabricated units are not inexpensive. However, they are capable of providing high noise reductions in the speech and machinery noise frequency ranges in short lengths.

A comparison of some typical, short, prefabricated sound traps is shown *(Table II)*. The performance of the traps is obviously better than that of the lined ducts in the large sizes, but is about the same as 10 ft of duct lined with a 1″ liner in the small sizes.

The lined plenum is an excellent noise-control device, provided the plenum has been included in the system for other than acoustical purposes. The use of a plenum solely for noise reduction is seldom economical. However, if the plenum is available, lining it and adding one or more baffles in the interior will certainly reduce the cost of noise control in any system. A lining material should be selected which will provide the maximum noise reduction in the noise frequency range where it is required. This may be done with the help of duct-liner data charts and noise measurements, or calculations of levels from the system elements involved. Where such data is lacking, the lining with an air-space backing shown in the *ASHAE Guide* is a safe general-purpose lining. It is the equivalent of 3″ or 4″ of blanket material fastened directly to the sheet metal.

Variations on duct lining, such as splitters and eggcrate "silencers," are often satisfactory where small amounts of noise reduction are required. However, the quality of their fabrication cannot be as closely controlled as that of commercial sound traps. In addition, the commercial sound traps use perforated metal facings and are thus able to handle much higher velocities than locally assembled splitters or eggcrates. This is not to say that the commercial units will solve everyone's problems. They do, however, usually provide higher attenuation of sound with lower pressure losses than equivalent lengths of splitters or eggcrates with the same free area. The locally built splitter or eggcrate unit is useful for low-velocity systems having no critical total pressure limitations and as an expedient when a job cannot await delivery of a stock commercial unit.

A comparison of the costs of duct-silencing methods, in terms of a number of bases, is tabulated *(Table III)*.

TABLE III: Cost Comparison for Duct Lining and Sound Traps

A. For approximately equal noise reduction.

		Installed cost
Sound Trap A	6" x 12" x 42"	$100
Sound Trap B	6" x 12" x 32"	70
Duct Lining	6" x 12" x 120"	80
Sound Trap A	12" x 24" x 42"	$140
Sound Trap B	12" x 24" x 32"	100
Duct Lining	12" x 24" x 20'	252
Sound Trap A	24" x 24" x 42"	$265
Sound Trap B	24" x 24" x 32"	130
Duct Lining	24" x 24" x 25'	400

B. For equal pressure-drop and approximately equal noise reduction.

		Pressure drop Inches of water	Noise reduction at 500 cps in decibels	Installed cost
At 500 cfm	12" x 24" x 24"	.025	33	$380
	12" x 24" x 32"	.025	33	130
	6" x 12" x 10'	.025	36	80
At 2000 cfm	32" x 48" x 42"	.015	33	$527
	3—24" x 24" x 32"	.015	33	480
	12" x 24" x 20'	.015	34	252
At 4000 cfm	48" x 48" x 42"	.03	33	$760
	4—24" x 24" x 32"	.03	33	600
	24" x 24" x 30'	.02	36	325

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Millions of tiny expanded cells are filled with inert gas—with the result that new PRESST-O-CEL is lightweight and flexible, yet ruggedly durable. For example: it is resistant to oils, acids, alkalis, fungus, rodents and vermin . . . is water and air tight. For the best—and longest lasting—installation, always specify PRESST-O-CEL.

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Heat Pump Eliminates Supplementary Electrical-Resistance Heating *by William J. McGuinness*

Practice of Architecture *column on mechanical and electrial design and equipment, devoted this month to the use of the heat pump in industrial plants.*

The new plant and offices of Flick-Reedy Corporation, at Bensenville, Illinois, have year-round air conditioning powered by a heat pump. Occupancy of the building includes manufacturing plus the executive and administrative offices of the Miller Fluid Power and Tru-Seal Divisions of the Corporation. The system, thought to be the largest of its kind in the world, serves a total area of 220,000 sq ft and has an air-conditioning tonnage of 640 tons. Using the air-to-air principle and eliminating the earlier disadvantage of supplementary electrical-resistance heating, it would appear to establish with some finality the acceptance and suitability of this method of heating and cooling. Economy, flexibility, absence of flammable fuels and smoke, and a minimization of operational and maintenance attention are among its major characteristics. The source of heat is outdoor air, supplemented only by the electricity needed for the compressors and for the circulation of air and water.

The term "reverse-cycle refrigeration" is commonly used to identify this process. There are actually four circuits at Flick-Reedy. In addition to the refrigeration, which is truly reversible, there is an outdoor-air circuit, circuit of heated (or chilled) water, and a circuit of indoor air which is cooled or heated by the water at air-handling centers. The core of the system is the refrigeration cycle. When the refrigerant gas is compressed, it must be cooled and condensed to become a liquid. In summer, this transmits heat to the outdoor air for disposal and, in winter, to the circulated water for heating. After becoming a cool, compressed liquid, the refrigerant is allowed to expand mechanically by releasing it to a lower pressure. In this process of "boiling," it absorbs heat from the water, in summer, to make it chilled water, and, in winter, from the outdoor air which supplies the heat for the building. Thus, the heat is pumped through the refrigeration system, in summer, to the outdoor air and, in winter, to the circulated water. In summer, the expansion takes place near the water and the refrigerant cooling is done by the outdoor air. In winter, the expansion takes place near the outdoor air and the refrigerant cooling is done by the indoor circulated water. Water temperature in summer is 47° F and in winter 105° F.

The chilled or heated water, circulated by pumps, is used in 16 zones served by air-handling units responding to local thermostats. Great flexibility and conformance to local demand is thus achieved. A constant supply of fresh air is added at the air units. Filtration and humidity control are also accomplished at these points.

The power plant is really a new kind of thing in building equipment. Standing clean, orderly, and well arranged adjacent to the outdoor air unit *(see illustration)*, it is composed of six reciprocating compressors, three rotary compressors, shell-tube units, auxiliary equipment, and an electronic supervisory data-control center. This center renders the operation almost entirely automatic in response to centralized control. The equipment complex is visible from all parts of the plant. It may be glassed-in later.

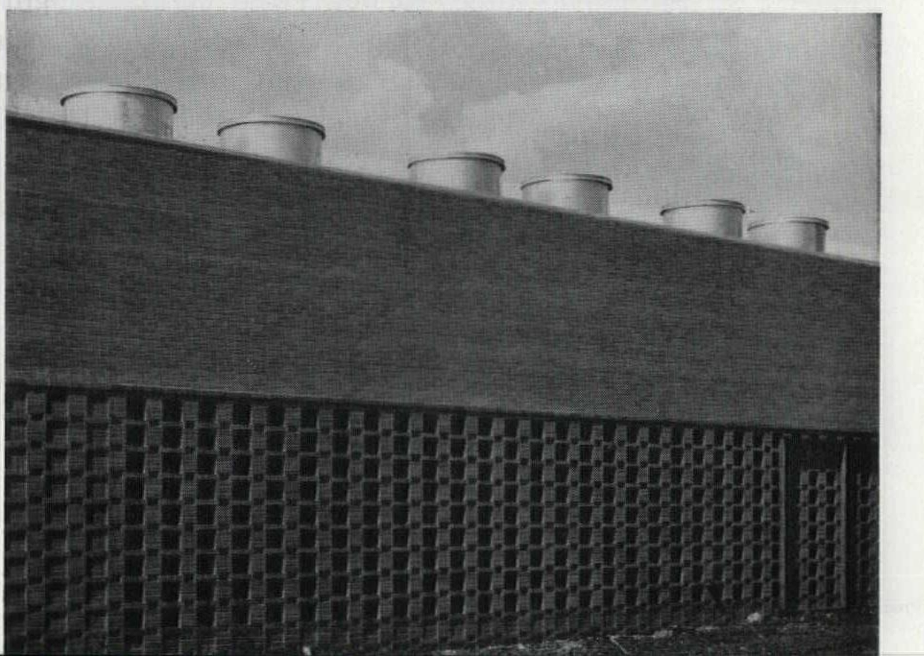
The reciprocating compressors cut in sequentially as the demand increases. In series with them are the rotary compressors, which start up when the outdoor air drops below 15° F. This constitutes the two-stage compression* developed by New York Division of Borg-Warner Corporation and adapted in this design by Zay Smith & Associates, Architects. One stage operates the system when the outdoor air is not lower than 15° F, and the secondary compression makes it efficient with outdoor temperatures as low as −10° F which is the design temperature for this installation. Prior to the development of multistage compression for this use, it was necessary to provide electrical resistance heating when the outside air temperature dropped below 15° F. These "strip" heaters are only one-third to one-fifth as efficient as the heat pump.

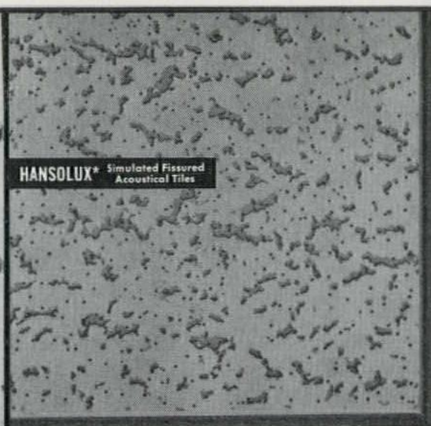
Careful estimates were made of the installation cost of the heat pump, compared to the cost of installing oil heating and mechanical cooling. The heat-pump cost was $540,000 while the cost of the combined system was $500,000. For winter heating only, the cost of oil for the boilers would have been $12,000 against $7200 for electricity for the heat pump. This fuel saving was just about balanced out when the interest charges on investment, depreciation, and added service costs were taken into account.

Each installation must be studied individually to determine whether, as in this case, the cost will be competitive. In general, when both heating and cooling are desired, and when the summer load is equal to or greater than the winter load, the heat pump will prove economically comparable.

* MECHANICAL ENGINEERING CRITIQUE, SEPTEMBER 1956 *and* JUNE 1958 P/A.

The cooling tower moves indoors and takes on a winter duty to make it operational throughout the year. In the winter it might be called a "heating tower." The outdoor end of the refrigeration cycle is clearly expressed by this air-handling section of the factory wall. Air is drawn through the brick grill, passes over the heat-transfer surfaces of fin-coils behind the solid brick wall, and is exhausted by axial flow fans on the roof. In summer, this air condenses the gas refrigerant which has absorbed the indoor heat. In winter, it gives up heat to the expanding gas for transfer to indoor use.





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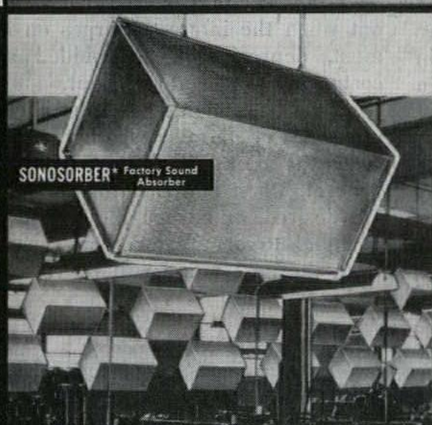

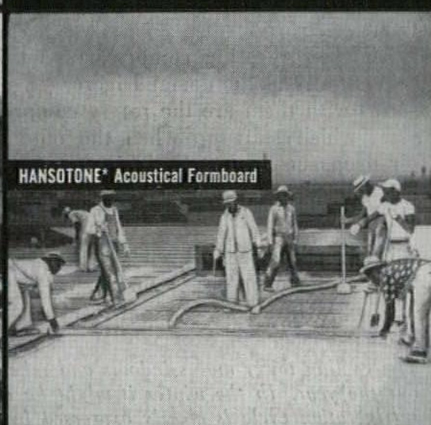

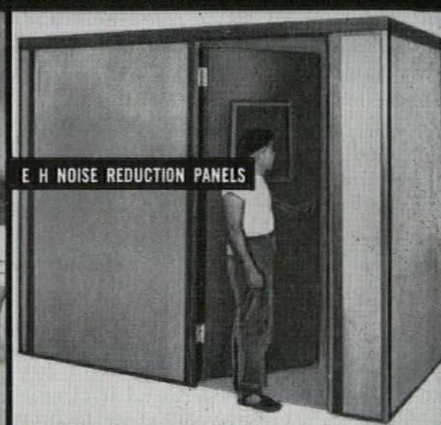

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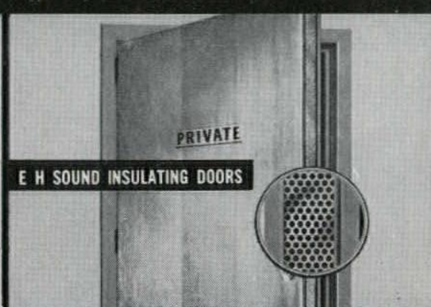

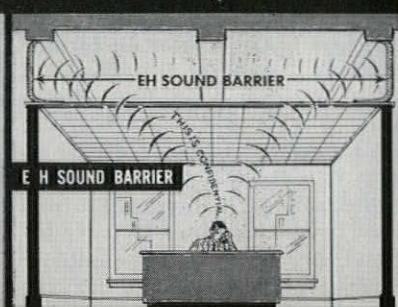

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Fuel Cost Lowered, Sickness Absenteeism Reduced... with Radiant Acoustical Ceiling

In 1955, when architects Beatty and Berlenbach recommended a Burgess-Manning Radiant Acoustical Ceiling for the proposed West Middle Island Elementary School of Middle Island, N. Y., the Board of Education of the Union Free School District was frankly sceptical. Only after making an inspection tour of a number of installations and hearing the enthusiastic reports of owners and occupants, were they convinced that such a ceiling could be feasible and practical.

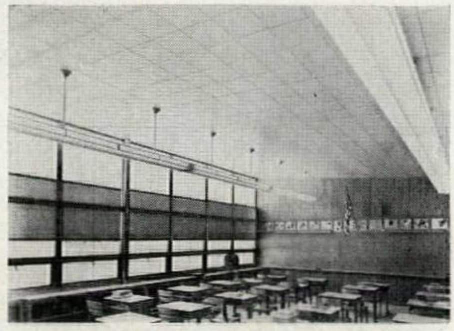
In due time the West Middle Island Elementary School was completed, with its Burgess-Manning Radiant Acoustical Ceiling installed.

The results—the following excerpts from a letter by Donald H. Fingar, School Board President, written after a year of operation, will tell the story:

"The system has been efficient, fast, and flexible of control with no uncomfortable areas. Our fuel consumption has been substantially less per cubic volume than neighboring schools with "modern" radiant convectors. — Our kindergarten conducts games and rest periods on the floor, a concrete slab, with no apparent discomfort. Our incidence of lost time due to colds and other respiratory troubles has been considerably less since moving from a building with radiant convectors to our present Burgess-Manning installation.

We believe this to be the ultimate in heating and acoustical comfort —"

Our thanks to Mr. Fingar, — any additional comment would be superfluous.



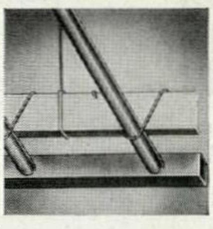
Radiant Acoustical Ceiling Basically Simple In Design

Considering the triple function performed by the Burgess-Manning Radiant Acoustical Ceiling, its construction is amazingly simple and compact, and is easily erected. It consists of only 4 major parts.

1. Suspension Grid

The suspension grid of 1½" channels on 4 ft. centers is not unusual.

2. Water Circulating Coil



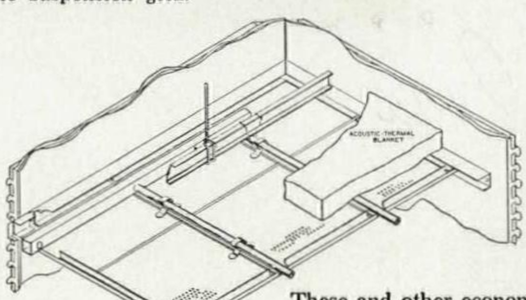
The grid type coil is made from pre-fabricated headers to which ½" laterals are welded. A sinuous type coil can be used where conditions make it desirable. It hangs from the suspension grid.

3. Acoustic-Thermal Insulation Blanket

The non-combustible sound-absorbing blanket, with the required noise reduction coefficient, is laid on top of the suspension grid.

4. Snap-On Panels

Heavy gauge perforated aluminum panels of the proper thermal conductivity are attached directly to the water circulating coil.



This isometric drawing shows all 4 parts assembled — a relatively simple construction that replaces the conventional radiators, or hot air ducts used for convectional type heating, and that permits reduction in size of air handling equipment such as blowers, fans, coils, filters, etc.

These and other economies permit installation of Burgess-Manning Radiant Acoustical Ceiling at a cost equal or lower than would be paid for various combinations of convection heating and air cooling, plus a suspended acoustical ceiling.

Write for descriptive Burgess-Manning Catalog No. 138-2 PA

3 Heating Cooling Acoustical

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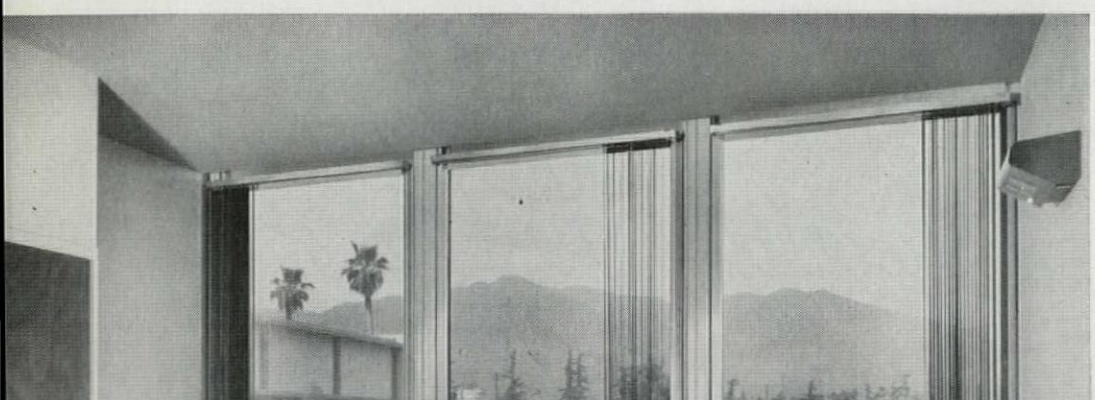

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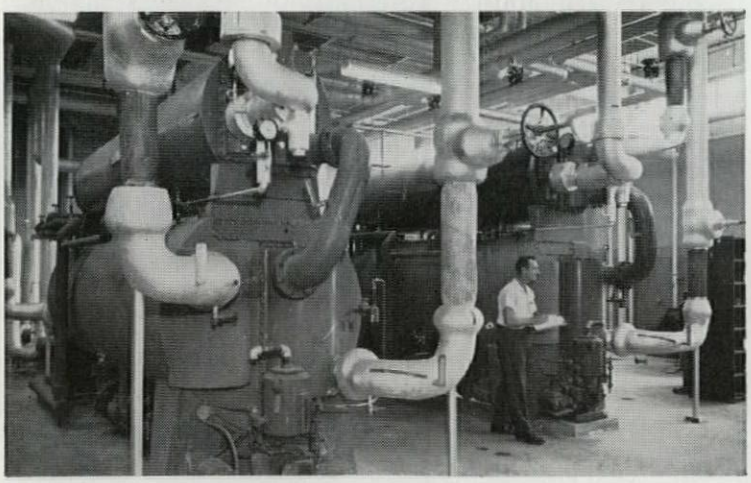
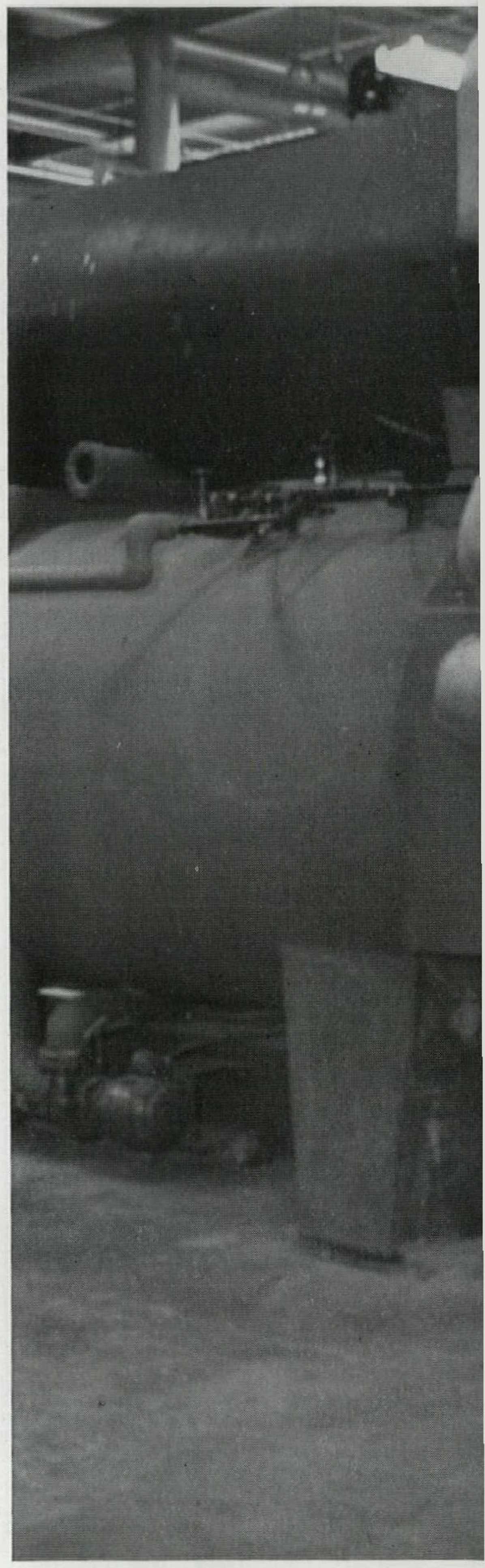
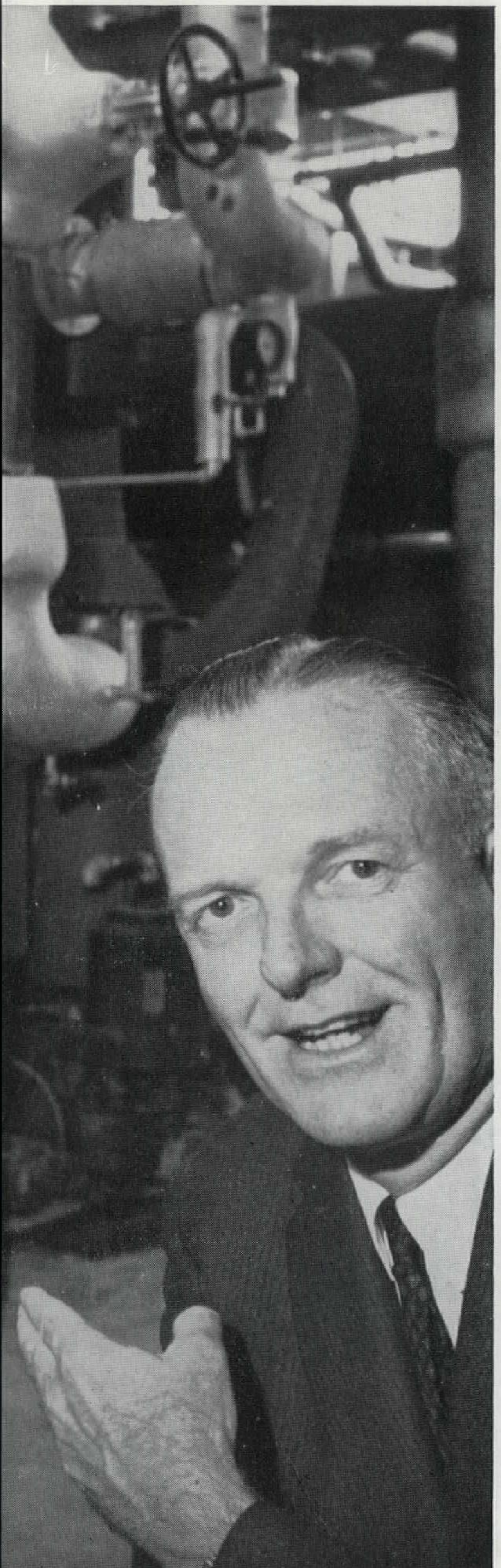
NO SUMMERTIME SLUMP With gas as the boiler fuel and York machines, the switch to summer cooling was no problem. Operating costs are low, too, thanks to Gas.

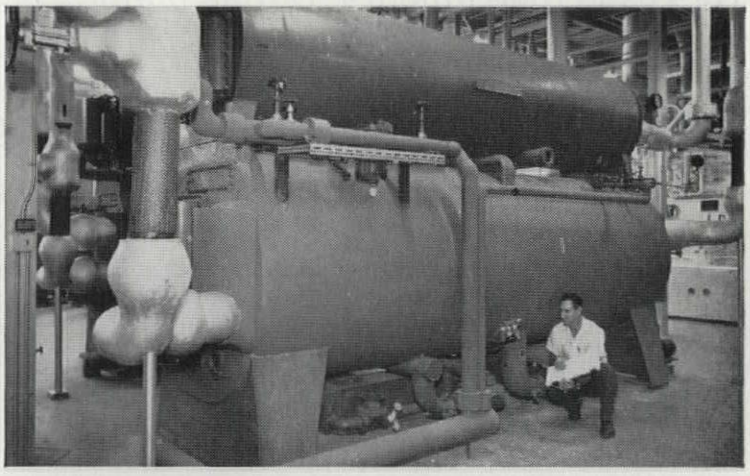
LATEST IN COOLING Gas operated York machines feature the use of tap water as refrigerant and lithium bromide as absorbent, one of the most efficient, practical refrigeration cycles developed so far. Machines start and stop automatically.



THE UTMOST IN FLEXIBILITY The units are cross-connected so that each operates independently if necessary.







MAINTENANCE COSTS TO DATE—ZERO! The Allen Company uses two York machines—a 230-ton unit serving 45,000 sq. ft. of office and cafeteria space, a 170-ton unit for process water cooling. Three small pumps and motors are the only moving parts in the entire system.

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"With our boilers sized for a winter load, we were naturally oversized for the summer months. But York's gas-operated Lithium Bromide absorption water chillers permit us to make efficient use of part of this steam capacity to cool," says Mr. M. J. Mather, President of the Allen Manufacturing Company, makers of hex-socket screws.

The York Lithium Bromide system eliminates the need for huge compressors found in other types of cooling equipment . . . which brings down the original cost considerably. And with gas the boiler fuel, you make year-round use of an otherwise wasted source of power *at rock bottom costs.* In addition, York machines are noiseless, lightweight, compact—easy to install and readily adaptable to almost any plant layout.

Find out how your present heating system can pay off for you all year 'round with gas-operated York automatic water chilling units. Call your local gas company or write to the York Corporation, Subsidiary of Borg-Warner Corporation, York, Pennsylvania. *American Gas Association.*

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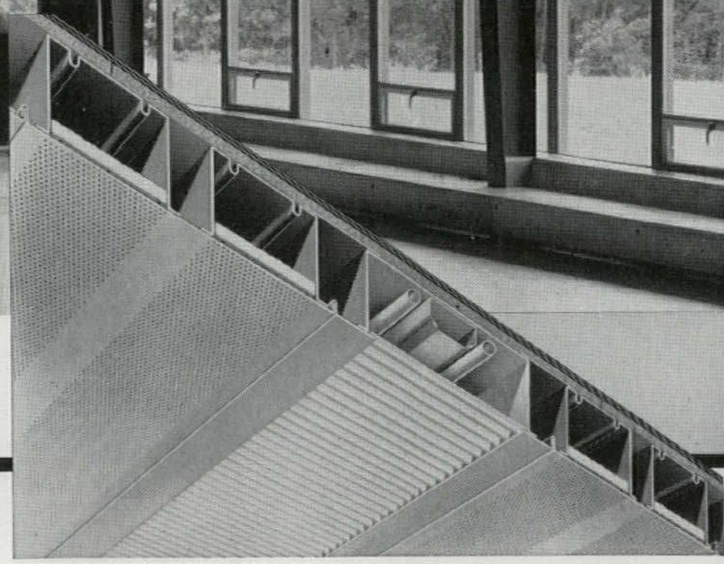

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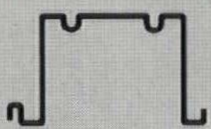

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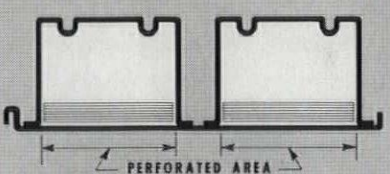

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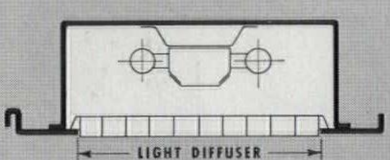

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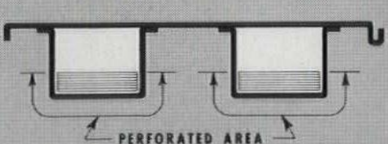

SECTION M2 (Acoustical)
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At Left: Cross Section of Long Span M-Deck Combined Roof-Ceiling with Troffer Lighting.

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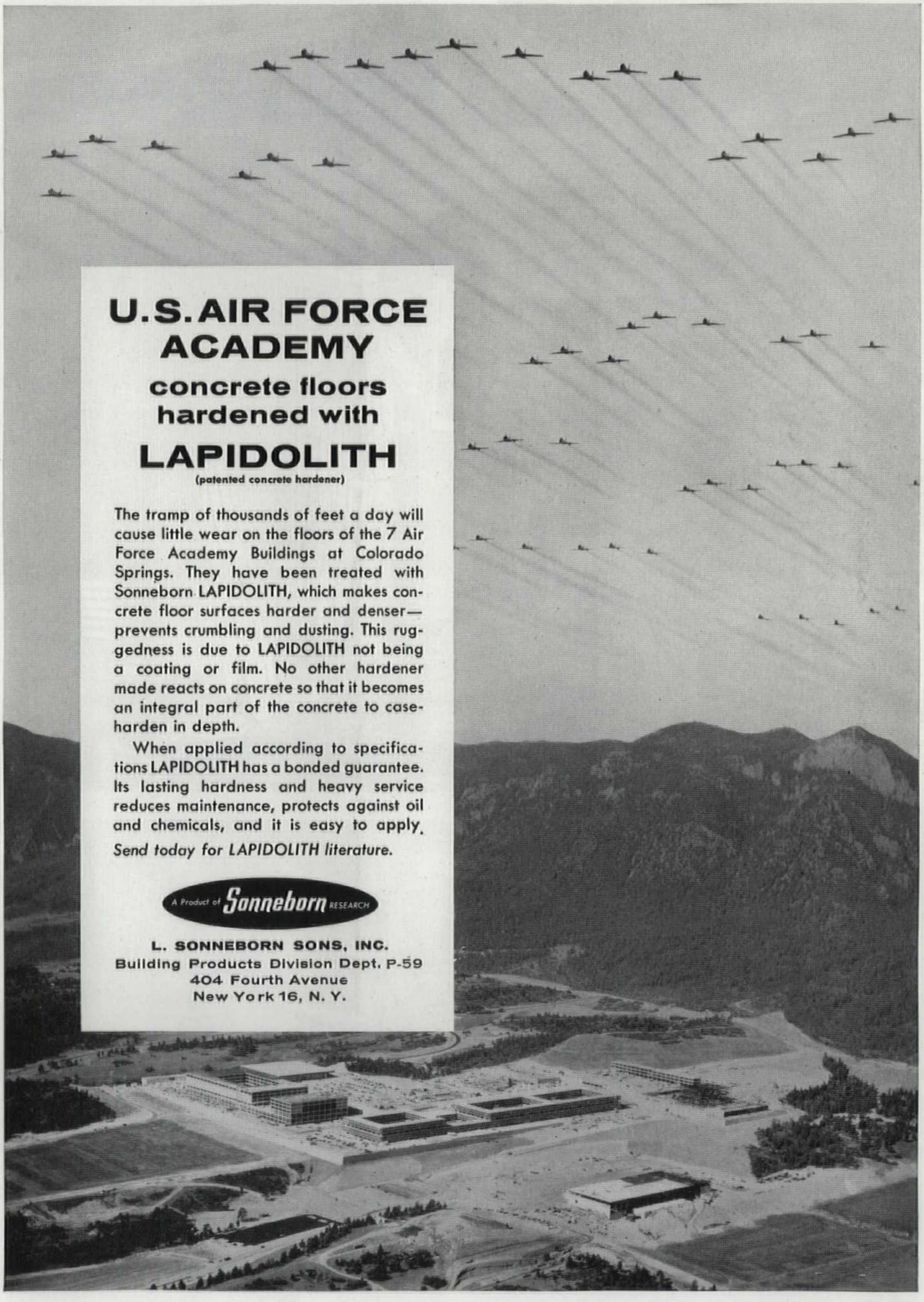

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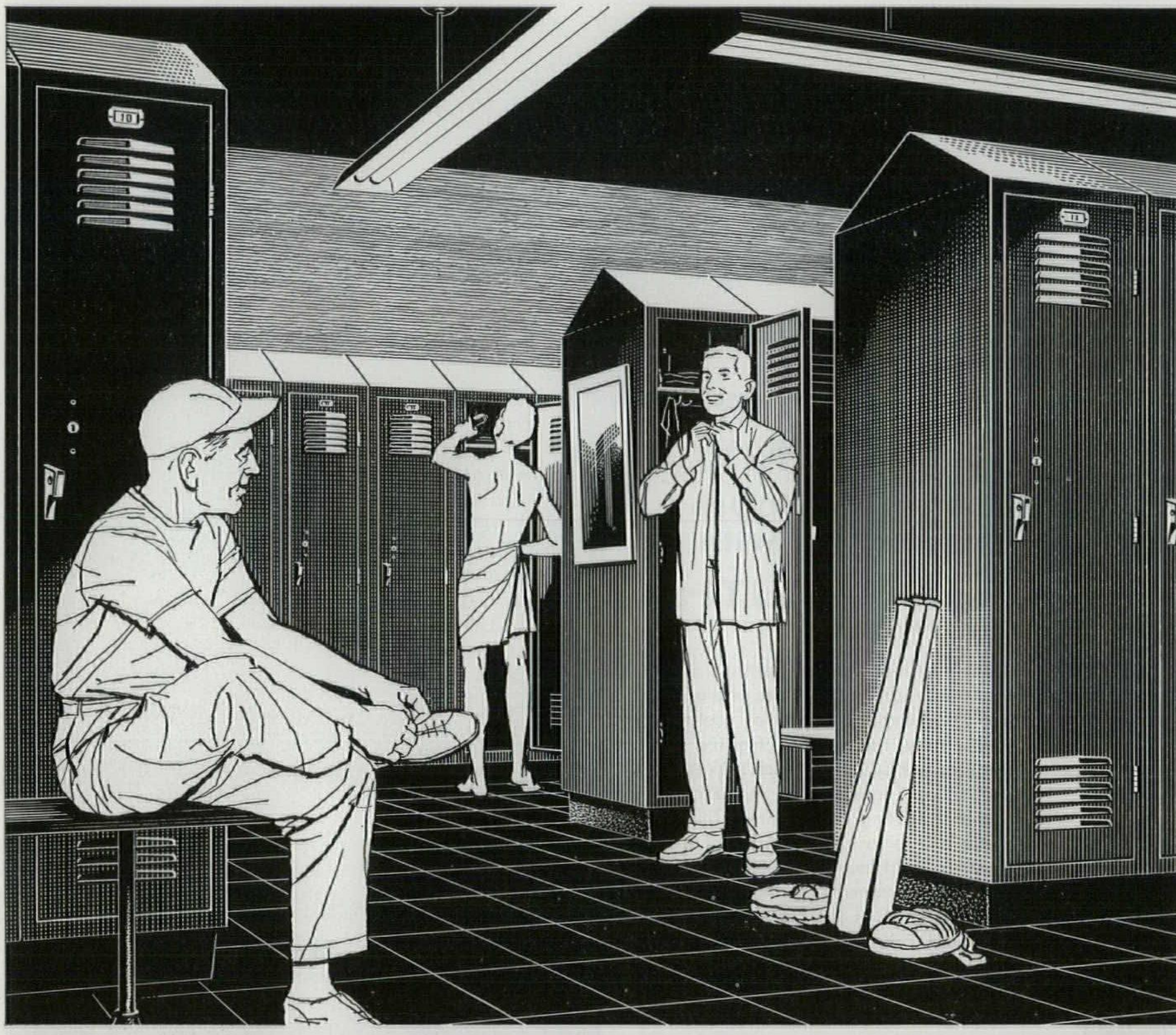

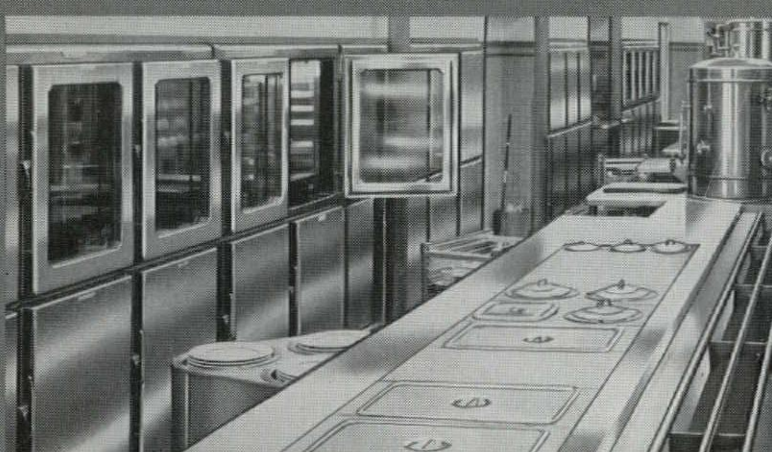

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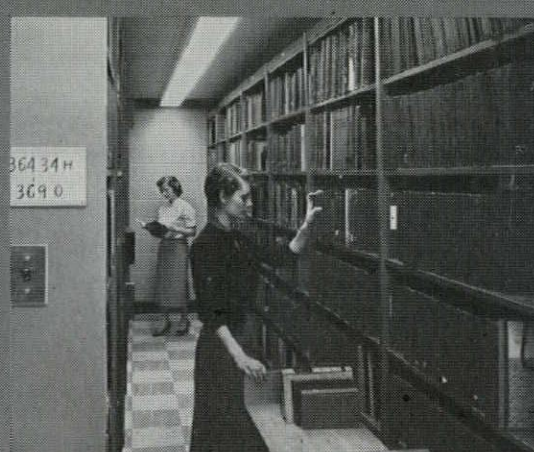

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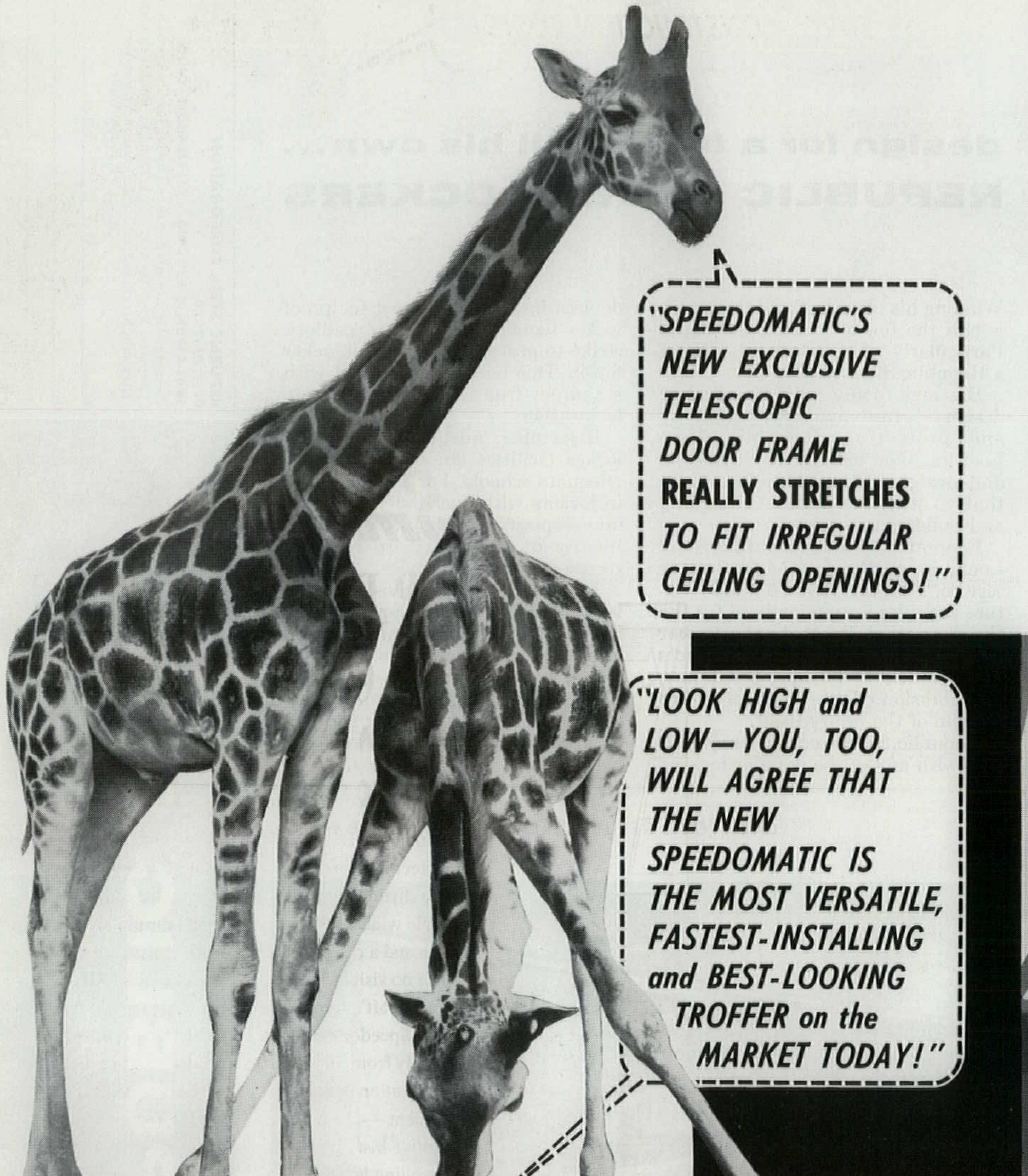
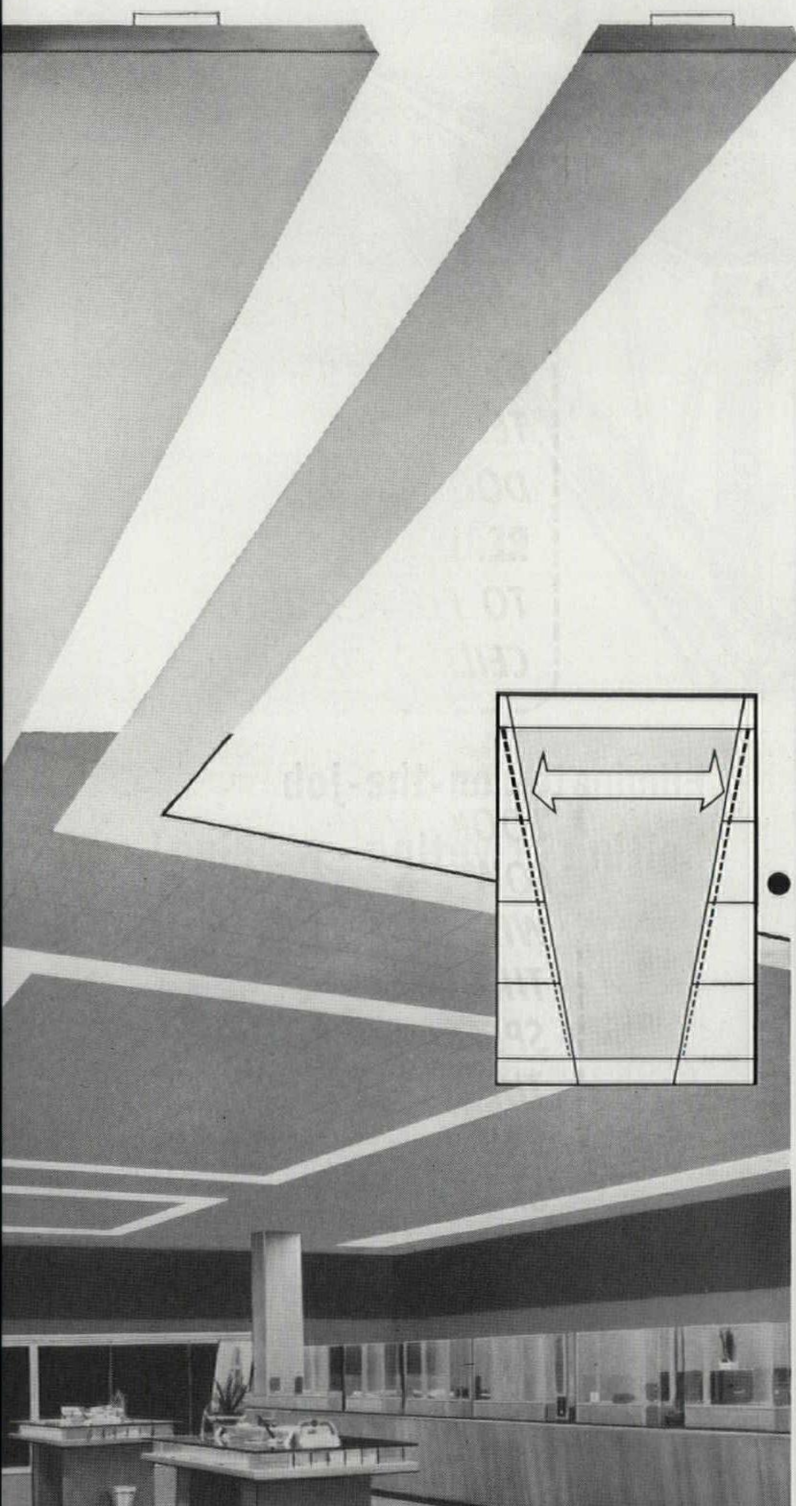


new *Smithcraft* SPEEDOMATIC TROFFERS SIMPLICITY ITSELF TO SPECIFY AND ORDER! The four basic types of Speedomatic troffers fit all of today's popular ceilings — and Smithcraft's *complete Ceiling Index* indicates the type of troffer to order for perfect installation in any ceiling system.

"BY GEORGE, IT IS ONLY $4\frac{15}{16}$" DEEP - SAVES CONSTRUCTION COSTS!"



new

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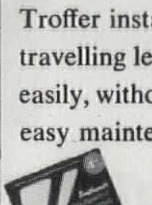
• • • WITH THE EXCLUSIVE TELESCOPIC DOOR FRAME

... that automatically expands or contracts to assure perfect fit even in irregular ceiling openings. The shielding medium is framed in the ceiling by a single width of metal, offering maximum illumination area and a clean, precise finished ceiling appearance, with no visible bolts, hinges, catches, etc. All of Smithcraft's complete series of one-foot and two-foot wide Speedomatic troffers are extremely easy to specify from Smithcraft's complete Ceiling Index. Installation of Speedomatic troffers is fast and efficient — the only tool needed is a screwdriver. Troffer installs in seconds from below by fast travelling levelling screws. Doors open and close easily, without mechanical catches, for easy maintenance.



For complete information on today's fastest-installing troffers, write for Smithcraft's Speedomatic folder. Also contains complete Smithcraft Ceiling Index and shielding information.

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America's finest fluorescent lighting **Smithcraft Lighting** CHELSEA 50, MASS.

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TRADE MARK REGISTERED

Eliminates on-the-job bolting • riveting • welding!

Macomber V-LOK provides structural rigidity and complete design latitude; reduces erection time and overall cost; allows earlier occupancy for interior finishing.

V-LOK's job-proved interlocking system, reinforced by rugged Macomber V-Section framing members, delivers at minimum cost a solid structure pleasing to architect, contractor and building owner, alike.

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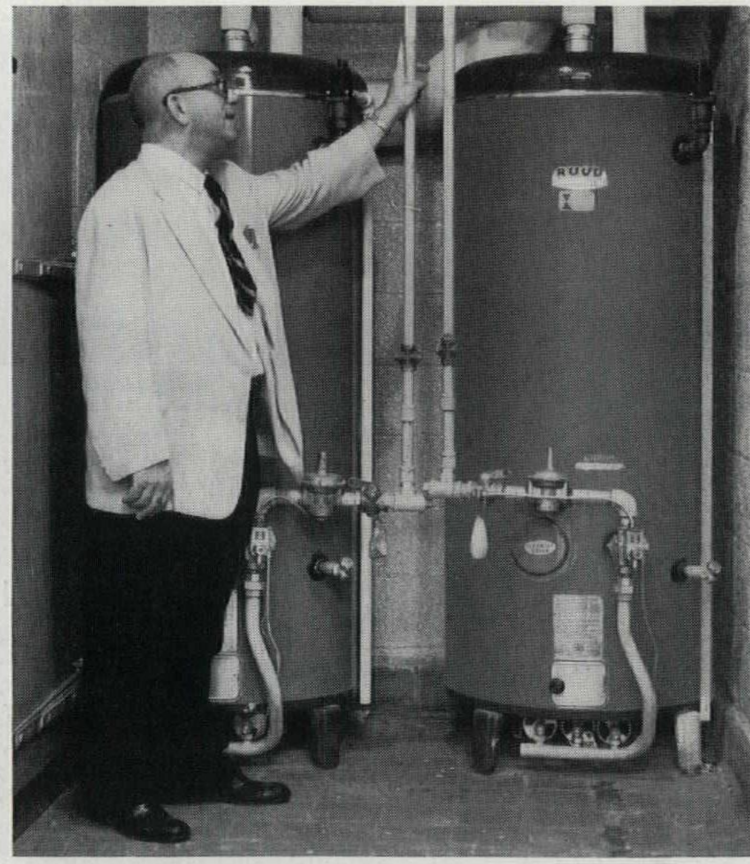
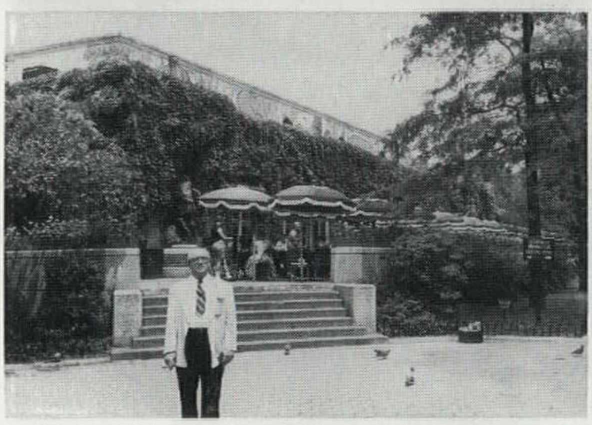
CANTON 1, OHIO

WATER HEATERS WITH ALCOA ALUMINUM MEET HEAVY DEMANDS AT CENTRAL PARK ZOO RESTAURANT





It takes a lot of hot water to feed 5,000 people. But two Ruud-Alcoa automatic gas water heaters assure an adequate supply to help New York's Central Park Zoo Restaurant handle even these peak Sunday crowds.

The two Alcoa alloy units serve seven outlets that are often used simultaneously. Since their installation, there has always been an adequate supply of hot water at every outlet—and no maintenance of any kind has ever been necessary.

Heavy-duty applications are just routine for Alcoa alloy water heaters. The aluminum alloy tank is strong, solid and corrosion resistant for longer life and complete freedom from water discoloration. High thermal conductivity assures rapid recovery rate and economical operation. Specially designed units meet American Gas Association Laboratories' requirements and those of the National Sanitation Foundation's Standards Nos. 3 and 5. For more information on any application—commercial, industrial or residential—send in the coupon, or write Aluminum Company of America, 1900-E Alcoa Building, Pittsburgh 19, Pennsylvania.

Your Guide to the Best in Aluminum Value

For Exciting Drama Watch "Alcoa Theatre," Alternate Mondays, NBC-TV, and "Alcoa Presents," Every Tuesday, ABC-TV

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Plumbing Contractor: Dave Reiner, Inc., New York, N. Y.

Aluminum Company of America
1900-E Alcoa Building
Pittsburgh 19, Pa.

Please send me *Water Heater Applications of Alcoa Aluminum*, the 12-page FREE booklet that tells why Alcoa alloy water heaters outperform other water heaters, gives the easy way to figure hot water requirements, lists case histories.

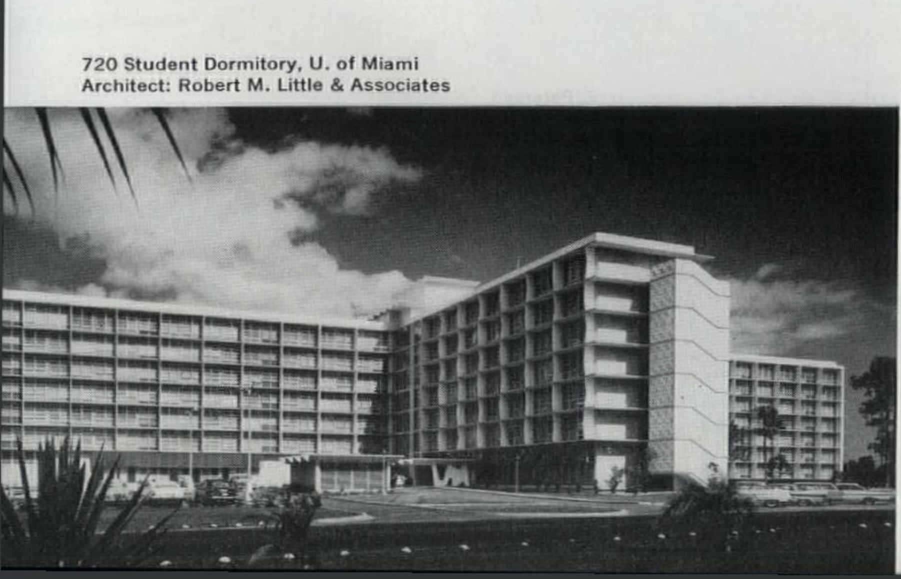
Name____________ Title____________

Company____________ Street____________

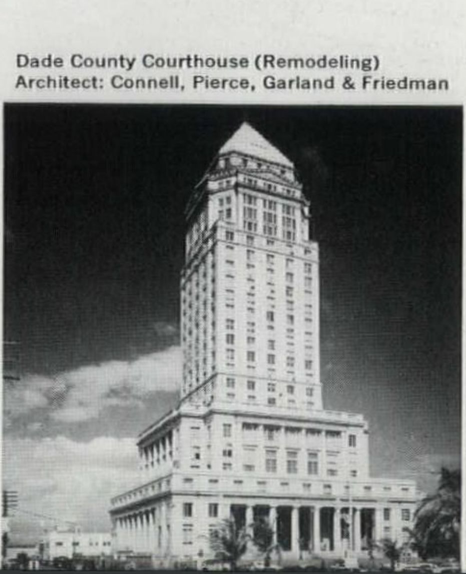
City____________ Zone______ State____________

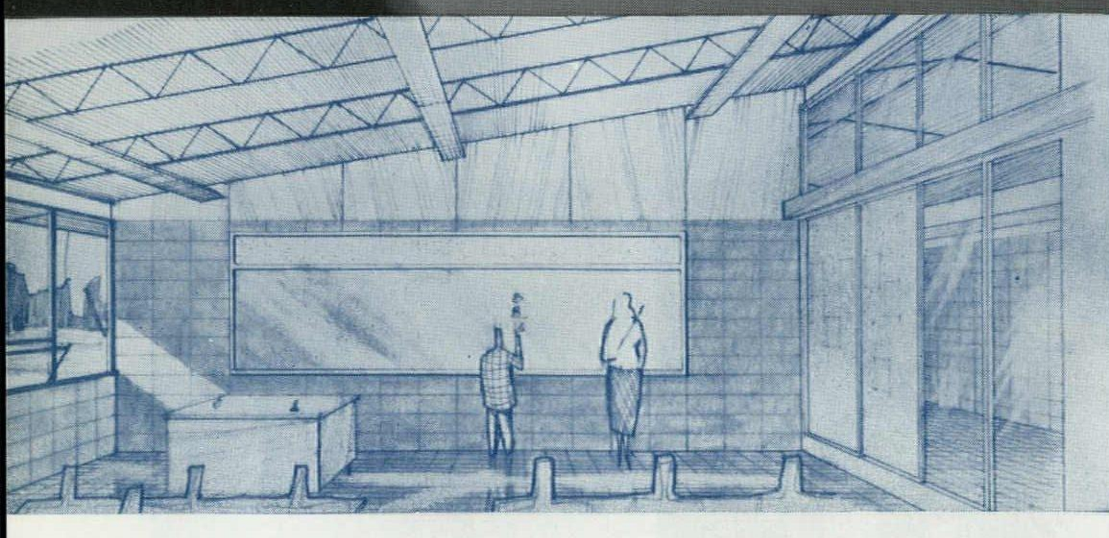
University of Miami Law School . . . Architect: Robert M. Little and Associates

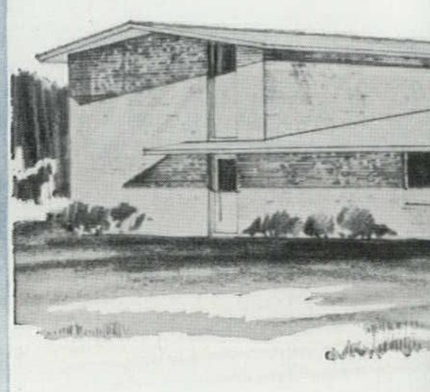
720 Student Dormitory, U. of Miami
Architect: Robert M. Little & Associates



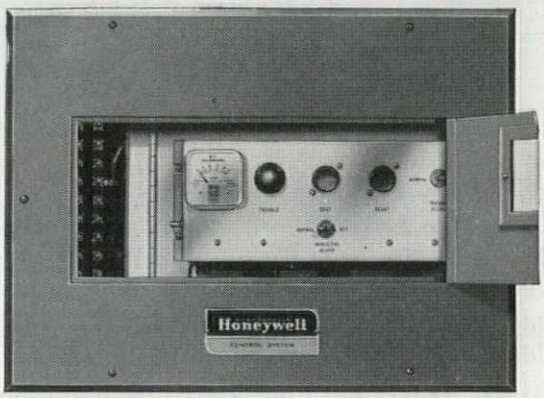
Dade County Courthouse (Remodeling)
Architect: Connell, Pierce, Garland & Friedman







Design for safety in schools and hospitals with
HONEYWELL AUTOMATIC FIRE ALARM SYSTEMS



W247 Panel for the ultimate in detection and alarm for safe evacuation of schools and hospitals. The panel features large bell capacity—up to 5 bell circuits operating a total of up to 50 bells. Choose from 3 types of alarms: *continuous ringing* (bells ring continuously to sound alarm), *master coded* (bells ring in code to distinguish fire alarm from other bells in building), or *selective coded* (bells ring in code to identify fire location). This panel is doubly safe because any wiring failure rings a separate alarm.

W237 Panel for maximum protection of lives and property in small offices, stores, industrial buildings. Available with standby battery operation that will sound alarm even during a power interruption. System is so foolproof that it can sound the fire alarm even with a double break or ground in the detector wiring. Detection circuit is completely supervised; two independent alarm circuits are provided. Numbered lights on panel quickly, positively indicate fire location. Both detection and alarm circuits are low voltage.

NOW HONEYWELL announces a brand new family of automatic fire alarm panels—the W247 line. This new series, added to the W237 family, greatly broadens Honeywell's line of automatic equipment. There are Honeywell panels and accessory equipment to meet all of your clients requirements. And all Honeywell panels are U. L. approved.

These Honeywell automatic fire alarm systems can signal the fire location immediately, and can be tied into the local fire department.

You get many other benefits, too, with Honeywell equipment. Honeywell fire alarm experts in 112 sales offices are always on hand to assist you with applications. During installation, factory-trained Honeywell men assist your engineer or contractor and check the finished job. Then, Honeywell men provide guaranteed service for one year. Honeywell also offers a low-cost maintenance plan that includes regular inspection, prompt service.

For additional information, see Sweet's file number 33 B/Mi, or call your nearest Honeywell office, or write Honeywell, Dept. PA-5-57, Minneapolis 8, Minnesota.

Honeywell

H HONEYWELL *First in Control*

ANOTHER PRESTRESSED CONCRETE STRUCTURE

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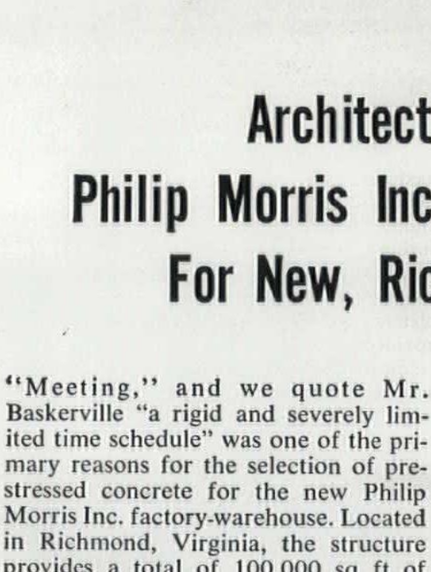
Richmond, Virginia
Architect Consultant to the Owner:
Ulrich Franzen, New York City
Prestressed Concrete Fabricator:
Concrete Structures, Inc., Richmond, Virginia

Architect H. C. Baskerville Tells You Why Philip Morris Inc. "Called For" PRESTRESSED CONCRETE For New, Richmond, Virginia Factory-Warehouse

"Meeting," and we quote Mr. Baskerville "a rigid and severely limited time schedule" was one of the primary reasons for the selection of prestressed concrete for the new Philip Morris Inc. factory-warehouse. Located in Richmond, Virginia, the structure provides a total of 100,000 sq ft of storage space for packaging and other materials used in the manufacture of cigarettes.



Structural Engineer Robert H. Deaderick and Job Captain Richard H. Cardwell looking over plans for the Philip Morris warehouse.

Warehouse dimensions are 250 ft by 405 ft with a 12 ft loading dock, and are divided into 5 bays each 81 ft by 250 ft Basic design requirements for the structure were (and again we quote the architect) "... eighty foot clear spans, sixteen-foot clear headroom, fire-resistant and sprinkler construction, concentrated supports to afford flexibility," and the aforementioned need for construction speed. In summing up, Mr. Baskerville adds, "after careful comparison of a number of framing systems, prestressed concrete proved to be the most *economical* system meeting all requirements." We have taken the understandable liberty of emphasizing *economical*.

As prestressed concrete construction increases throughout the country, we at Roebling find that architects, engineers and builders have their own *emphatic* reasons for choosing it. In every case, many of the same reasons are given; flexibility, construction speed, low maintenance, insurance benefits, economy, design and aesthetic adaptability; though naturally one quality is more important than another in specific examples.

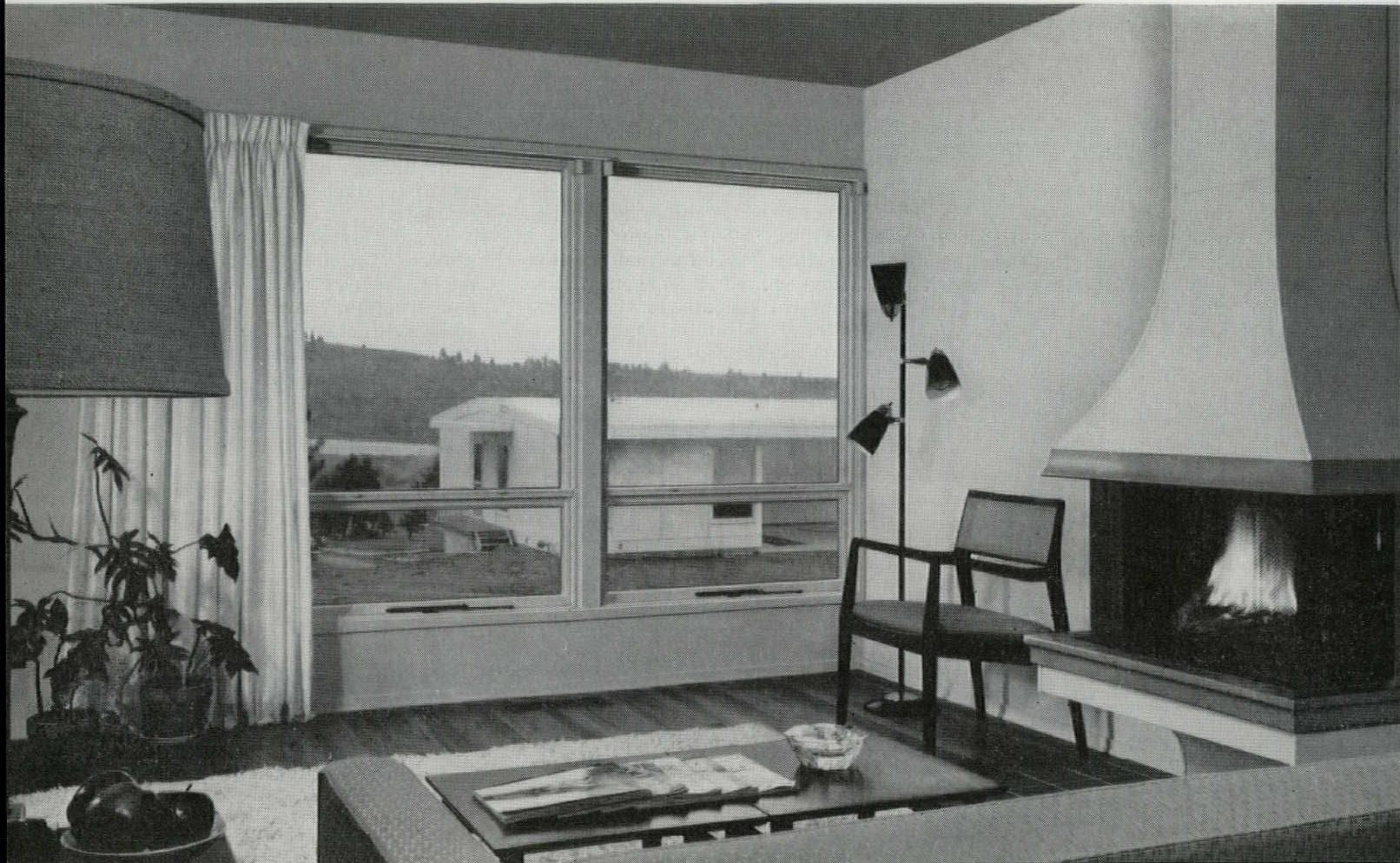
In any case, and for any reason, the prestressed method of construction certainly deserves your attention. The Construction Materials Division of John A. Roebling's Sons Corporation, Trenton 2, New Jersey, has long been active in bringing the benefits of the prestressed method to architects and builders everywhere. We are in a position, therefore, to share with you data and information we have accumulated on all phases of prestressed concrete. Any inquiry bearing on any part of this remarkable subject will be answered promptly and fully.

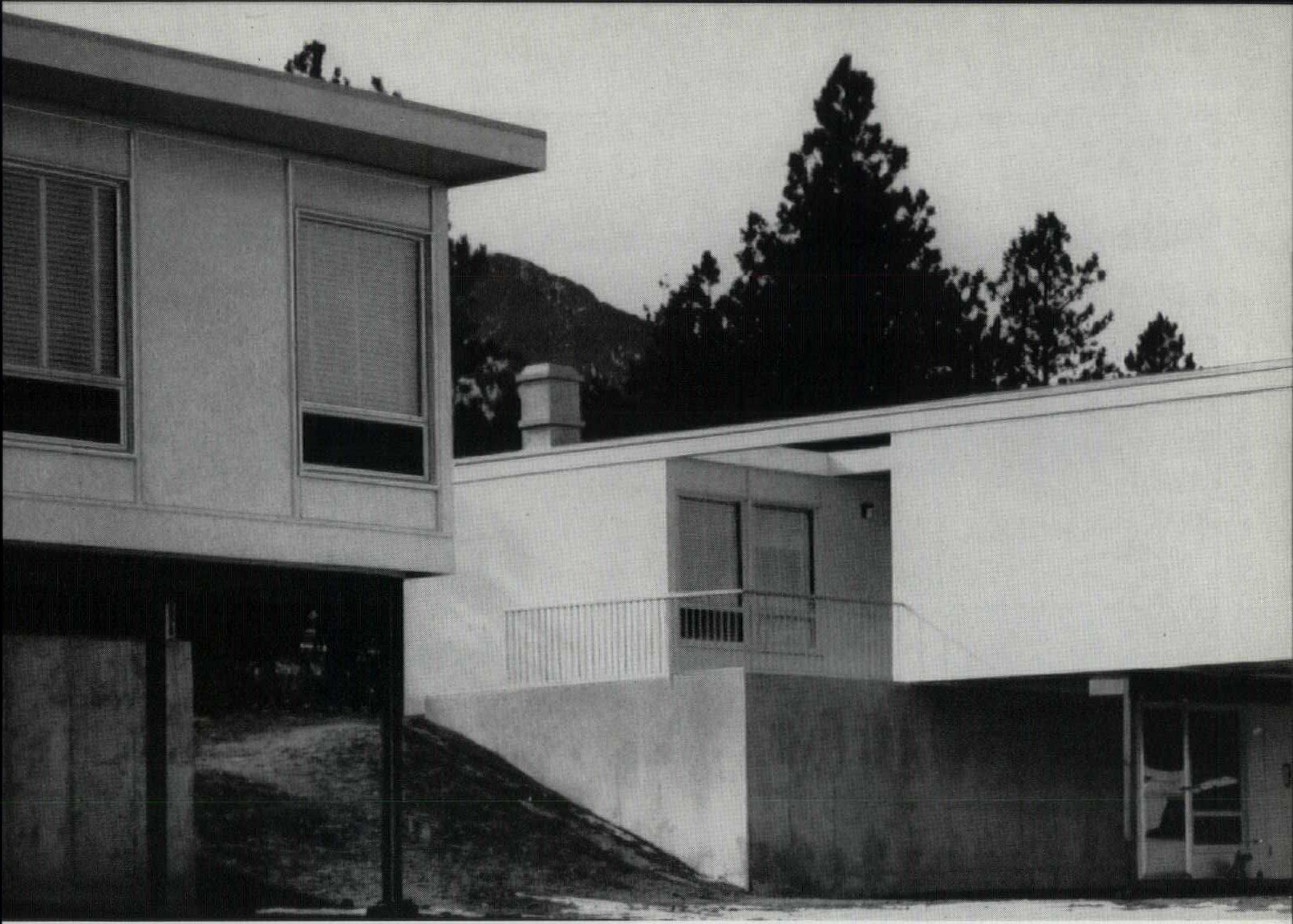
ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

CONSULT ROEBLING . . . First in U. S. with prestressing and tensioning elements

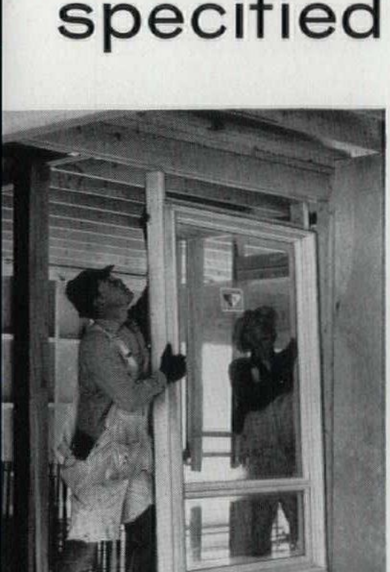
BELOW—Two Andersen Strutwall units butted together result in this handsome picture window effect. Lower operating sash are awning type. Permit ventilation even during rain storms.





U.S.A.F. Academy housing, Colorado Springs, Colorado. Architects: Skidmore, Owings & Merrill, Chicago.

18,700 new Andersen Strutwalls* specified for USAF Academy housing



Andersen Strutwalls afford tightest possible joining of windows and walls. Insure all-weather comfort. Cut installation time as much as ½ over conventional windows.

Andersen's structural window and wall component brings plenty of light, cheer and ventilation into the first 1,200 housing units at the new United States Air Force Academy in Colorado Springs.

Choice of Andersen Strutwalls was a big factor in meeting the close and difficult building schedule. Says Mr. Harry Rubenstein of the Del E. Webb Construction Company and Rubenstein Construction Company, a joint venture: "*We estimate that a crew of six men set 120—or more—Strutwalls a day. This we estimate, would be about 50% more than the number of conventional windows that the same crew could install in a day.*"

The new Andersen Strutwall offers substantial savings in both time and costs in any kind of single story frame construction. This modular unit comes completely assembled with load-bearing side struts, nailers and lower jack studs. Simply cut the load-bearing struts to fit header construction. Nail to adjacent studs.

The result is the tightest possible joining of window and wall. And greatly reduced chances of error, as well.

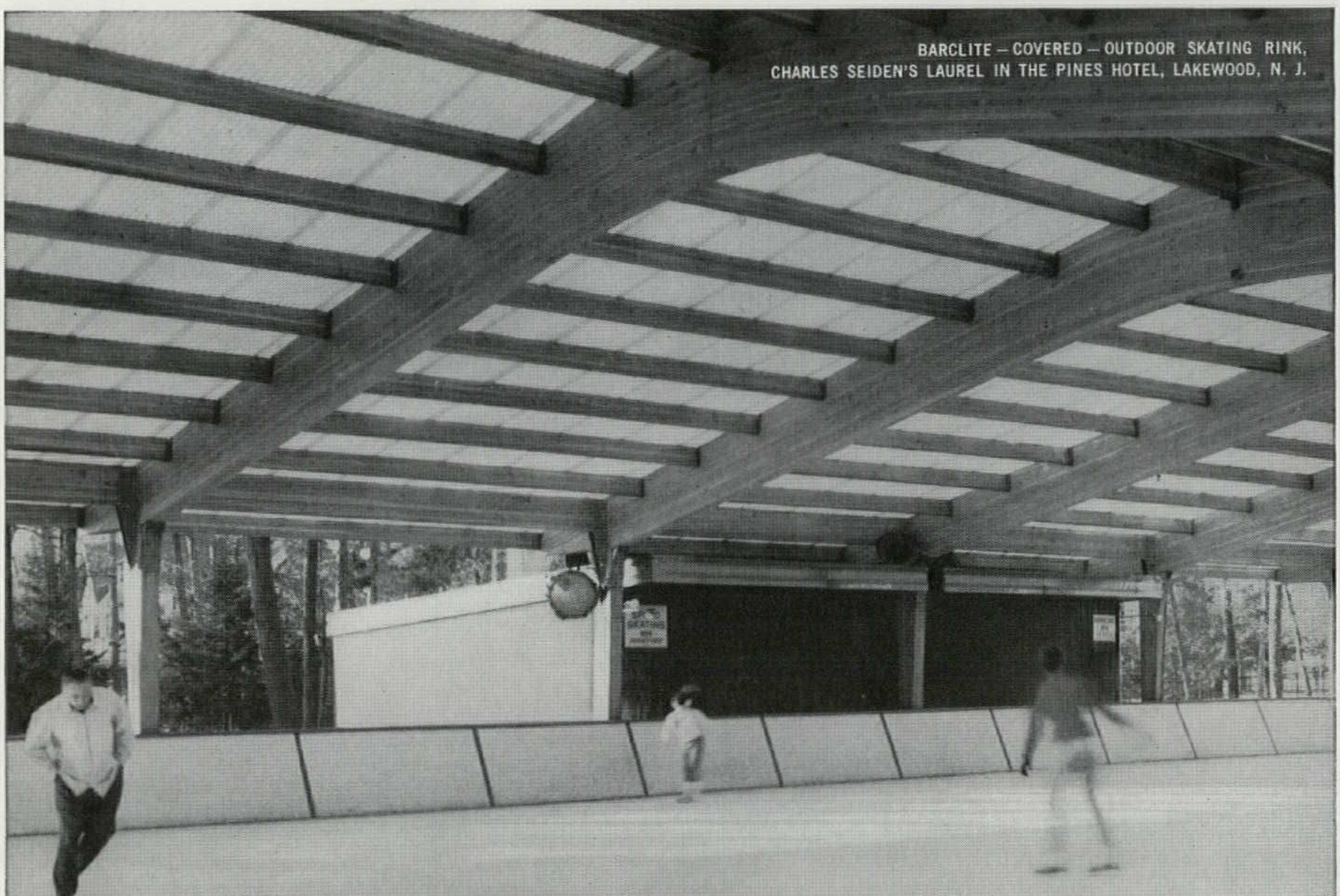
Andersen Strutwalls are now available in 7 sizes, 2 styles, together with 2 sizes of Strutwall door frames. For more information, or specification data, write: Andersen Corporation, Bayport, Minn.

Andersen Windowalls*

*Trademarks of Andersen Corporation

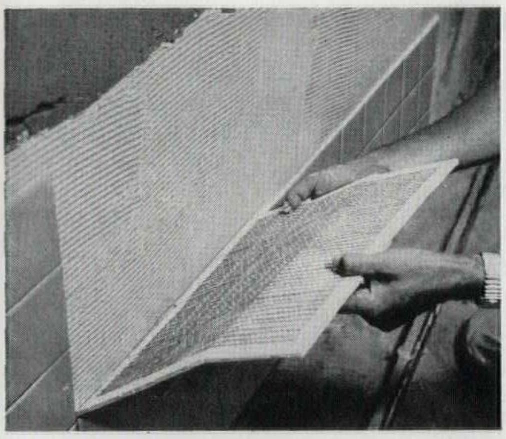
AW

ANDERSEN CORPORATION • BAYPORT, MINNESOTA



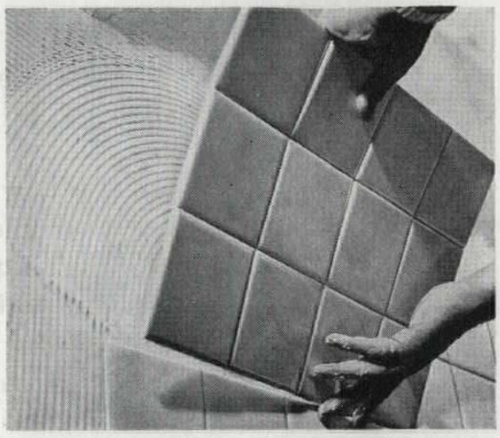
BARCLITE — COVERED — OUTDOOR SKATING RINK, CHARLES SEIDEN'S LAUREL IN THE PINES HOTEL, LAKEWOOD, N. J.

Suntile SETFAST* Wall Tile
AND MODERNIZATION PROGRAMS
Installs easily over existing walls!

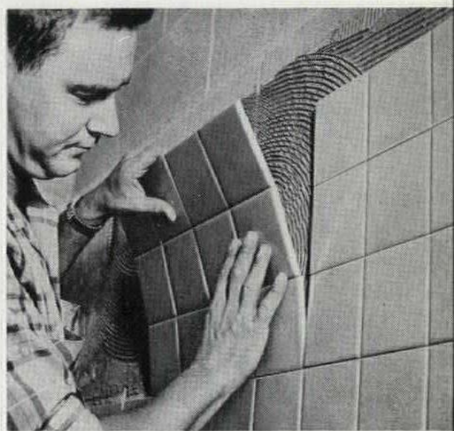


FAST INSTALLATION — Ideally suited for thin-set installation method using either an approved adhesive or self-curing mortar.

SETFAST may be installed over mortar beds of conventional thickness skimmed with self-curing cement. No soaking required!



MODERN ECONOMY — 12-tile, factory inspected units cover 1½ sq. ft. Individual operations reduced.



PERFECT SPACING — beautifully precise, autom alignment and easy handling.

SETFAST Wall Tile is self-leveling . . . and confo to minor irregularities in existing wall surface!

Suntile SETFAST Ceramics

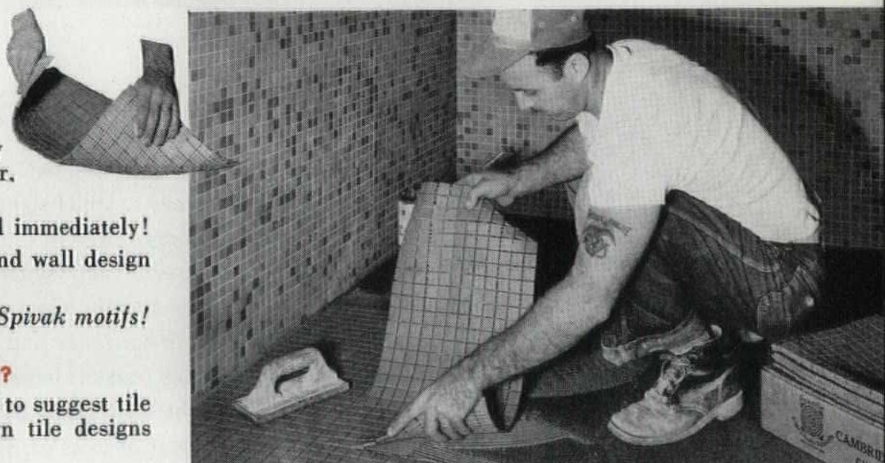
— in one-by-two foot sheets offer you design versatility with unheard of economy!

Mechanic sets 288 one-by-one inch ceramics at once, perfectly bonded and spaced. He can inspect his work, avoid error, because he installs ceramics *face up*.

No paper to soak off, no mess to clean. Tile can be grouted immediately!

SETFAST ceramic patterns encourage originality in floor and wall design — patterns, geometrics, abstracts, and randoms.

Available from stock, *including the famous, exclusive Max Spivak motifs!* Send for catalog.



CAN OUR SPECIAL DESIGN STAFF HELP YOU?

Our ceramic artists, headed by Harry J. Macke, will be glad to suggest tile applications to your plans or elevations; or put your own tile designs in layout form.

*Patent Pending

THE CAMBRIDGE TILE MFG. CO

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Send me folders and data on Suntile SETFAST Wall Tile and Ceramic

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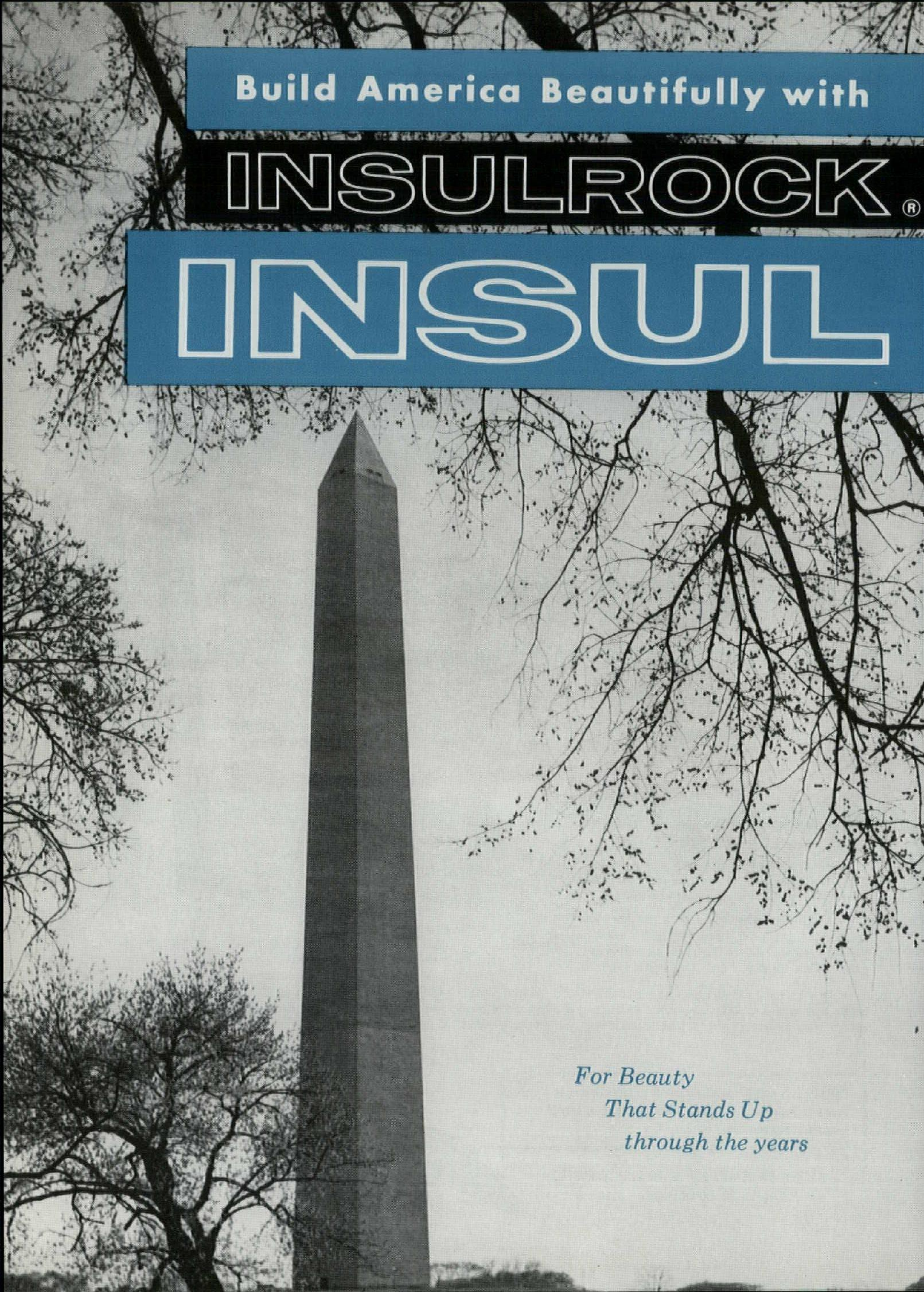
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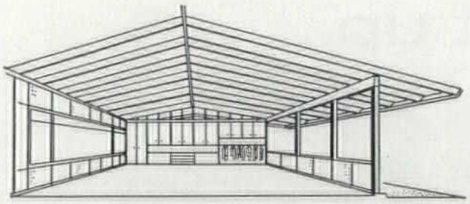
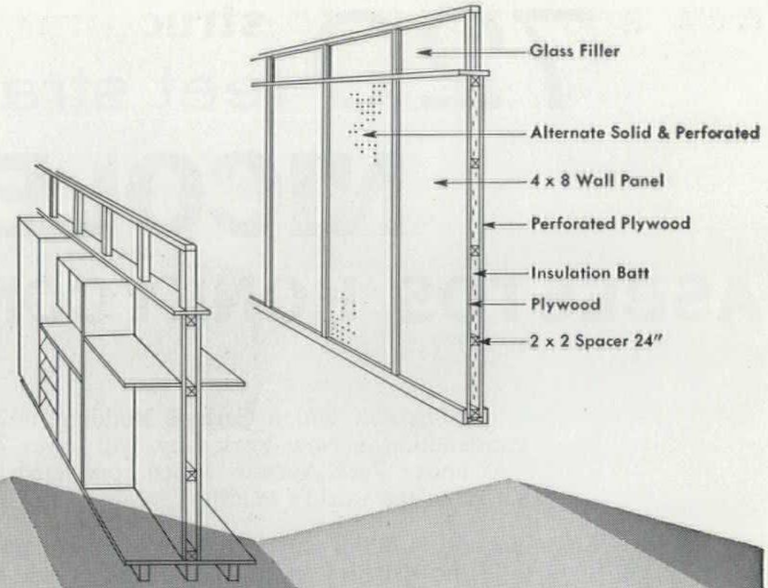
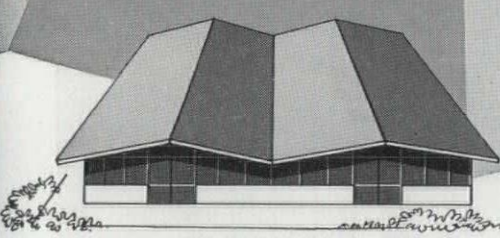


The interior may be left open for classroom uses
. . . or divided into smaller areas by movable partitions

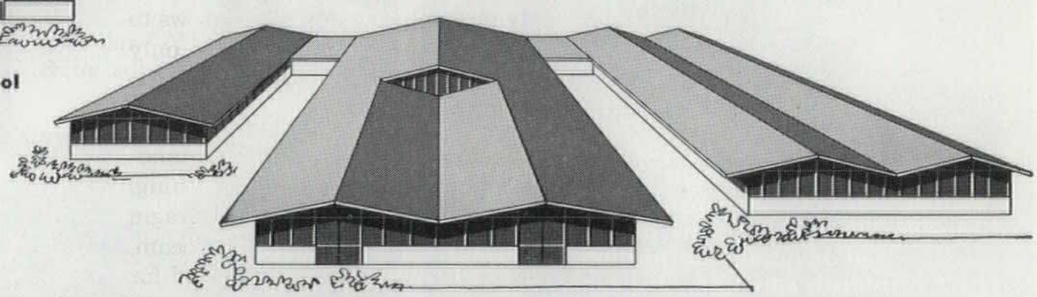


FOLDED PLATE ROOF

PROVIDE MAXIMUM FLEXIBILITY FOR AN EXPANDABLE SCHOOL



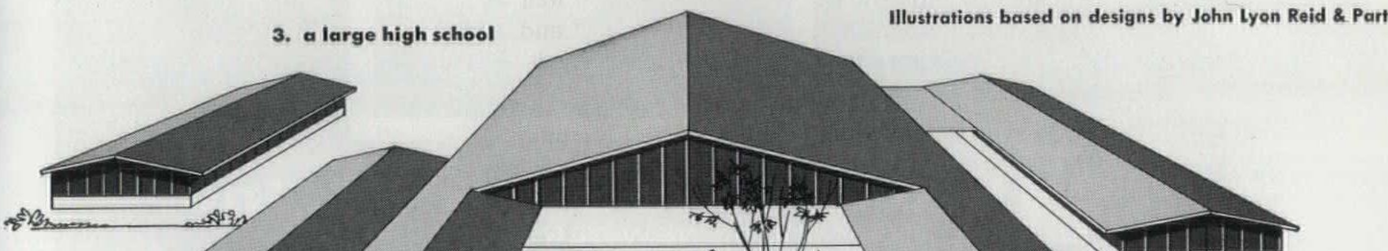
1. a small elementary school



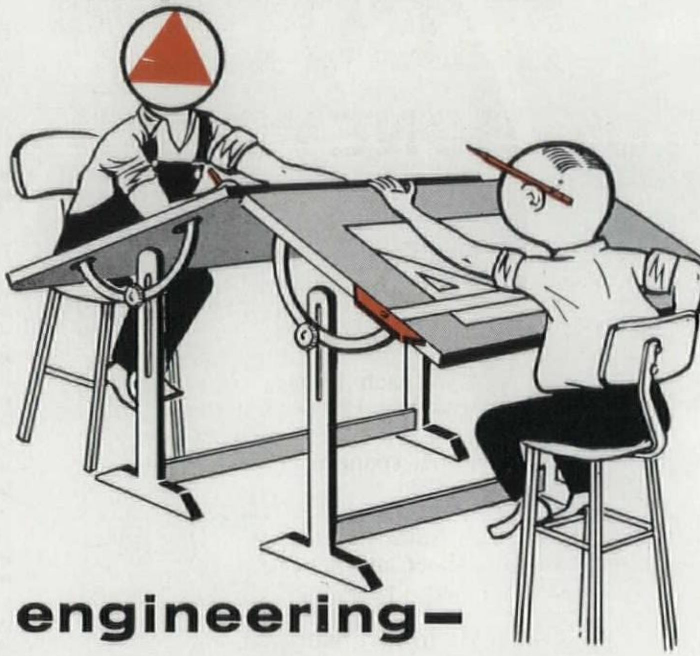
Units can be added as needed

Illustrations based on designs by John Lyon Reid & Partners

3. a large high school



adapting *standard* hardware to meet special requirements . . .



a part of GJ engineering–

Answers to door control problems are not always found in the "book" of standard control hardware. Unusual requirements in function or installation often create "never before heard of" problems. The solution may require but a slight modification. Then again, a radical innovation may be necessary.

For 35 years GJ engineers have worked out thousands of adaptations to solve specific problems. Some of the early ones are "standards of the industry" today. Shown below are a few recent adaptations that illustrate the meaning of *engineered solutions to door control problems*, as they are worked out at GJ every day.

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SHEPARD ELEVATORS
took the bite out of gear tooth wear

The worm gear . . . heart of traction elevator machines . . . really isn't complicated. It looks and operates just like any other machine's gearing.

But years ago Shepard Elevator Co. discovered a flaw in standard worm gear machining practice. Uncontrollable minor imperfections in the tools used produced high spots on certain teeth. This hastened wear, caused some vibration and lowered operating efficiency.

Shepard solves the problem

The solution, while not easily arrived at, was basically simple. By changing the number of gear teeth the engineers were able to compensate for cutting tool faults and produce a perfectly uniform gear.

This, combined with other manufacturing and design improvements, resulted in a worm gear that gives unmatched operating efficiency, and almost never has to be replaced because of wear. Mechanics will tell you that's quite an accomplishment.

Now available nationally

Ninety-nine years' experience has contributed to the excellent reputation Shepard passenger and freight elevators enjoy in the Midwestern area. Now these fine machines are available nationally in a wide range of sizes and speeds. Give your clients the benefit of Shepard bids on geared elevators. In addition to geared units, Shepard manufactures all sizes of gearless hoisting equipment for higher speed elevators. Make your work easier by requesting Shepard's expert elevator planning assistance. See our catalogue in Sweet's Architectural File.

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Indexed in Art Index, Architectural Index.

REINHOLD

readers like NEWS REPORT

January, 1959, saw the introduction of P/A NEWS REPORT, *an expanded feature of the magazine designed to present news of the field—new buildings, personalities, technical developments, reference data for professionals—in a sprightly, easy-to-read fashion. Reaction to* P/A NEWS REPORT *has been most gratifying, as the following remarks from readers show:*

Dear Editor: I find your P/A NEWS REPORT an interesting supplement to P/A. I particularly like the format. It's pleasing to see digests of interesting subjects in these days of bigness. I'm no judge of readership, but I'm sure it receives a high rating at Giffels & Rossetti.

L. ROSSETTI
Giffels & Rossetti
Detroit, Mich.

•

Dear Editor: . . . Sincerely feel that it is superior to similar features in other publications. May we express the hope that it will be continued in essentially its present form.

D. G. MURRAY
Murray-Jones-Murphy
Tulsa, Okla.

•

Dear Editor: I was very pleasantly surprised to find the NEWS REPORT in P/A. It is truly a mirror of architecture and art. I hope that the NEWS REPORT will continue to come to my home every month.

V. SENUTA
Stone & Webster Engineering Corp.
Boston, Mass.

•

Dear Editor: . . . We like it very much and would like to encourage you to continue with the same type of format. We especially like the reliable news of architectural products. . . .

A. W. ALEGRE
Alegre & Harrison
Reno, Nev.

•

Dear Editor: P/A NEWS REPORT is excellent. Let's have more and let's go!

E. A. WIBERG
Executive Vice-President
American Society of Mechanical Engineers
Tuchschmidt & Associates
Chicago, Ill.

(Continued on page 72)

snow-melting in 1911

Dear Editor: In the article, "Snow-Melting with Wrought-Iron Pipe," in FEBRUARY 1959 P/A, credit is given to the Rochester (N.Y.) Gas & Electric Corporation steam-heated sidewalk constructed in 1925 as the first recorded installation of a mechanical snow-melting system. I would like to record an earlier one.

The street and entrance sidewalks in front of the "Amlot" apartment house, 360 Genesee St., Utica, New York, were equipped with snow-melting pipes when that building was built in 1911. The builder and designer was my father, Fenton W. Johnson, who was not an architect but included designing apartment houses and snow-melting systems among other accomplishments.

The apartment-heating system is steam but I believe he used a converter and piped low-temperature hot water under the sidewalks. The system worked well for a number of years and created a great deal of comment in Utica. I was not aware that my father invented the system, but he may have done so.

I believe that a later owner let the pipes freeze up in the early '20s and they probably were never repaired.

HUGH B. JOHNSON
McGaughan & Johnson
Washington, D. C.

quantity vs. quality

Dear Editor: I thought I detected in your NEWS REPORT on the Grand Central City project (MARCH 1959 P/A) a note of concern. This mere note should have been a roar of protest and indignation. What is going to be inflicted on this helpless city challenges all rational and decent standards with a triple offense: sociologically, esthetically, and ideologically.

It is most unlikely that any of the gentlemen who finance and design this "world's largest" office building have ever descended to subway level at 9 A. M. or 5 P.M. They have never witnessed that

(Continued on page 61)

George A. Sanderson, Feature Editor of PROGRESSIVE ARCHITECTURE, died April 12 of a heart attack at his home in New York. He will be sadly missed by his colleagues and by his friends in many parts of the country.

George had been a valued member of the P/A Staff since 1944, when he came to the magazine from duties in the Office of War Information — a wartime assignment that interrupted his journalistic career after working with *Newsweek, Sweet's Catalog, Architectural Record,* and for a time in California, as Building Editor of *Sunset.* A native of Massachusetts, he attended Groton and held degrees from Yale and MIT. Before journalism called, he worked as an architect in California and in Boston.

George was warm and sympathetic to work with, although an editor with strong views about personalities, events, and architecture—especially design quality. His desire was always to document good work and to applaud the fine men of the profession. Architects found him an ever friendly critic.

George A. Sanderson
1906-1959

(Continued from page 59)

nightmarish moment when the crowds are caught in total paralysis because no one can move. They have never heard women scream, literally, scream with pain being punched into the subway cars so that the doors may close; they have never watched the older workers cling frantically to platform columns for fear of being pushed onto the tracks. Those people do not live in New England villas. They live in tenements in the Bronx and Brooklyn. They have to catch that train or be late and lose their jobs. The indignity of their way to work, the brutality of their meal hour when thousands try to grab a cheap bite along fountains and counters, shows in their faces and their manner.

Esthetically, there was one moment of relief for the eye in the linear wasteland of our avenues. The Grand Central Tower had an outline, *a profile,* a play of light and shadow that reminded the weary senses that someone once had cared to provide a solid substance as a syncope in the amorphous mass of indifferent shapes. So modest have we become in our claims for visual identification that even the eclecticism of 1929 has been gratefully received. Together with the Terminal Building, the tower provided *human* scale and architectural personality: something even to attack, but of its own character. This now will be lost against the umptiest glass curtain wall which boasts as highest design achievement one more facet than Ponti's Milan edition, or the "Zeckendorf Hotel" (illustrated two pages later in your NEWS REPORT). But, oh, how beautiful does its narrow side photograph! Cleopatra's Needle is a piece of wet liver compared to this "sleek beauty." Yet no one will ever see it that way. The model shot is a fraud, as all such shots are: what we will see is the refrain of a very old song.

In the passionate arguments that have gone back and forth about this project, the participation of two of our most renowned educators has stirred the deepest protest. Those kind enough to look for apologies have pointed out that Roth would have built "the world's largest," anyhow—with or without the pedigrees of Gropius and Belluschi. For anyone engaged in the education of young architects, this is a dreary justification. By blurring over the lines of ideal and compromise, our standards go down the drain. This would be true in any case where an architect of fame is willing to sell out to a promoter. In the case of Gropius and

(Continued on page 62)

(Continued from page 61)

Belluschi it is a profound tragedy. There is no need to analyze this tragedy and its implications. All that is needed is to quote verbatim a few sentences from the much publicized speech, "Apollo in Democracy," Dr. Gropius gave in 1957 on the occasion of receiving the Hanseatic Goethe Prize:

"Instead of leading by moral initiative, modern man developed a mentality which leans mechanistically on quantity instead of quality and serves predominantly utilitarian ends instead of building up a new spiritual faith. . . . In our technological society we must passionately emphasize that we are still a world of human beings, and that man must stand in his natural surroundings as the center point of all planning and building. Until now we have so worshipped our new idols, the machines, that our spiritual concepts of value have slipped away. Therefore we should first re-examine the fundamental relationships between man and man, and between man and nature, and not yield to the pressure of special interests or short-sighted enthusiasts who see mechanization as an end in itself. *Only too often nowadays we still meet with a deep-rooted tendency to avoid far-reaching concepts of planning, and, instead to set down inorganically a number of unrelated partial improvements.* . . . This thought of helping regain cultural balance has dominated my life."

SIBYL MOHOLY-NAGY
Pratt Institute
Brooklyn, N. Y.

fame everlasting

Dear Editor: Hello—after many years of silence! The reason for writing, among other things, is to mention the curious phenomenon which persists: people still seem to think I am writing my OUT OF SCHOOL series for P/A. It is the damnest delayed action. I run into them at meetings, conventions, and on the street. Then recently I received a letter from a young professor at Midwestern University as follows:

"Recently I was interested in reading several of your OUT OF SCHOOL articles for P/A in 1950 and 1953. In fact, I've assigned them as reading for the office-practice course which I teach. It is my belief that continuous and consistent co-ordination of the various planning and design professions is essential to the successful development of any project concerned with the physical environment. With effective co-ordination, we may well create an environment within which man may more fully enrich his physical and spiritual values. As a designer, I feel that the form of our physical surroundings undoubtedly plays a more important role in the formation of attitudes and culture than most people would assume."

Such—apparently—is immortality.

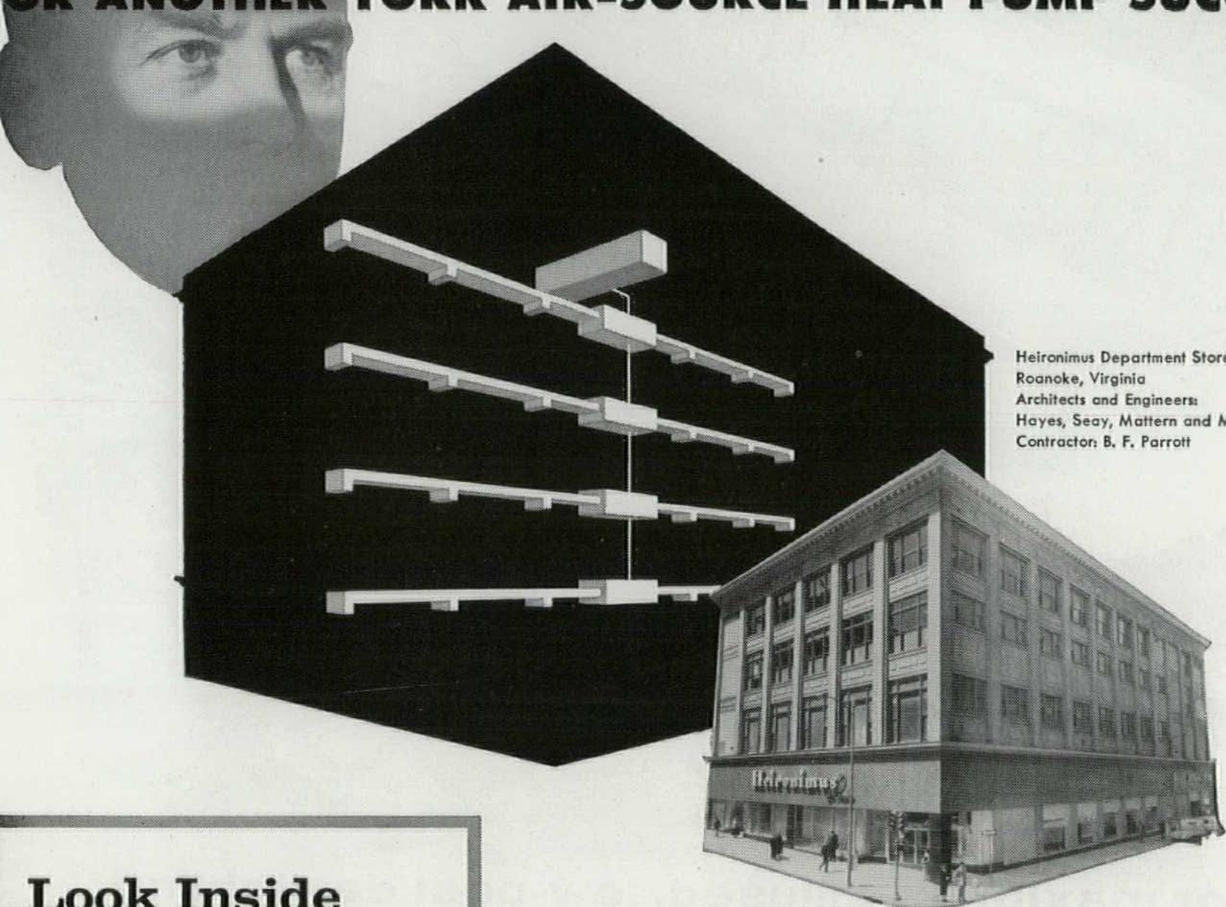
CARL FEISS
Planning and Urban Renewal Consultant
Washington, D. C.

p/a awards praised

Dear Editor: Needless to say, we were deeply honored and flattered that our project was selected for top honors by PROGRESSIVE ARCHITECTURE. We were convinced that we had an outstanding con-

(Continued on page 66)

Look Inside THIS DEPARTMENT STORE FOR ANOTHER YORK AIR-SOURCE HEAT PUMP SUCCESS



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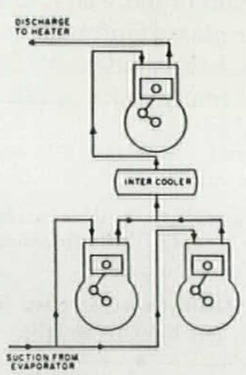

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(Continued from page 62)

ception from our architects, but it was nice to have our opinion receive the seal of approval by such outstanding and distinguished experts as yourselves.

And I know the award meant a great deal to the Sacramento Redevelopment Agency. In competing for this proposal, we did not make any presentation or brochure of what we would contemplate doing in Sacramento. We simply showed them work we had done in the past on other projects, and gave them our pledge that we would put together an outstanding team of creative architects to do the finest possible job for their community. They awarded us the project, accordingly, without our having put pencil to paper on a specific proposal for Sacramento. It was a pure act of faith on their part that we would do a first-rate job. So I know they took great satisfaction and great pride in the fact that we did come up with a plan that apparently was of such distinction, and that their judgment and confidence in us was thereby validated. I am sure you made the five members of the Sacramento Redevelopment Agency very, very happy indeed.

As a final note, I think the affair of the awards dinner, as well as the discussions on the following day, could not have been handled with more finesse. They were interesting, stimulating, never dragged, and were thoroughly enjoyed by all concerned. I congratulate you, not only on your good judgment in selecting the award winners—that goes without saying—but also on the expert and sensitive fashion in which both the dinner and the subsequent day were arranged.

JAMES H. SCHEUER
Chairman, Executive Committee
City and Suburban Homes Co.
New York, N. Y.

winner criticized

Dear Editor: In JANUARY 1959 P/A I noted that the one religious example cited had a choir and organ separated by the width of the church. You may remember that I am, with you and one of the Jurors, a member of the Commission on Architecture of the National Council of Churches, and that I am Chairman of the Joint Committee on Church Architecture and Music. In my judgment a church cannot have good music in worship with such spatial separation between choir and organ. In light of the importance of this matter, how can it be such a fine design, in spite of other features that might represent excellence in design? What does the architectural program say about requirements for music?

BERTRAM Y. KINZEY, JR.
Associate Professor
Department of Architecture
Virginia Polytechnic Institute
Blacksburg, Va.

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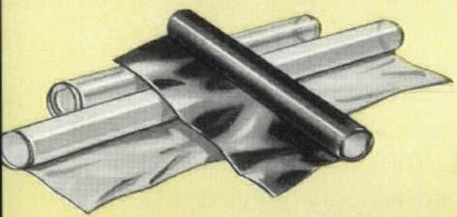

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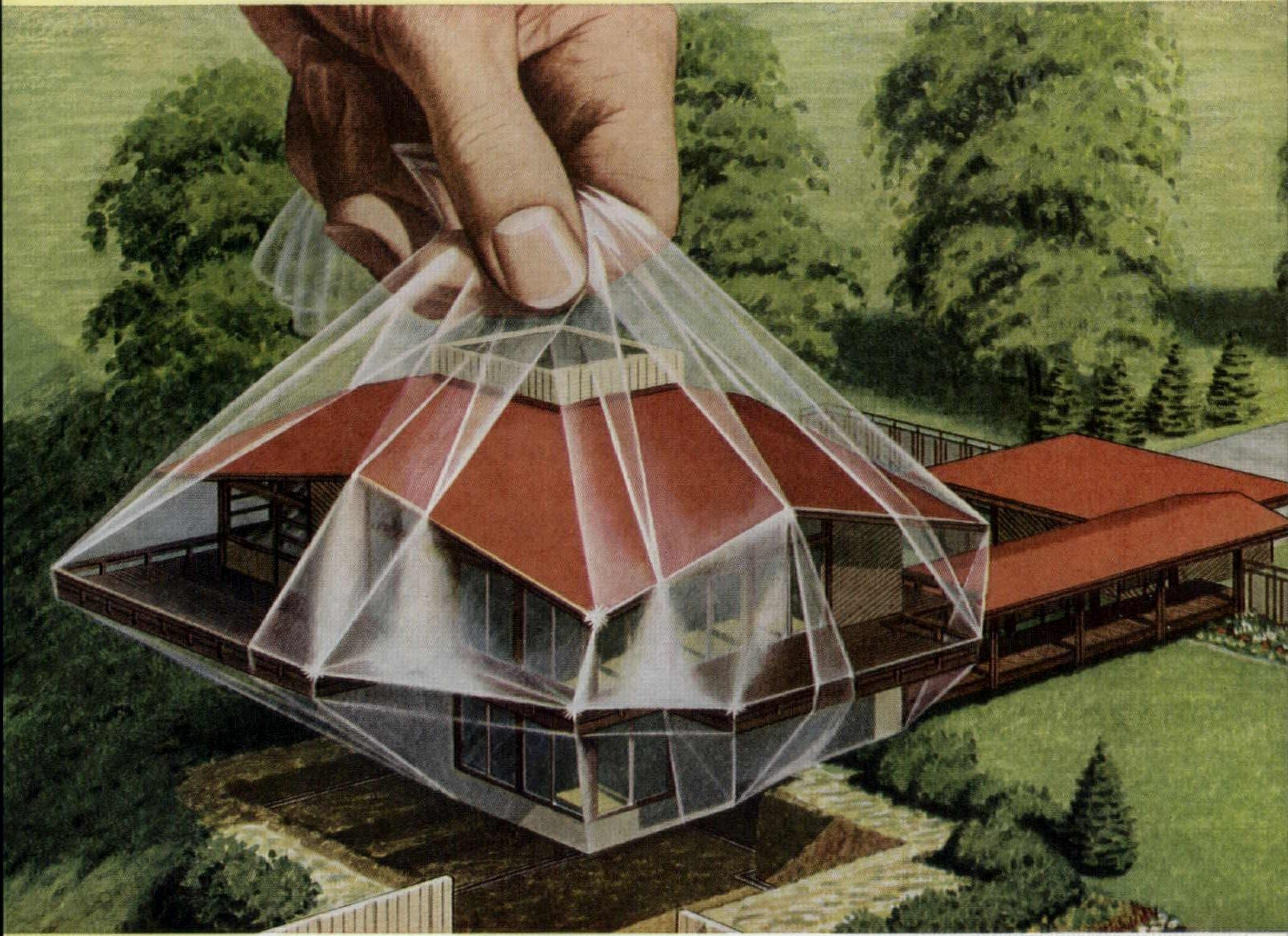

ARCHITECT: ELEANORE PETTERSEN, A. I. A.

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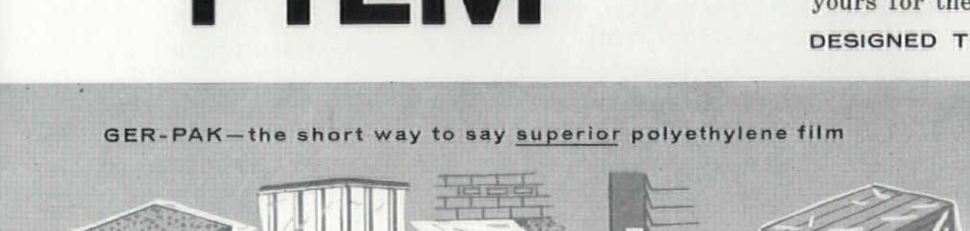

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(Continued from page 59)

Dear Editor: When P/A arrives in our office we all seem to read the NEWS REPORT first. It's a feature we like and we hope it becomes a permanent part of your magazine.

CRAIG ELLWOOD
Craig Ellwood Associates
Los Angeles, Calif.

•

Dear Editor: The part I like most is the fact that you cover a great number of people this way each month, and usually I know personally a fairly high percentage of the architects reported on, and it gives me an opportunity to become a little more aware of what they are doing. I hope that you continue the NEWS REPORT as a feature in the magazine.

A. QUINCY JONES, JR.
A. Quincy Jones-Frederick E. Emmons
Los Angeles, Calif.

•

Dear Editor: P/A NEWS REPORT has been, for me, filling a gap in short, concise architectural news, which has appeared to be fairly interesting to date. The idea is meeting with great success in this office.

W. EARL WEAR
Pacific Palisades, Calif.

•

Dear Editor: Perhaps one of the most difficult things for an architect to do is to grasp the progress of his profession as related to a national and international trend. The P/A NEWS REPORT obviously is a great aid in this direction for it puts in a few pages the current and proposed work that is being done. Such a section can give an insight to the esthetic and philosophical thinking of his contemporaries.

JOHN C. CAHILL
Collins-Kronstadt & Associates
Washington, D. C.

•

Dear Editor: We find your P/A NEWS REPORT very helpful. It gives us a quick idea of the best that is being designed and built; it also gives us a handy way to keep our manufacturers' literature file right up to date.

LEIGH S. WOODWARD
David J. Abrahams & Associates
Boston, Mass.

•

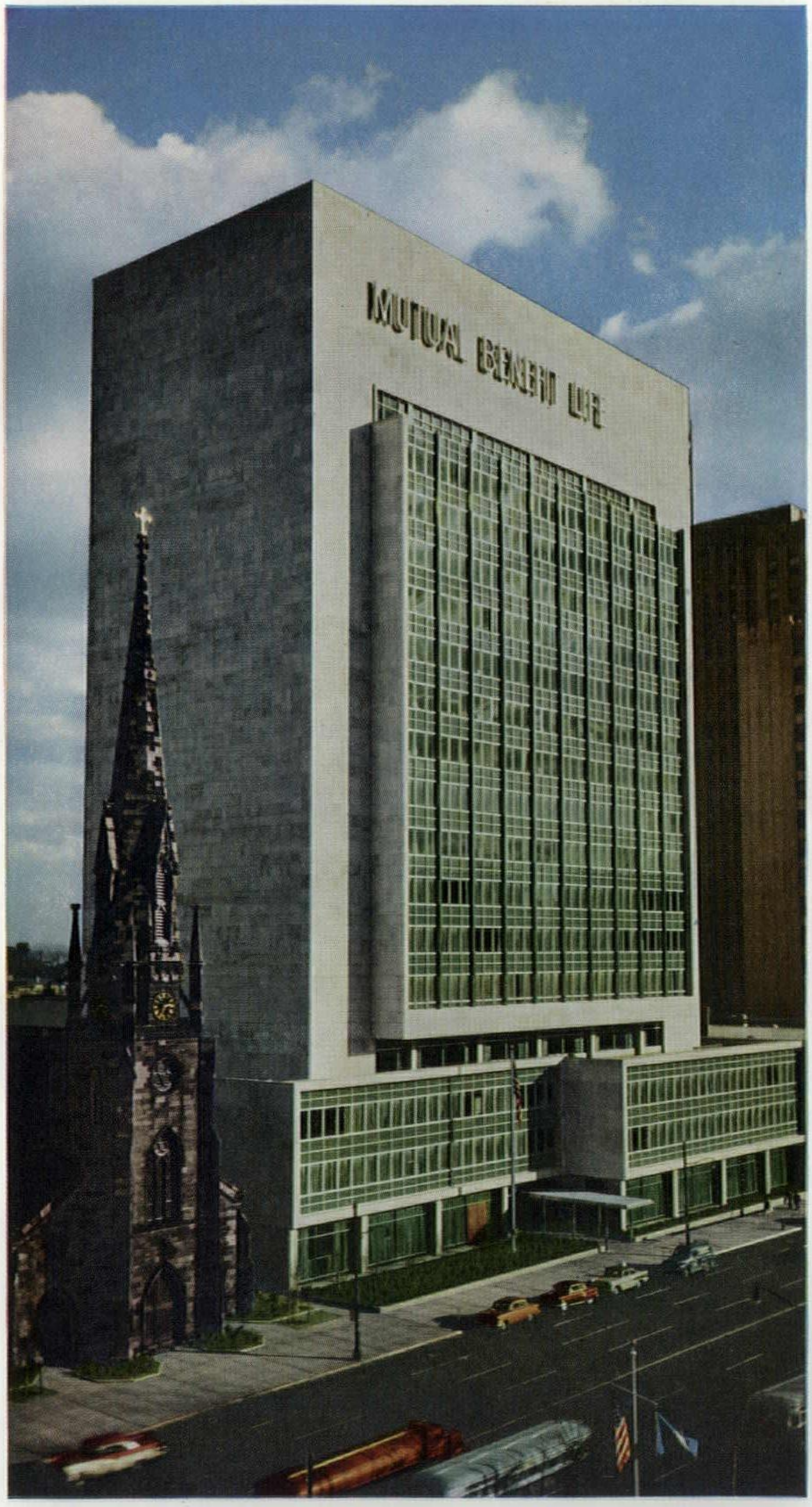
Dear Editor: For some time I have followed with interest the P/A NEWS SURVEY section of PROGRESSIVE ARCHITECTURE and was agreeably impressed with its concise, factual presentation. The P/A NEWS REPORT seems an expansion of this attractive feature. Particularly interesting is the compilation of manufacturers' new products in a comprehensive survey. . . . The format is good. The ivory-colored pages give this section a desirable distinction.

A. M. McINTYRE
Stone & Webster Engineering Corp.
Boston, Mass.

•

Dear Editor: . . . Wish to inform you that we are well impressed with the [NEWS REPORT] idea and feel that it is a notable advance for your particular journal. The practice of architecture seems to be getting more complex by the day and "straight-from-the-shoulder" condensed information of this nature is a very welcome time-saver. Thus far your material is "meaty" and also conveys the feeling of authenticity. We hope that this feature will become a permanent section of P/A. We value your magazine highly.

E. E. NEWCOMB
Glover & Newcomb
Topeka, Kans.



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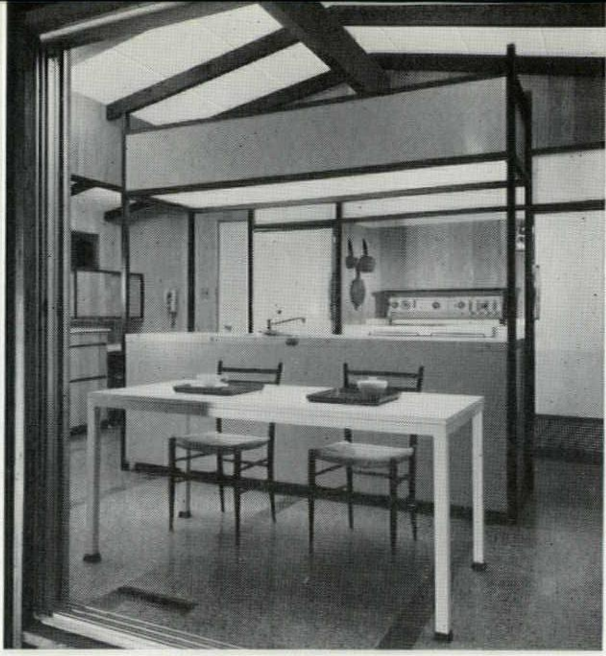
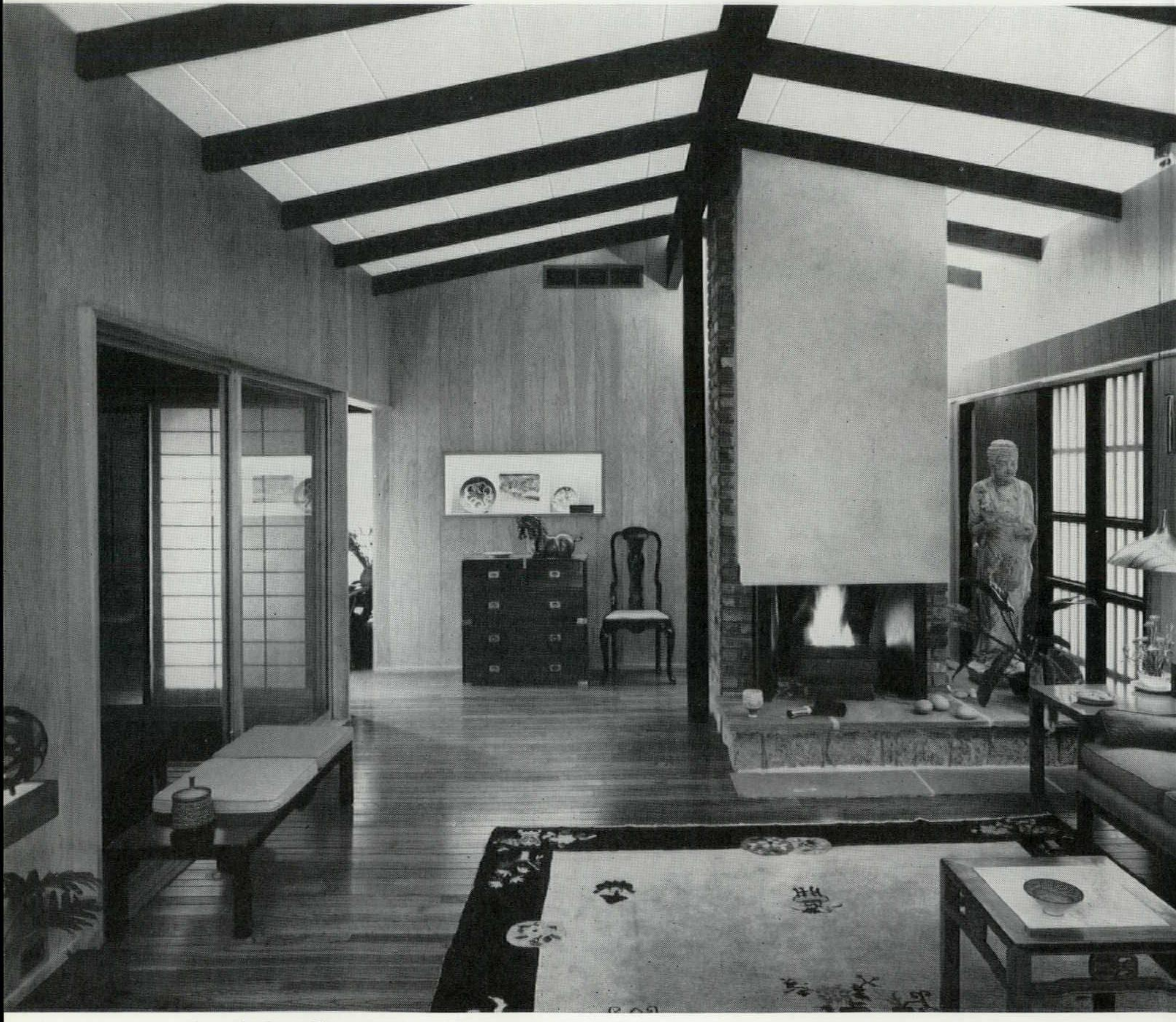


Kitchen dining area. Architect David Leavitt, AIA, is a partner in Leavitt & Henshell, New York City.

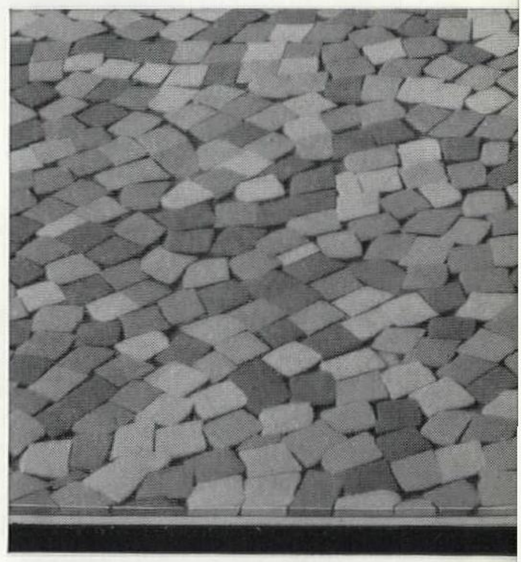
Home is designed on 3′ module with four roof heights. Highest is over the living room.



Photos by Ernest Silva, courtesy Living for Young Homemakers

There's an Armstrong Floor precisely right for any particular interior . . .

AT TAKASHIMAYA DEPARTMENT STORE, NYC, THAT FLOOR IS the Tessera Series IN Armstrong VINYL CORLON



Color chips are actual size in foreground. White line is alkali-resistant Armstrong Hydrocord Back.

The ordered elegance of Japanese domestic architecture is the perfect environment for the lacquered tables, parchment lamps, and other furnishings sold here, in the new Takashimaya department store. The architects used the Tessera Series in Armstrong Vinyl Corlon to adapt their Japanese design to the rigorous practical needs of a Manhattan store.

"Tessera's" delicate mosaic pattern—composed of colored vinyl chips set in a bed of translucent vinyl—contrasts richly with the plain surfaces of other structural materials. The beige coloring suggests the traditional tatami mats and harmonizes with the frames of the shoji. Being monochromatic, "Tessera" provides a unifying background for the varicolored displays.

In regard to service, "Tessera" is a heavy-duty floor comparable in performance to battleship linoleum that will decorate Takashimaya for a long time. Its superior resistance to abrasion and furniture loads and the smooth, virtually seamless surface assure easy, economical maintenance for many years.

Technical data on "Tessera" (for samples and complete specs, contact your Armstrong Architectural-Builder Consultant) **composition:** chips are tinted, opaque vinyl, set in a bed of translucent vinyl; **surface resistance:** excellent for grease, alkalis; very good for solvents, detergents; **ease of maintenance:** superior; **static load limits:** 75 psi; **underfoot comfort and quiet:** good; **over-all thickness:** .090"; **wearing-surface thickness:** .058"; **available in:** seven monochromatic colorings; in 6' wide rolls; **installed price:** 75-90¢ per sq. ft.

N.B. The exclusive, alkali-resistant Armstrong Hydrocord Back permits "Tessera" to be used over below-grade and on-grade subfloors, as well as above grade. "Tessera" may also be installed over lightweight aggregate concrete slabs of proper density.

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Asphalt Tile 3/16" (A,B)	Asphalt Tile 1/8", 3/16" (greaseproof)
Linoleum .0625"	Linoleum .125" Battleship
	Cork Tile 3/32"
	Excelon Tile .0625" (Vinyl Asbestos)
45¢ - 60¢	**60¢ - 70¢**
Vinyl Corlon .070"	Vinyl Corlon .070" (Hydrocord Back)
Linoleum .125"	Rubber Tile 1/8"
Cork Tile 1/8"	Cork Tile 3/16"
Excelon Tile 1/8" (Vinyl Asbestos)	Linotile 1/8"
70¢ - 90¢	**90¢ and over**
Vinyl Corlon .090" (Hydrocord Back)	Custom Corlon Tile 3/32", (Homogeneous Vinyl) 1/8"
Rubber Tile 3/16"	Custom Vinyl Cork 1/8"
Custom Corlon Tile 3/32", 1/8" (Homogeneous Vinyl)	Opalesq Vinyl Tile 1/8" (Homogeneous Vinyl)
Cork Tile 5/16"	

Takashimaya Inc., Fifth Avenue, NYC
architects: Steinhardt and Thompson, NYC, associated with Junzo Yoshimura, Tokyo
floor: the Tessera Series in Armstrong Vinyl Corlon No. 86535

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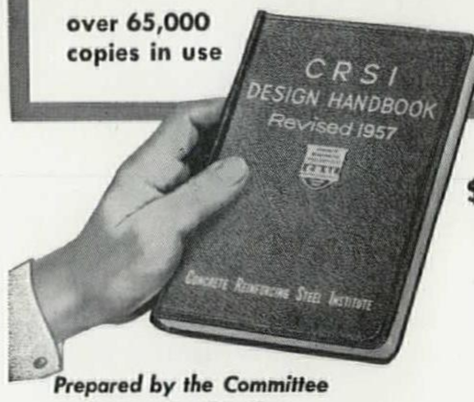

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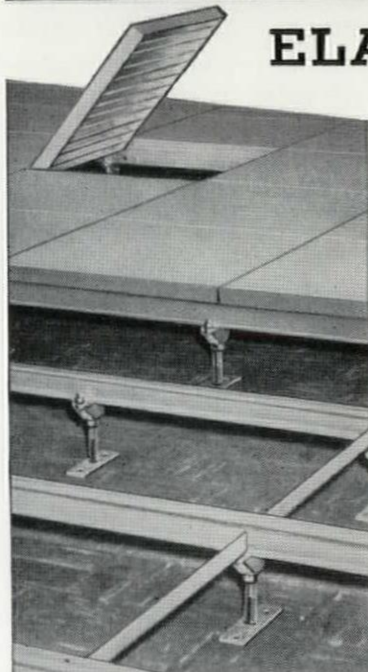

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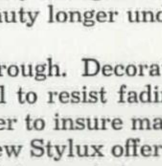

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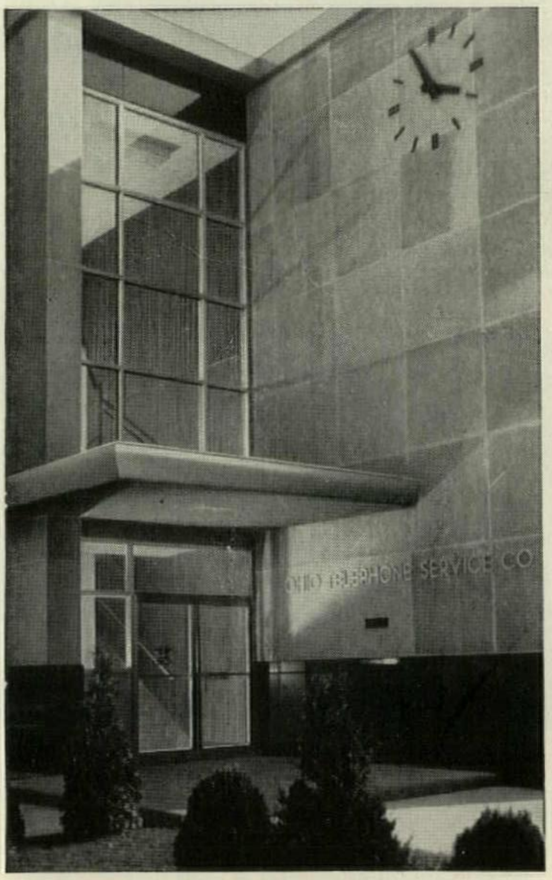
PROGRESSIVE ARCHITECTURE
news report

- Architecture Comes of Age in Israel (above)
- Stone Evokes Bernini in New Orleans
- Plastic Laminate Combines Light Diffusion, Sound Control

NEWS BULLETINS   WASHINGTON   NEW PRODUCTS   MANUFACTURERS' DATA

General business office of the Greenville, Ohio, Telephone Company, with Consoweld Platinum Walnut woodgrain pattern on the walls. Consoweld was applied directly over gypsum board. It is also used in the entry, stair halls and corridor, operators' lounge, long-distance operating room, and the manager's office.

Consoweld Laminated Plastic Beautifies Walls, Saves Construction Time on Telephone Building



Entrance to the attractive new building of Greenville, Ohio Telephone Co. Freytag and Freytag, AIA, Sidney, Ohio, were the architects; Fry Construction Company, Greenville, O., was the builder. Consoweld was supplied by Fiddes-Moore, distributors, at Dayton, Ohio.

The use of Consoweld laminated plastic as surfacing for walls cut construction time three weeks on the Greenville, Ohio, Telephone Company building, according to C. W. Fry, of Fry Construction Company.

Consoweld Saved 3 Weeks . . . The architect, Ferd E. Freytag, recommended laminated plastic to eliminate the three-weeks' drying time for plaster before delicate electronic equipment could be installed. Another brand of conventional 1/16-inch thickness, originally considered, would have had to be cemented to plywood. Consoweld 10, 1/10-inch thick, could be applied directly over the gypsum-board walls. Another factor in the choice was Consoweld Twin-Trim matching mouldings, which provide unbroken areas of color.

Woodgrain Patterns Used Throughout . . . Consoweld Platinum Walnut pattern is used in the business office, entrance hall, stair hall, and corridor. The long-distance switchboard room has Harvest Brown Birch on the walls; in the operators' lounge is Honey Maple, and in the office of Manager H. F. Clapper, the walls are Consoweld Red Mahogany pattern. According to Contractor Fry, Consoweld cost no more than plastering and painting, and its use enabled his company to complete the job several weeks earlier.

Because of its freedom from dust, dirt, and maintenance, Consoweld is extremely desirable for telephone buildings and other locations where electronic equipment is used.

Mail the coupon for more information on how you can save time and money by using Consoweld on walls, wainscoting, and counter tops for buildings and homes.

61

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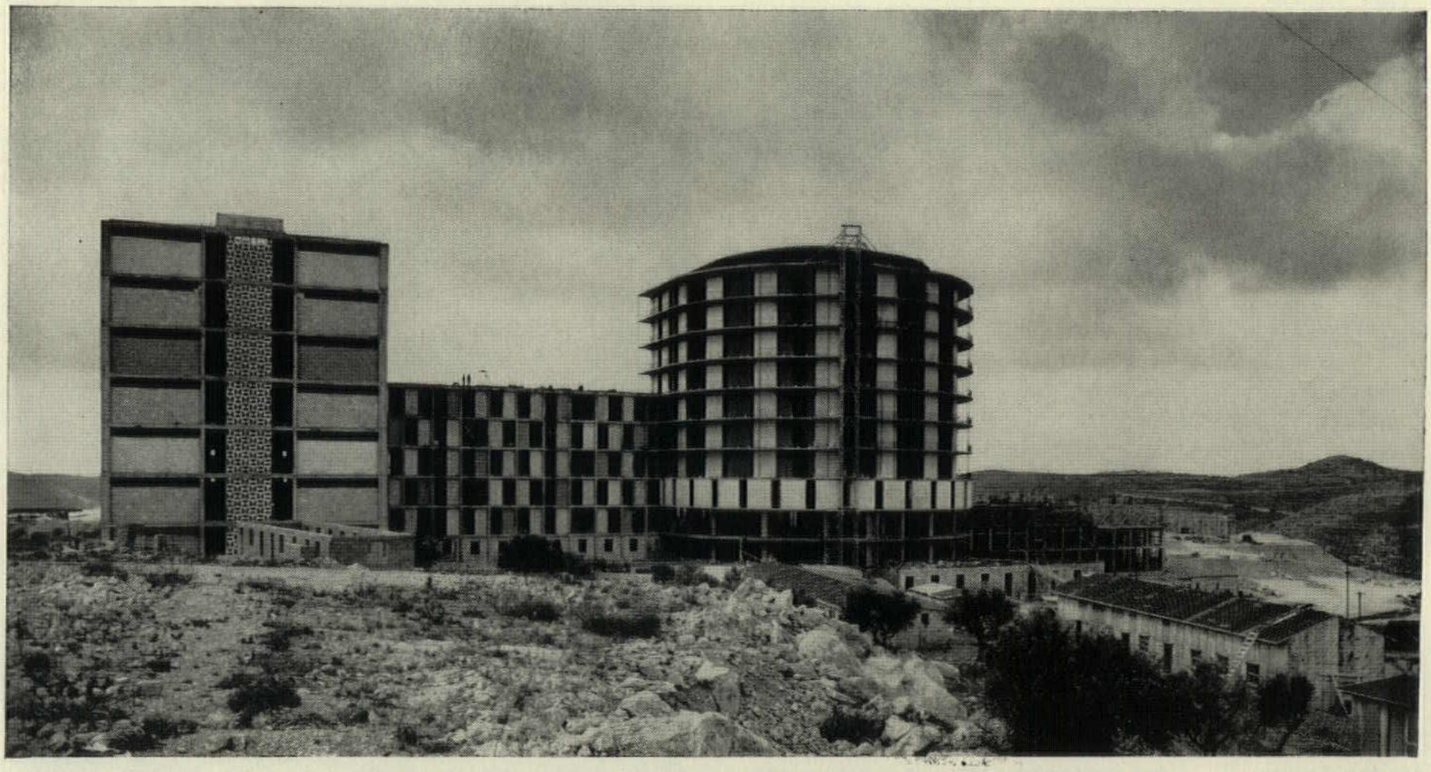


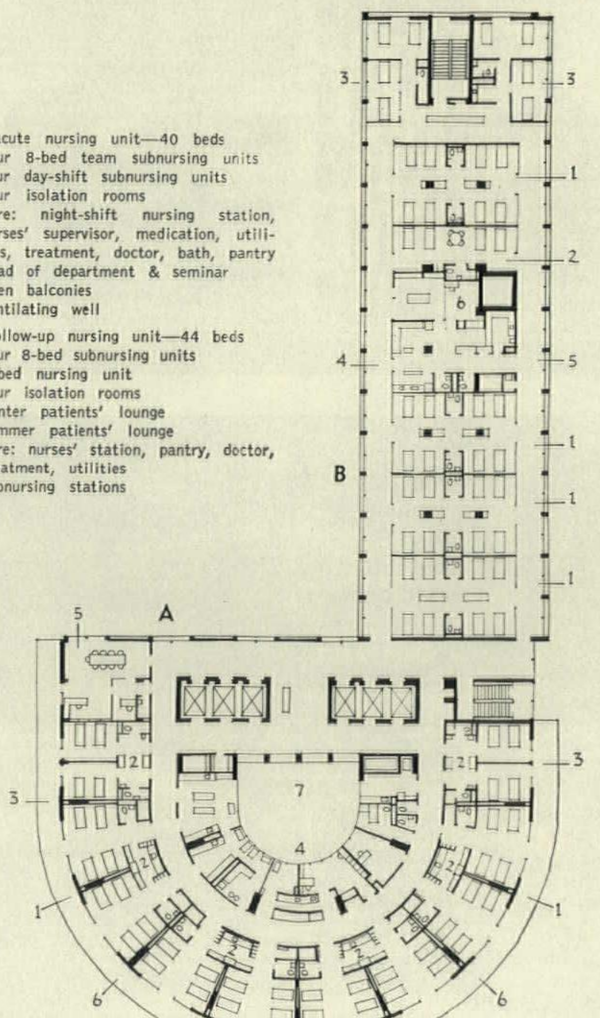
Israel photos: Julius Shulman

ARCHITECTURE COMES OF AGE IN ISRAEL

Medical Center Is Newest Major Building

A acute nursing unit—40 beds
1 four 8-bed team subnursing units
2 four day-shift subnursing units
3 four isolation rooms
4 core: night-shift nursing station, nurses' supervisor, medication, utilities, treatment, doctor, bath, pantry
5 head of department & seminar
6 open balconies
7 ventilating well

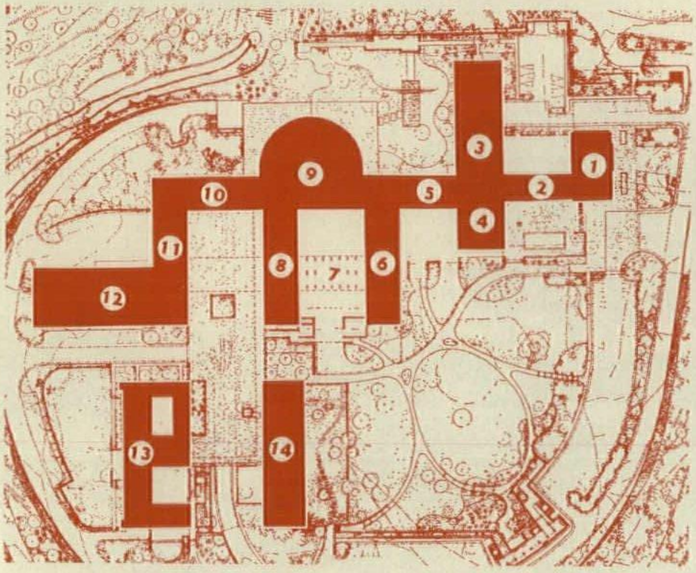
B follow-up nursing unit—44 beds
1 four 8-bed subnursing units
2 4-bed nursing unit
3 four isolation rooms
4 winter patients' lounge
5 summer patients' lounge
6 core: nurses' station, pantry, doctor, treatment, utilities
7 subnursing stations

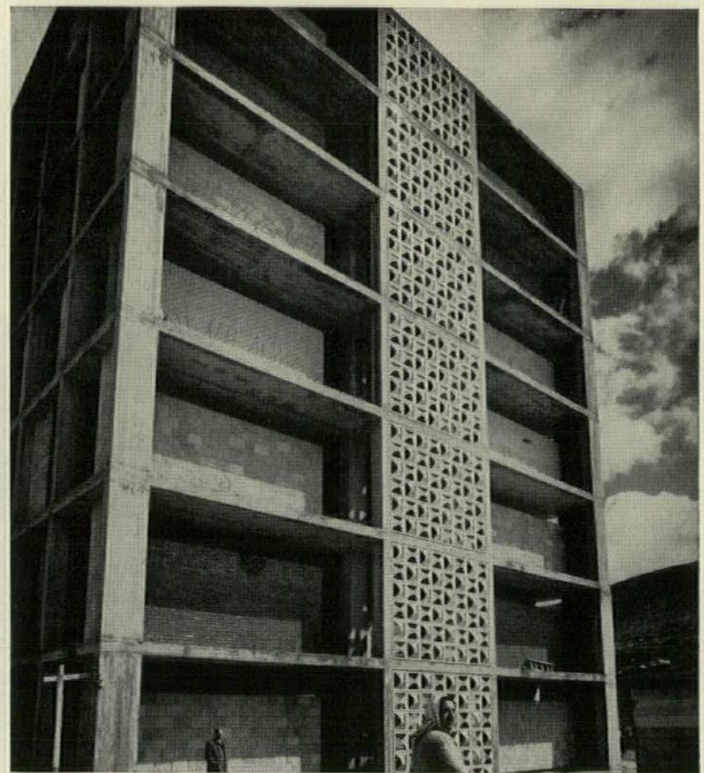


JERUSALEM, ISRAEL—The upsurge of good design in Israel described on page 91 is made patent by one of the largest projects to approach completion—the Hadassah Hebrew Medical Center. Designed by Architect Joseph Neufeld, New York, the Center contains a 500-bed hospital, 40-bed maternity pavilion, outpatient clinic, nursing school and residence, medical school, dentistry and pharmacy schools, clinical research and student laboratories, lecture halls, main auditorium, and synagogue.

A unique feature of the Center is the radial nursing unit

1 main auditorium
2 lecture halls & administration
3 research laboratories
4 students' laboratories
5 clinical laboratories
6-7 outpatient clinics
8 follow-up nursing units, x-ray, deep therapy, hospital & o.p.d. lobbies
9 acute nursing units, operating suite, main dining hall
10 emergency admission, main kitchen & laundry
11 administration, overnight stay rooms
12 workshops & garages
13 nurses' school & residence
14 maternity pavilion

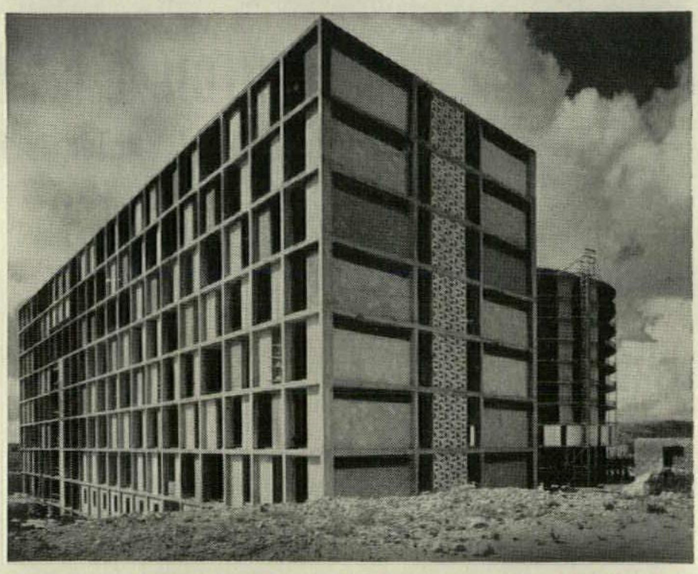


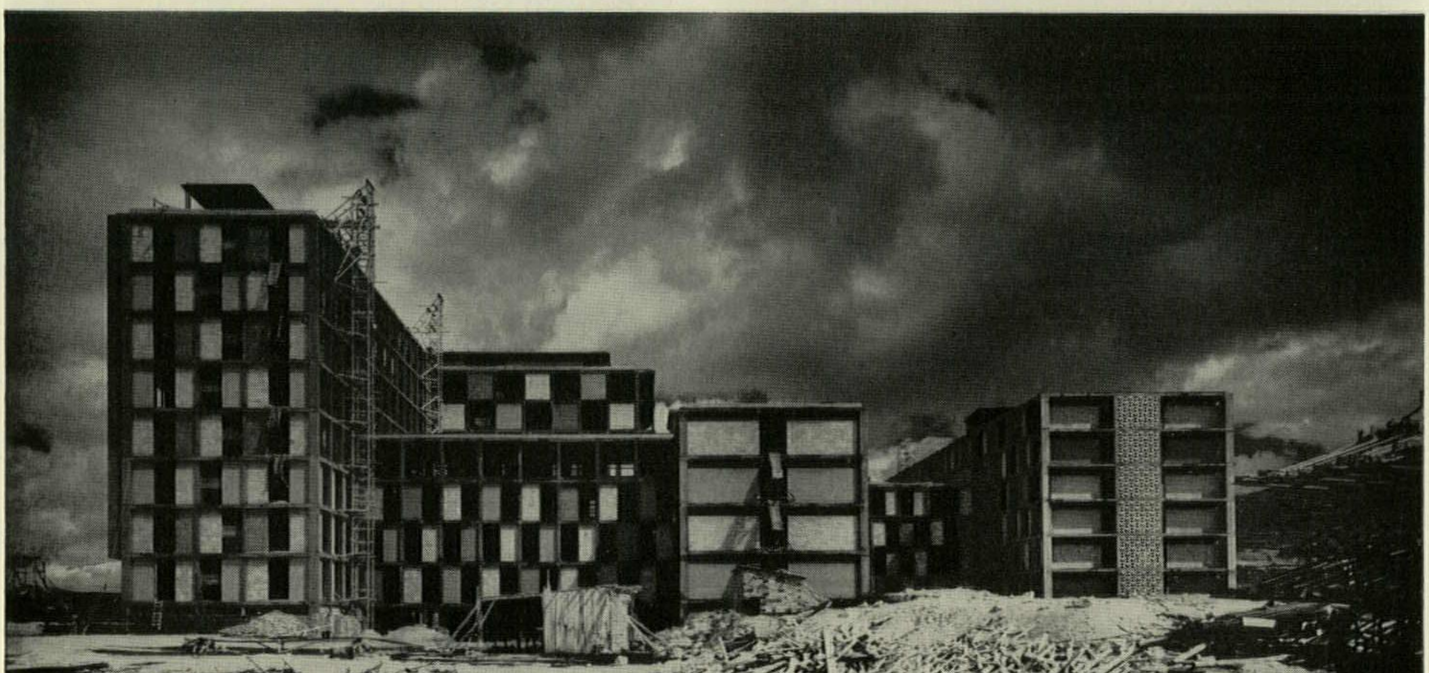


for the acutely ill. In the center of each floor, a core contains doctor's room, main nursing station, treatment room, pantry, etc. Radiating from this core are units of two 4-bed rooms and subnursing station. Convalescent patients are treated in the adjacent rectangular follow-up unit, which permits cost savings through use of a less specialized staff. Eight-bed wards and service core are flanked by two nursing and lounging corridors, which can be used alternately in winter and summer.

Exterior treatment of the Center reveals the grid pattern of reinforced-concrete structure. Squares between the exposed columns and ledges are filled with either stone, white or red brick, or sculptured precasts, with half the aperture containing an aluminum window-wall unit.

Landscape Architect—Lawrence Halprin, San Francisco; Structural Consultant—A. L. Zetlin, New York; Mechanical Engineers—Jaros, Baum & Bolles, New York.





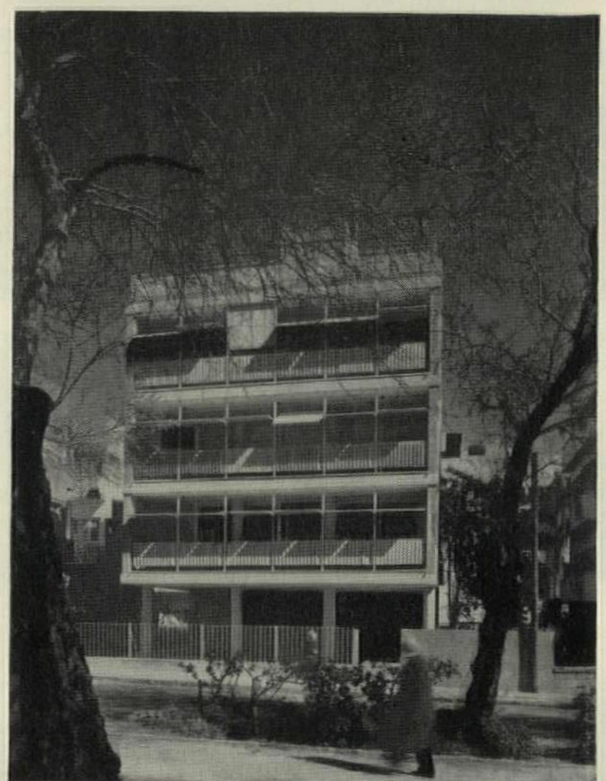
ISRAEL — 1959

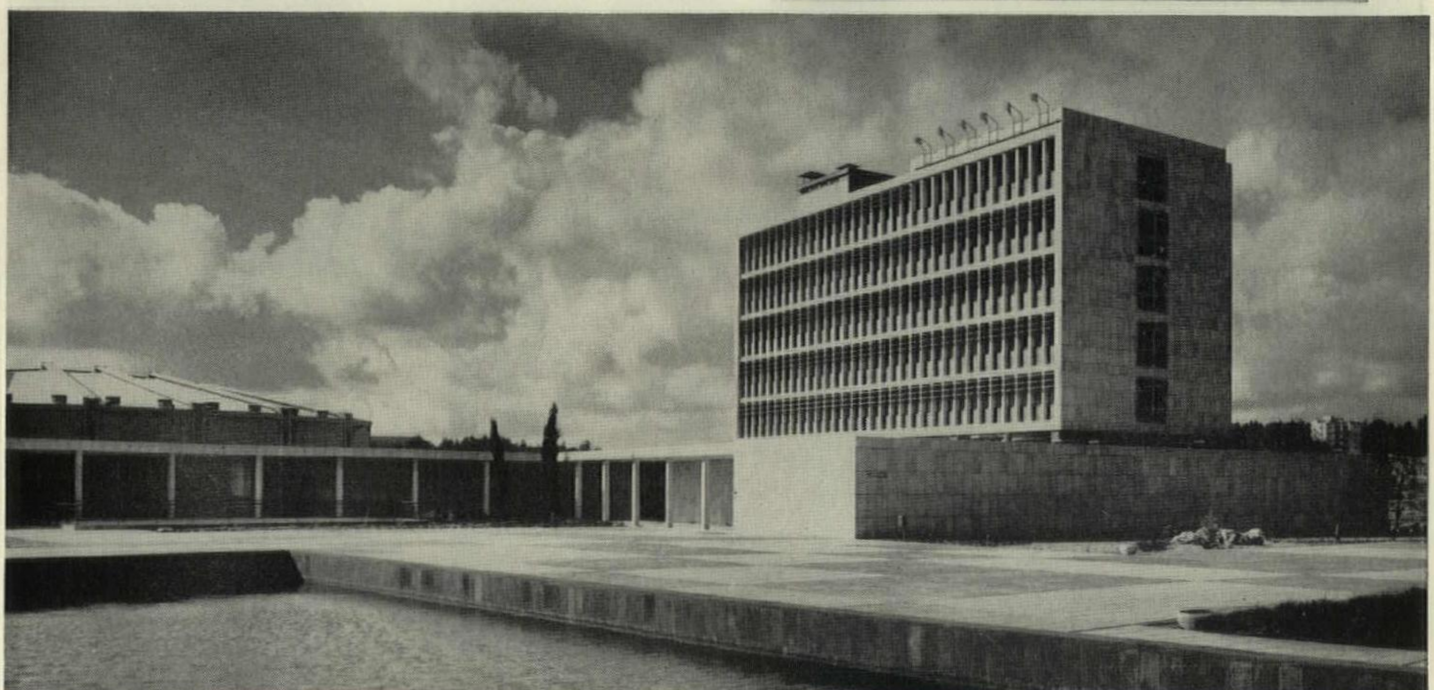
by Julius Shulman

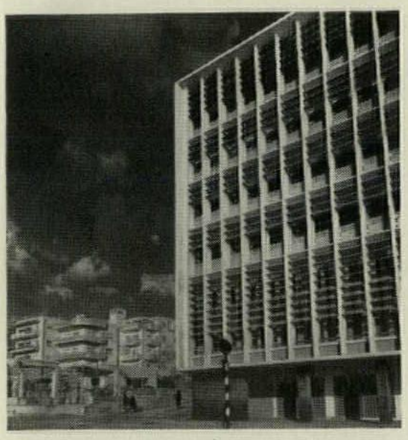
Seeing Israel recently on a swift but thorough twelve-day photographic trip was more than enough to make one realize that this young nation has arrived at a maturity far exceeding that of [some other] older nations.

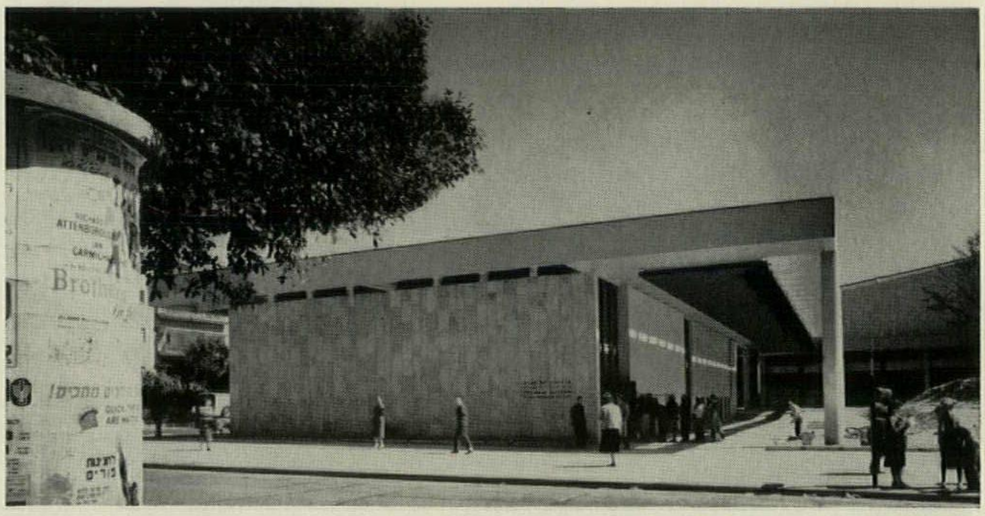
The architects of Israel are entering a new era of design thinking, resulting in the formation of a new design generation. This is an era of new materials, of more open and relaxed structural concepts. But the seriousness of the architects is still evident in their fervent devotion to function. The buildings are perhaps the most successful ones in the world from a climate-control point of view. The scarcity of wood has necessitated that masonry, concrete, marble, and the plentiful limestone be used to the fullest extent. New uses of building materials and more daring solutions are resulting in great changes in the architectural map of Israel. This is certainly apparent in the view of the Dan

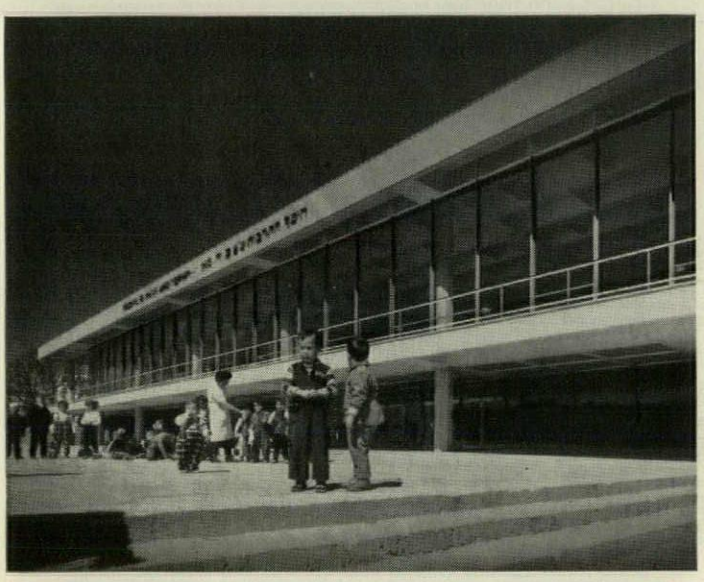
New Israeli Buildings: Winston Churchill Auditorium, Haifa (above), Sharon & Idelson, Architects; Apartment Building, Tel Aviv (right), Dov Karmi, Architect; Hebrew University Classroom & Administration Building, Jerusalem (below), Dov Karmi, Architect.







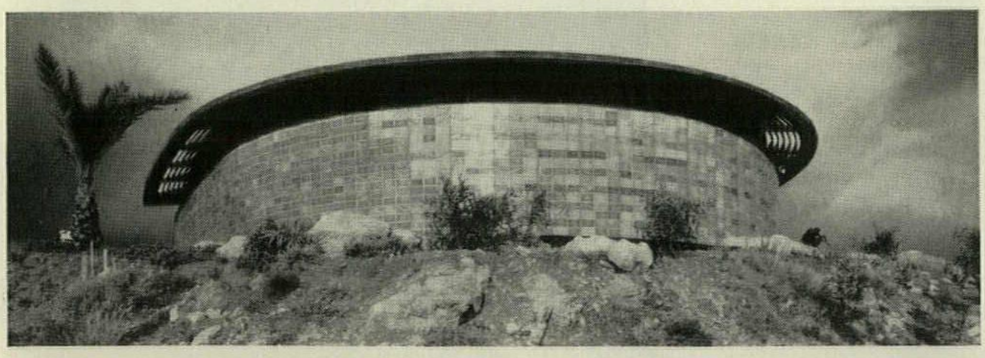


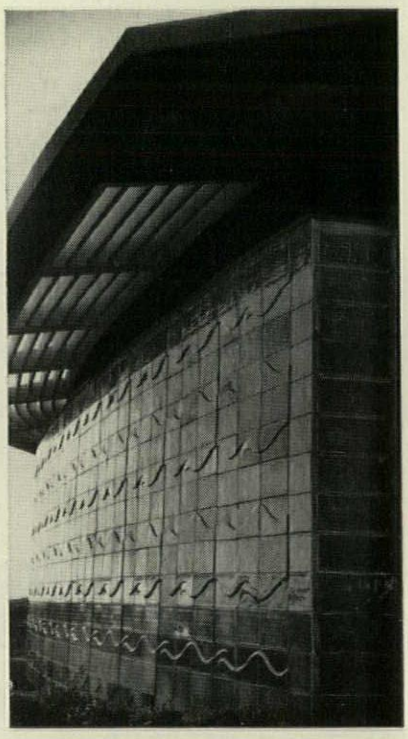


Hotel which shows, in the background, a glimpse of the almost frantically designed and constructed apartments of the Thirties.

As more funds are being made available for public buildings, and with a system of competitions for design awards, young architects are appearing. There have been private funds provided for museums and concert halls and universities. All this has hastened the pace. Indications are that there are no limits for Israel's needs for new communities. The architect's position and responsibility place him in the fore. A gigantic program of nationwide planning is his job!

New Israeli Buildings: Dan Hotel, Tel Aviv (above left), A. H. Fenchel, Architect; Helena Rubenstein Pavilion, Tel Aviv (above right), Karmi & Rechter, Architects; Frederic Mann Auditorium, Tel Aviv (left), Karmi & Rechter, Architects; Archeological Museum, Tel Aviv (below), Bauman & Whittkower, Architects.

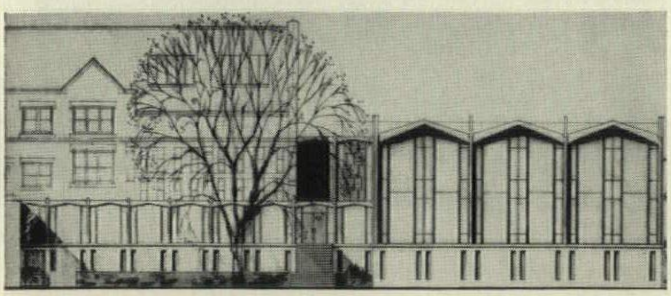




ARCHITECTURAL BULLETINS

● Eastern Air Lines announces that its new terminal at New York International Airport will be the largest passenger building in the world for use by a single airline. The terminal, now under construction, has a lobby with 220 by 130 ft of uninterrupted space (more than the arena of Madison Square Garden). Driveways for buses, taxis, and private cars discharge passengers in an enclosed area adjacent to the lobby. Building is so designed that there is no stair climbing for passengers. The late Chester L. Churchill, Boston and New York, was architect.

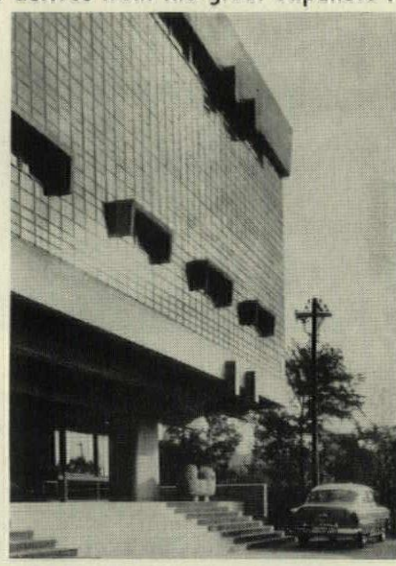
● Façade of new library wing for Harvard Divinity School will be of limestone and glass. Building will have three floors for stacks below ground, and two stories above ground for reading, study, and office space. Construction will start this spring, and the wing will be followed by an additional



building at a later date. Architects: Shepley, Bulfinch, Richardson & Abbott.

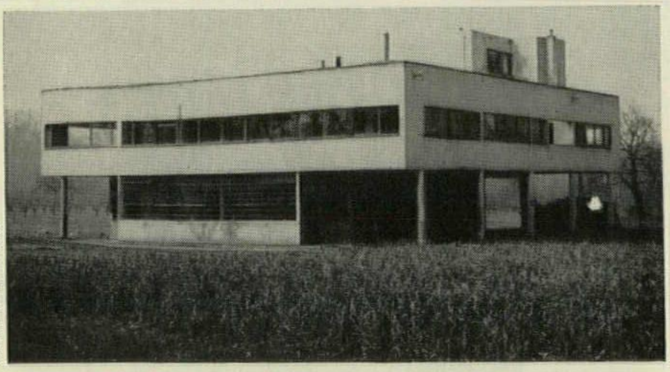
● Edward Larrabee Barnes will receive 1959 Brunner Memorial Prize in Architecture of National Institute of Arts and Letters. The $1000 award will be presented by Henry R. Shepley at the Joint Annual Ceremonial of the Institute and American Academy of Arts and Letters on May 20 . . . Twin first prizes in AIA's Sixth Annual Journalism Award Competition went to Frederick Gutheim and George McCue. Gutheim won $500 for his article on New York's Lincoln Art and Culture Center in October, 1958, Harper's, and McCue won a like amount for his articles on architecture in St. Louis Post-Dispatch.

● International Grand Prize of Architecture and Art, of the French magazine, L'Architecture d'Aujourd'hui, has been awarded to Japanese Architect Kenzo Tange. Tange won award for two works completed in 1958: Art Center in Sogetsu (shown) and Hotel de Ville in Tokyo. In awarding the prize, the Jury noted that the architect combines "very diverse qualities with an unusual felicity: taste in plastic investigation, strength of invention, excellent use of materials and quality of detail; and . . . has revealed himself as a very personal creator, whose approach to contemporary architecture derives from the great Japanese . . . tradition."



● Construction has started on the Hall of Records for County of Los Angeles, Calif. Building, which will be in Los Angeles Civic Center, will have eight floors plus basement and penthouse in main area. Exteriors will be of ceramic veneer and granite. Sun-control system of south façade will consist of series of 120-ft-high, aluminum louvers which will adjust with movement of the sun. Architects: Neutra & Alexander, Honnold & Rex, the late James R. Friend, and Herman C. Light.

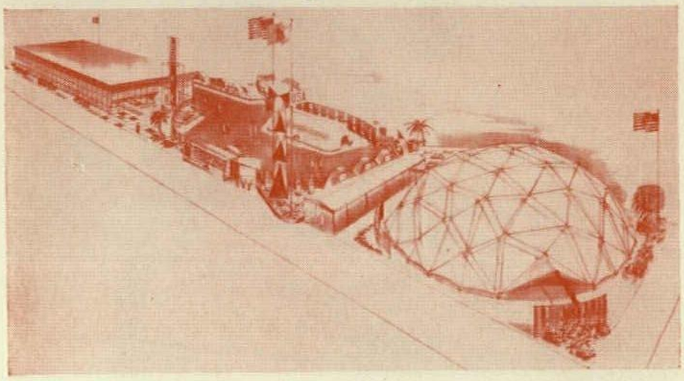
● The threatened destruction of Le Corbusier's historic, but sadly neglected, Villa Savoie at Poissy elicited a message of concern from P/A to Andre Malraux, French Minister in Charge of Cultural Affairs. The following reply was received from the Ministry of National Education: "Monsieur: The French Minister-in-Charge of Cultural Affairs, M. Andre Malraux, has asked that I acknowledge receipt of your telegram, which he found of great interest. For some time, he has been concerned regarding the threat hanging over the Le Corbusier Villa, known as Villa Savoie, at Poissy, an expression of modern architecture with which he is familiar and which he admires. In other words, the concern expressed in your telegram coincides exactly with his own sentiments, and his desire to try to save the villa. He has therefore taken the necessary measures to accomplish a surcease to the plan to demolish the Le Corbusier house. We must advise you that French law does not recognize an edifice designed by a living artist as belonging in the classification of an historical monument. The Minister, nevertheless, intends to try to find some solution that will reassure those eminent friends of French art in America, and throughout the world. Thanking you for the confidence you have expressed in him, the Minister wishes to convey his assurance of his serious attention to the matter."

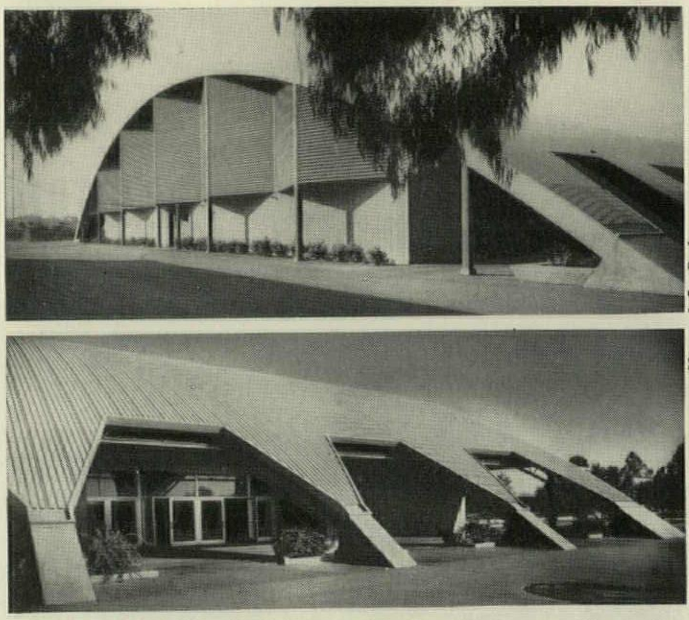


World Wide Photo

● As part of the summer-session program of University of Michigan, a Seminar will be held in Ann Arbor on June 29, on the subject of the Development of the American City. Participants will include: Dean Philip N. Youtz; Planner Charles Blessing; and P/A Editor Thomas H. Creighton.

● U. S. Exhibit at the Casablanca International Trade Fair is divided into three sections: geodesic dome housing the Circarama shown at Brussels World's Fair; central open area showing exterior displays; and a Unistrut building containing indoor exhibits. Theme of the exhibit is "New Techniques for Better Products." Designed by Stowe Myers, with Michael Griva and Murray Kasman.

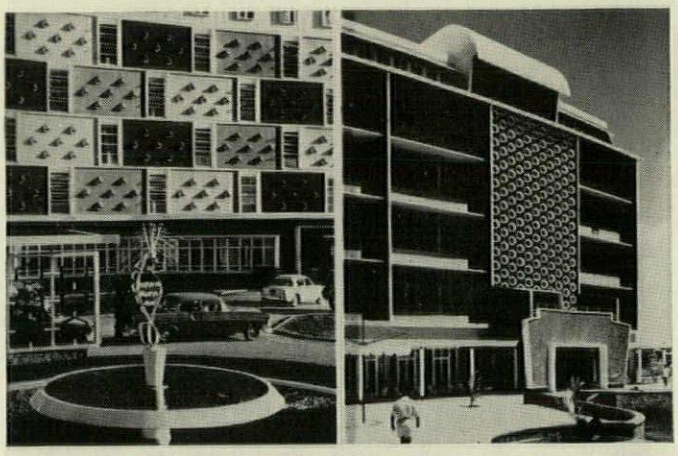




Maynard L. Parker

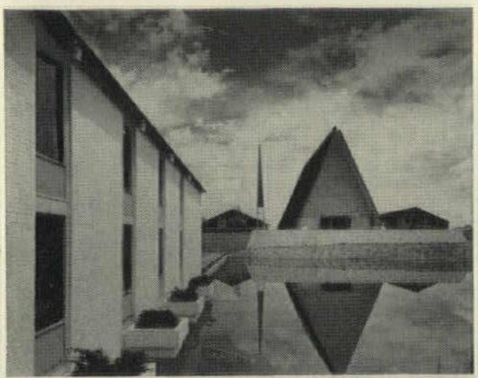
● Feature Exhibits Building at National Orange Show, San Bernardino, Calif., provides a vast, clear-span area for the exhibiting of citrus products. Major annual show is usually in mid-March; building can be used other times for different exhibit and assembly purposes. Long arched roof creates deep, buttresslike overhang at sides of building, shielding exhibitors and viewers from sun and rain. Architects: Harwell Hamilton Harris, Dallas, Texas, and Jerome Armstrong, San Bernardino.

● Oceanic Hotel on Mombasa Island, Kenya, Africa, uses trade winds of the Indian Ocean to provide natural air conditioning. Hotel, located four degrees south of the Equator, is perched atop a cliff overlooking island's harbor. Ducts on front of hotel (left) catch breezes from sea and cause them to be circulated through structure. All bedrooms are on seaward side (right).



● "Form Givers at Mid-Century" is name of architectural exhibit prepared by American Federation of Arts and sponsored by a national magazine. Opening of exhibition at Washington's Corcoran Gallery coincided with 50th Anniversary Convention of Federation. Show goes to New York's Metropolitan Museum of Art in time to open on the late Frank Lloyd Wright's birthday, June 8. Subsequent showings will be in Boston, Pittsburgh, Minneapolis, and Richmond. Architects other than Wright included in the exhibition are Gropius, Mies, Breuer, Saarinen, Wallace K. Harrison, Stone, Philip Johnson, Buckminster, Fuller, Sullivan, Neutra, Aalto, Le Corbusier, and Skidmore, Owings & Merrill.

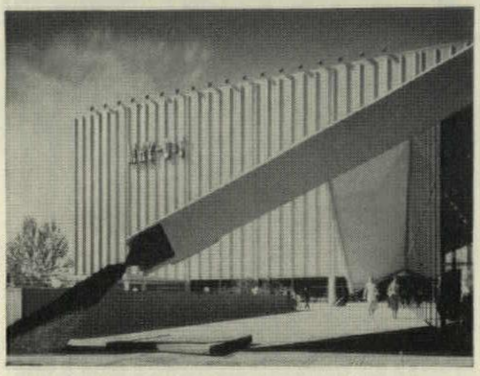
Alexandre Georges

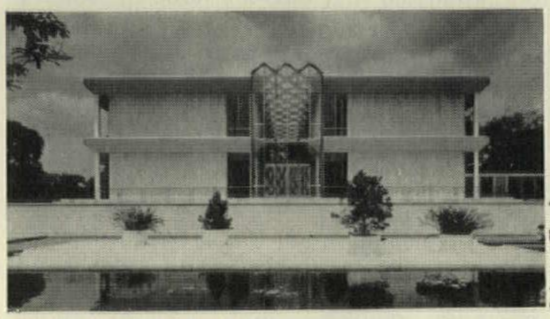


Morley Baer

Frank Lotz Miller

Warren Reynolds





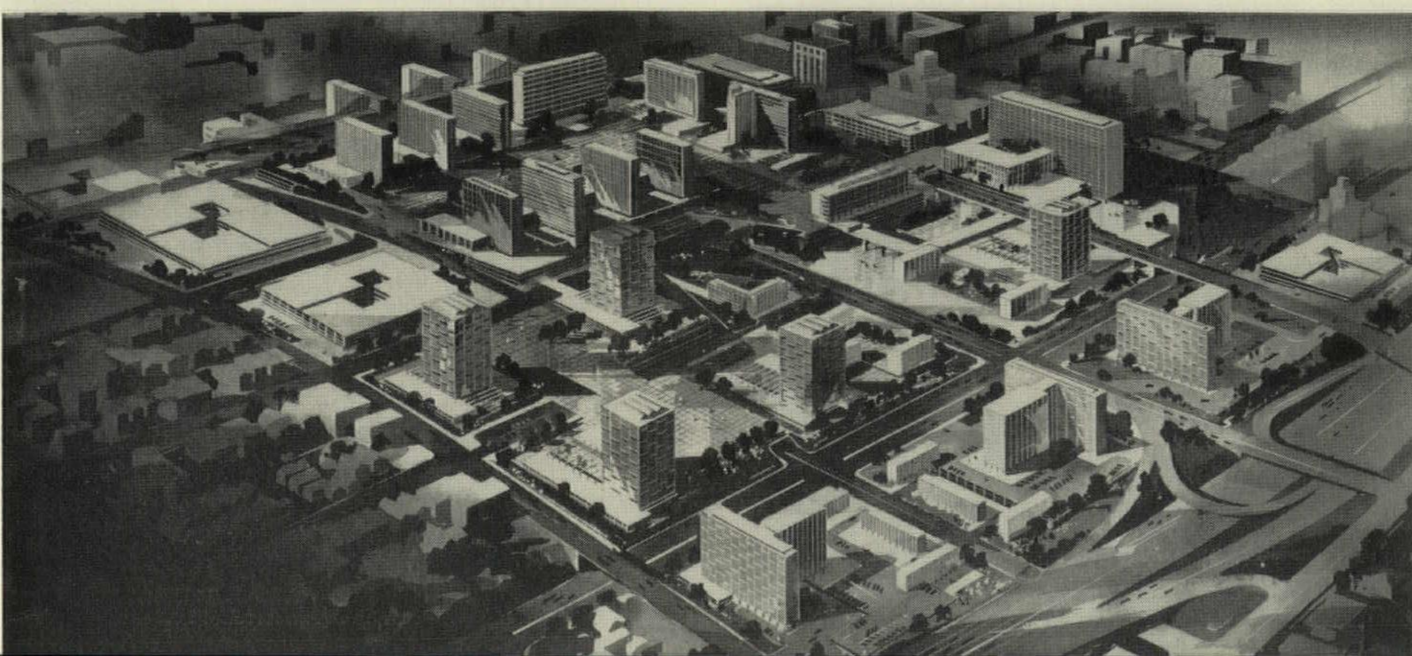
Baltazar Korab

● New Fellows to be inducted at AIA National Convention in June include, in addition to P/A Editor T. H. Creighton —W. S. Allen, Jr., Bro. Cajetan, J. B. Baumann, J. M. Bennett, G. W. W. Brewster, H. H. Brown, W. E. Campbell, Hubert H. Crane, Robert W. Cutler, Arthur Q. Davis, R. L. Durham, A. S. Golemon, Charles M. Goodman, I. M. Harrison, W. C. Jones, Jr., R. S. Kastendieck, Paul H. Kirk, J. Lawrence, Jr., S. A. Lichtmann, T. W. Mackesey, A. W. Mather, T. F. McDonough, Herbert C. Millkey, Edwin Bateman Morris, Sr., F. D. Parham, Alfred B. Parker, Harry M. Prince, M. L. Radoslovich, Thorne Sherwood, Chloethiel Woodard Smith, G. E. Kidder Smith, W. J. Snyder, Harold T. Spitznagel, Oskar Stonorov, Harry B. Tour, H. C. Whitehouse, Kenneth E. Wischmeyer, H. F. Withey, Theodore J. Young.

● Los Angeles' Bunker Hill redevelopment project will consist of a 24-acre residential plaza with 3100 apartment units; 16-acre commercial plaza; 6-acre hotel and 14-acre motel sites; and shopping and office provisions. Plan, by Charles Luckman Associates with William L. Pereira, will divide the currently semislum area into three separate sections.

● First Honor Awards in AIA's 1959 program go to five buildings shown above. They are: Concordia Senior College, Fort Wayne, Ind., Architects—Eero Saarinen & Associates; Central Service Facility, Spokane, Wash., Architects —Kenneth W. Brooks & Bruce M. Walker; Diaz-Simon Pediatric Clinic, New Orleans, La., Architects—Colbert & Lowrey & Associates; Zeckendorf Plaza Development, May-D & F Department Store, Denver, Colo., Architects—I. M. Pei & Associates, Associate Architects—Ketchum & Sharp; McGregor Memorial Community Conference Center, Wayne State University, Detroit, Mich., Architects—Minoru Yamasaki & Associates.

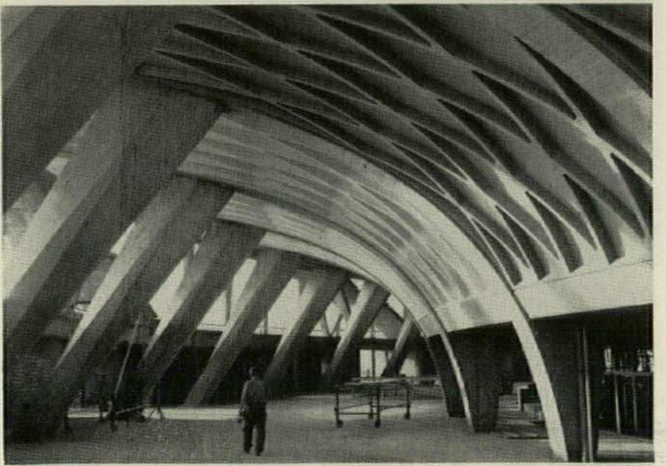
Awards of Merit go to: Silver Springs, Fla., Tourist Center, Architect—Victor A. Lundy; Temple Emanu-El, Dallas, Texas, Architects—Howard R. Meyer & Max M. Sandfield, Consulting Architect—William W. Wurster; Benjamin Franklin Junior High School, Wayne, Mich., Architects—Minoru Yamasaki & Associates; San Angelo Central High School, San Angelo, Texas, Architects—Caudill, Rowlett & Scott, Associate Architect—Max D. Lovett; Carpenter Residence, Medford, Ore., Architect—George T. Rockrise; Trade-well Market, Burien, Wash., Architects—Welton



Becket & Associates, Associate Architects—Rushmore & Woodman; Beattie Residence, Rye, N. Y., Architect—Ulrich Franzen; Mile High Center, Denver, Colo., Architects I. M. Pei & Associates, Associate Architects—Kahn & Jacobs; Lee Residence, New Canaan, Conn., Architect—John Black Lee; Gretna Methodist Church, Gretna, La., Architects—Lawrence & Saunders.

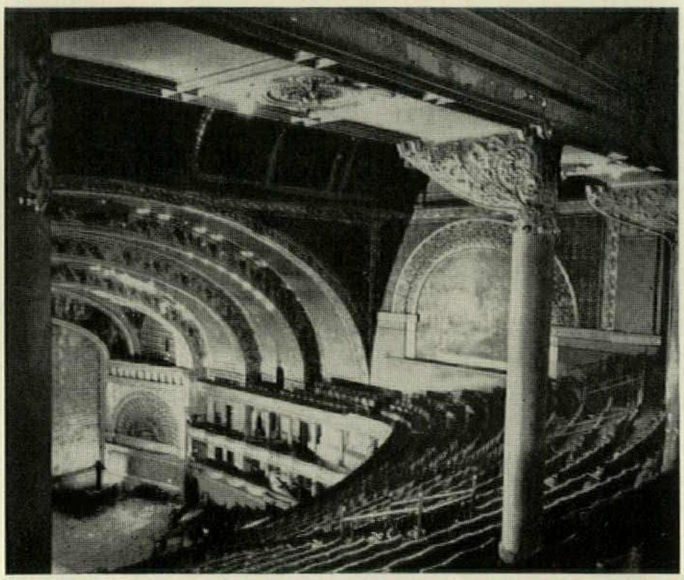
● Exhibition covering the career of renowned Italian engineer Pier Luigi Nervi was displayed recently at New York Architectural League. At a banquet in honor of Nervi (he was kept from attending by doctor's orders), John E. Burchard, MIT, and James Johnson Sweeney, Director of

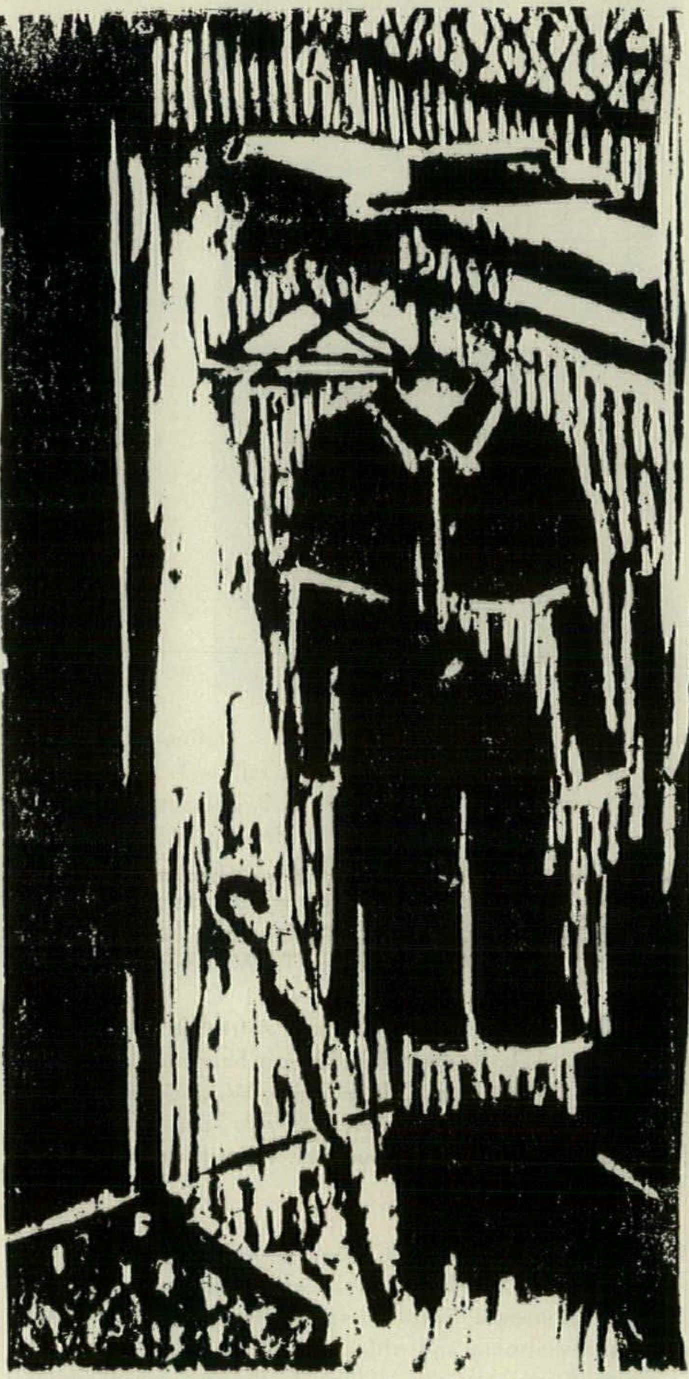
World Wide Photo



Guggenheim Museum, paid tribute to the structural designer, and Architect Marcel Breuer reminisced about his collaboration with Nervi on design of UNESCO Building in Paris. Shown in exhibit was 1960 Olympic Sports Palace. Illustrated is interior of perimeter gallery.

● Committee has been formed to investigate possibility of restoring Chicago's historic Auditorium Theater by Louis Sullivan and Dankmar Adler. Sum of $2,700,000 is to be raised to meet cost of restoration of great auditorium, which in its 70-year history has been used as opera house and concert hall, musical theater, World's Fair entertainment area, World War II Servicemen's Center, and, currently, part of Roosevelt University. Auditorium would serve as setting for cultural programs for Chicago and the university. Chairman of restoration committee is Mrs. John V. Spachner.





Woodcut: Jane T. Waring

● A farm wagon drawn by two black horses bore the coffin of Frank Lloyd Wright from Taliesin East to a small chapel in the Wisconsin pines on April 13. Following a brief service there, Wright was buried near the country cemetery where most of his forebears rest.

Both Taliesin workshops will continue to function as part of Frank Lloyd Wright Fellowship Foundation, under the presidency of his widow, Olgivanna Lloyd Wright. Projects on the boards or under construction will be supervised by the Foundation, including a memorial chapel near Taliesin East where Wright's body will eventually rest, and a fireproof, air-conditioned vault where the late architect's drawings will be stored.

There will be a Memorial Service and Dinner at Taliesin East on June 8, Wright's 90th birthday. The occasion will afford the Fellowship the opportunity to discuss in detail future plans of the Foundation.

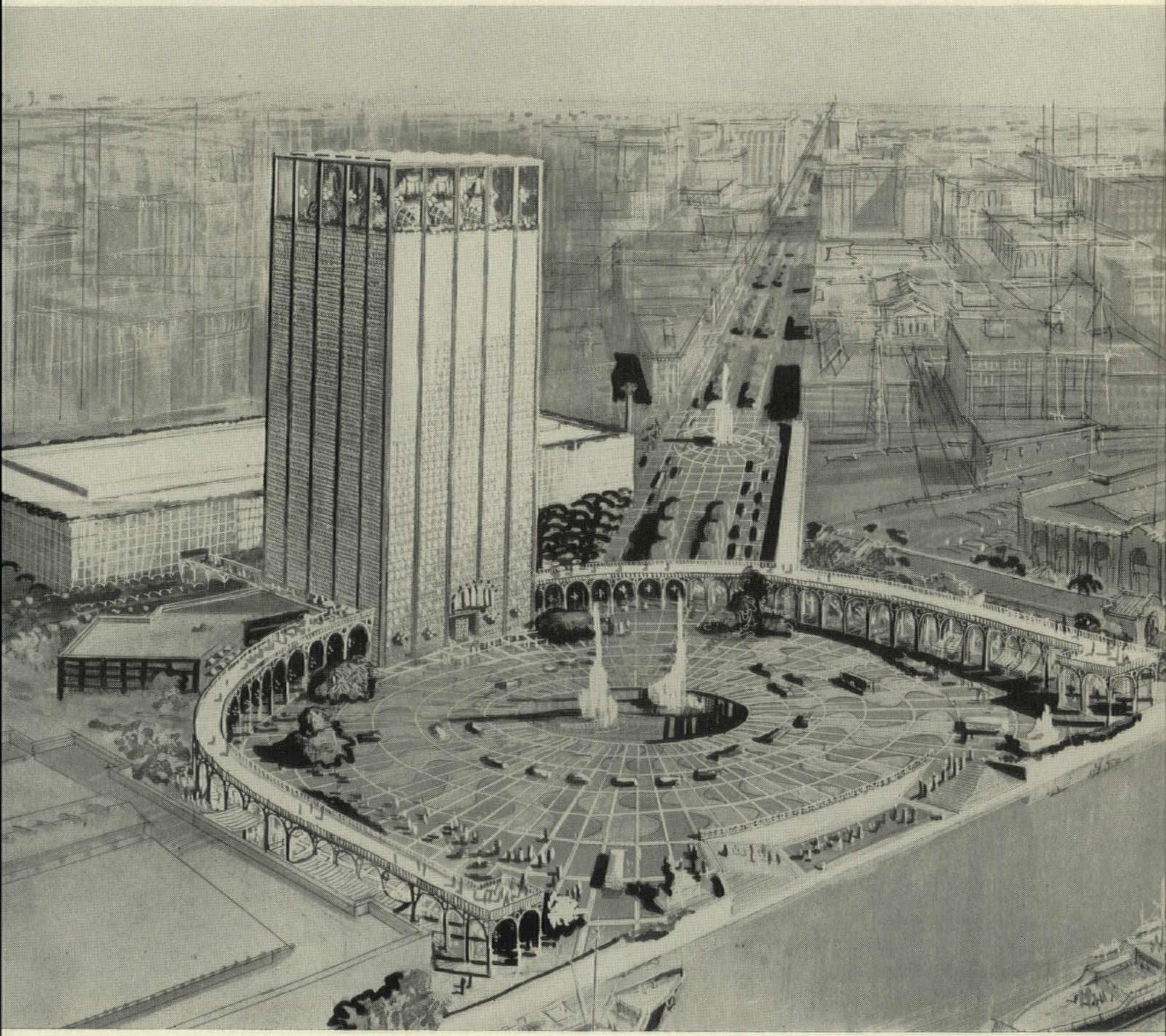
Wright's obituary and an evaluation of his work appear on pages 135-142 of this issue of P/A.

STONE EVOKES BERNINI IN NEW ORLEANS

NEW ORLEANS, LA.—Two-level colonnades embracing a 500-ft-wide piazza will extend from the Mississippi River levee to the proposed new International Trade Mart here. Architect Edward Durell Stone, New York, has designed a romantic, Berniniesque scheme for this complex, which will be approached via a landscaped, befountained mall at the foot of Canal Street.

The project includes four elements: a 190-ft-high office and exhibition tower; a long, capacious building to house auditorium and parking facilities; the colonnaded piazza; and the mall. The office tower will rise from 17 to 21 stories, with approximately 300,000 sq ft of office and exhibit space. The two top floors will contain restaurant, bar, and tourist attractions, offering views of New Orleans and the river. Except for the open gallery around these floors, the tower will be shielded with white brise-soliels, and the vertical ribs will be sheathed in gold-anodized aluminum. The four-story auditorium-parking building will accommodate 600 cars. The top-floor auditorium will have 75,000 sq ft of space. A set-back penthouse will contain a cafeteria and administrative offices. Bridges will connect the auditorium and the tower, and continue around the larger building to the upper level of the colonnades.

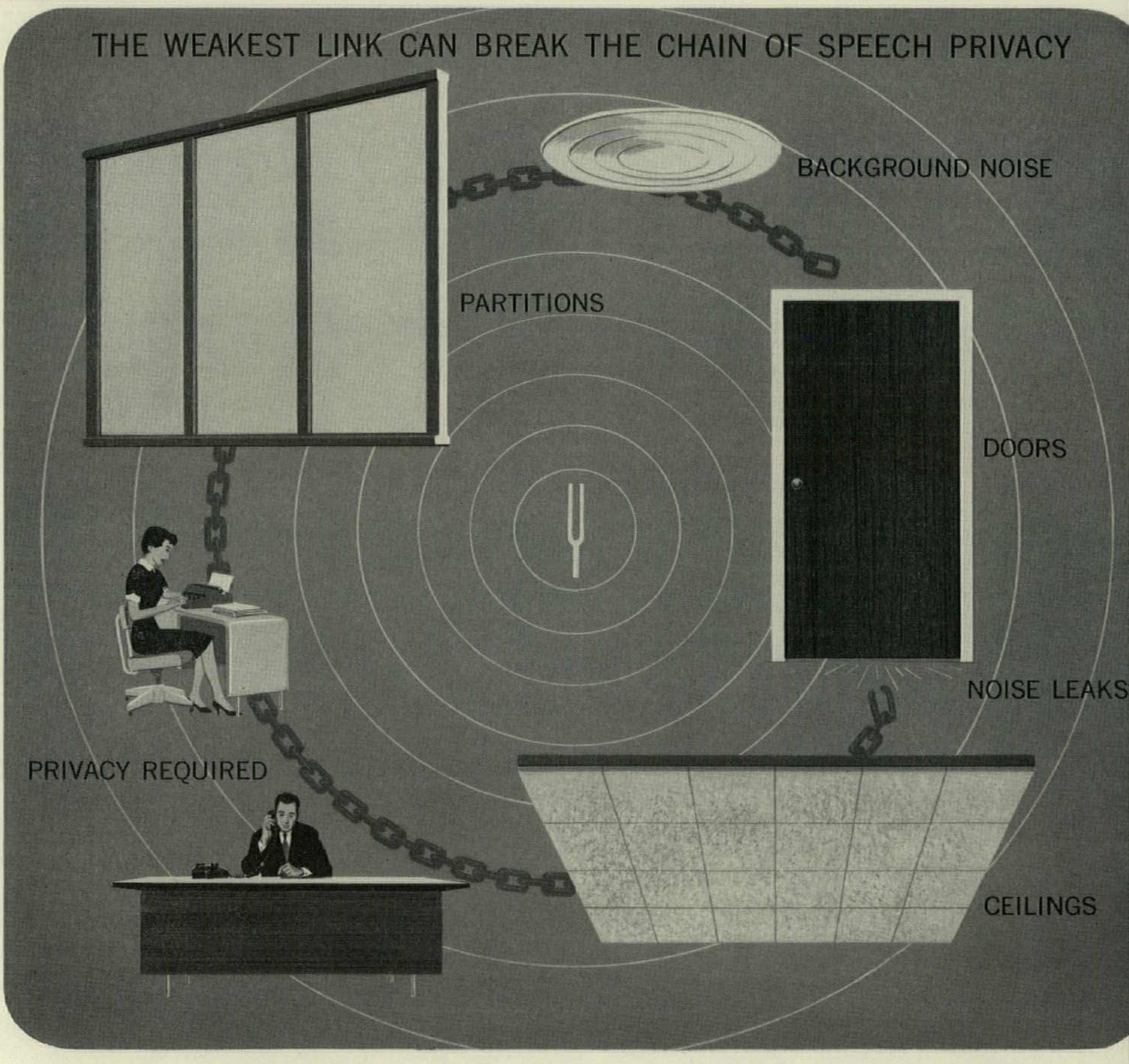
The lower level of the colonnades is expected to shelter sidwalk cafés and bazaars. At the center of the piazza will be a large double fountain sending aloft two jets of water —one muddy brown, symbolizing the Mississippi; the other crystal clear, representing the Gulf of Mexico.



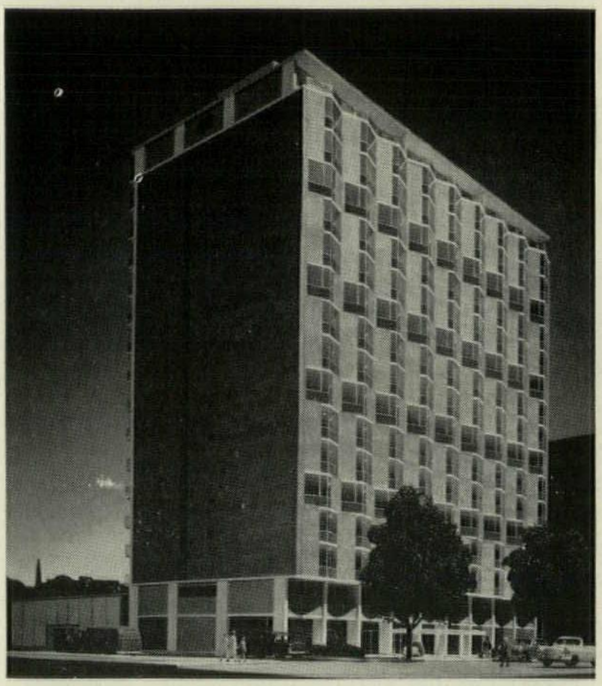
IDEAS NEW AND NEWSWORTHY FROM OWENS-CORNING FIBERGLAS:

A NEW DEVELOPMENT IN DESIGN OF OFFICE SPACES TO MEET PRIVACY REQUIREMENTS

...AND A PRACTICAL APPROACH TO TRANSMISSION PROBLEMS



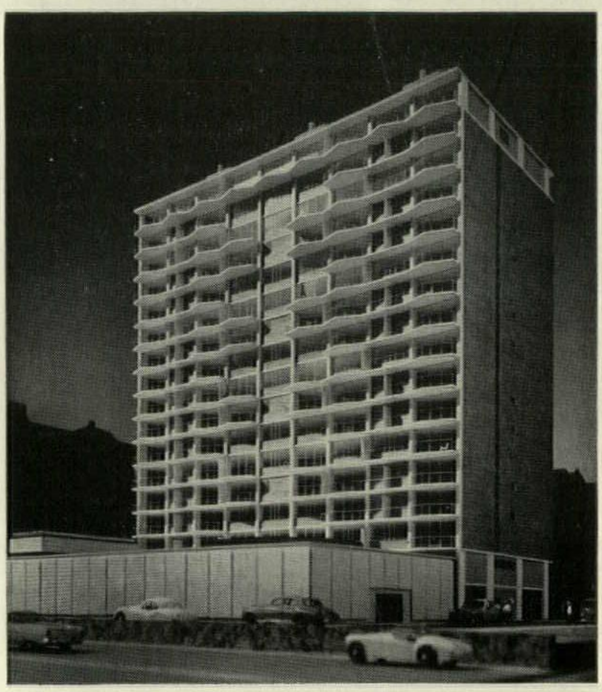
For more information, turn to Reader Service card, circle No. 301



Stubbins Designs Apartments for Back Bay

BOSTON, MASS.—High city officials and civic leaders attended the announcement luncheon for a projected 17-story apartment building on Beacon Street designed by Hugh Stubbins & Associates of Cambridge. The reason for the distinguished turnout was that this described as Boston's first large, privately financed apartment building in more than 25 years, signaling a "rebirth of in-town residential construction."

All living rooms will be on the water side, facing views of Charles River Basin. Each apartment will have cantilevered balconies with steel-framed safety glass railings (below) extending from the living room. The structure will contain 78 apartments, ranging from two and a half rooms to duplexes with four bedrooms and three and a half baths. There will be three penthouses. Turner Construction Company is General Contractor.



D.C. Airport To Be Jet-Age Prototype

by Frederick Gutheim

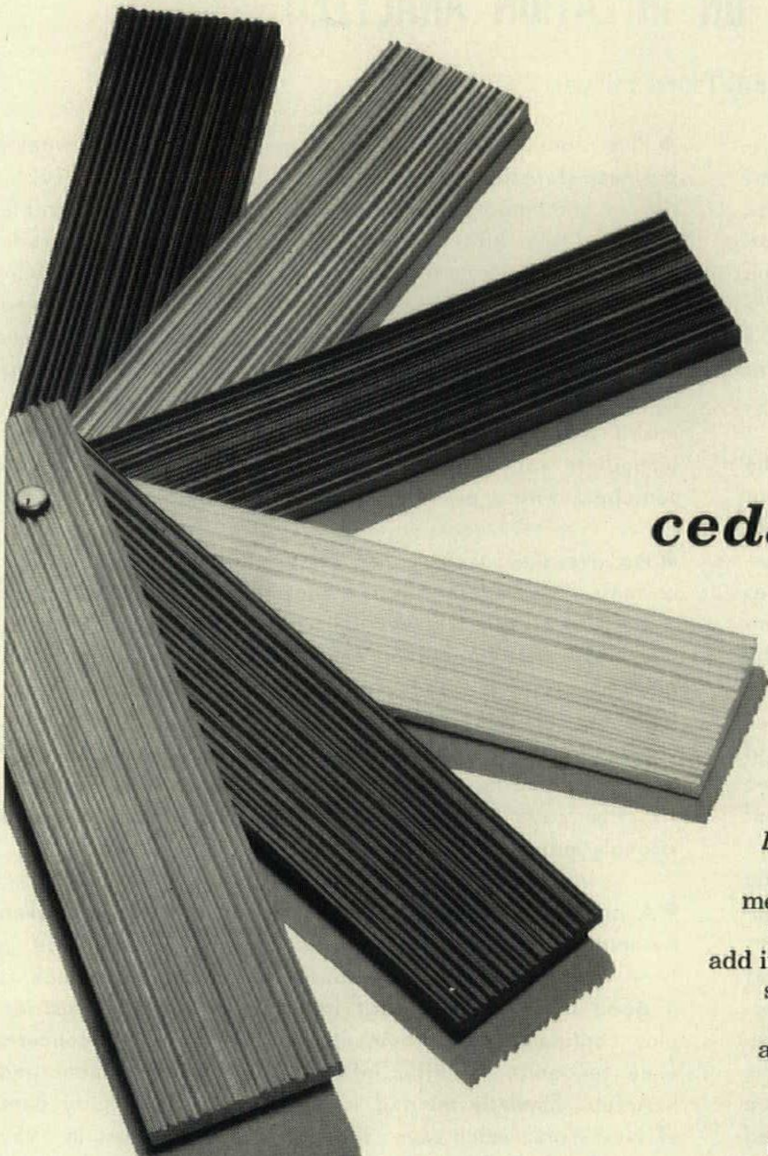
Perhaps the most intriguing thing about Eero Saarinen's new terminal building at Washington International Airport is that the architect succeeded in reducing the size of the structure by one-third. This is the showcase for airport design. The Federal Aviation Agency is doing this job itself, and for an organization that usually sits in judgment in the work of others, it is not an invitation to daring innovation. Yet what has emerged is nothing if not bold. It will influence the design of all subsequent jet airports. It is likely that most future airports will regard the standards, routines, and equipment that are being worked out at WIA as prototypes. The airport is at Chantilly, Va., some 23 miles west of Washington.

The device that will shape the future jet airport is the mobile lounge. It is a hybrid—part vehicle and part building. Its 15 ft width and 60 ft length removes it from the category of vehicles, but it is self-propelled and will carry 80 passengers from the terminal to the plane. Until the mobile lounge departs, it is an organic part of the airport terminal building, to be entered by passengers after their check-in is completed and in which they wait for take-off. The lounge then moves from its terminal dock to the plane under its own power and over special roadways. Approaching the plane, the lounge establishes connection by means of an enclosed, adjustable ramp, and the passengers enter.

The mobile lounge permits a much smaller, highly centralized terminal building (as distinguished from a finger plan with departure lounges). European airports which do not require long walks under escort from terminal to plane have improvised bus arrangements or, in the case of Frankfort and Amsterdam, special low-platform buses. At WIA the greatest advance is seen as a reduction in the amount of walking required—only 350 ft as contrasted to an estimated 650 to 1400 ft in present-day airports (exclusive of hikes from the parking lot and interchanges).

The actual mobile lounge design is still to come from the concept revealed last month in Washington. No designer has been chosen; no prototype of the $100,000 vehicle has been built. Both jobs in a package contract are expected to start momentarily. The problems to be dealt with will include a structure to provide passengers with comfort and to shelter them from the noise, blast, and fumes from jet planes, not merely those now in use but the second generation of jets which will be in operation by about 1965.

The new airport itself is staggering in its scale. Runways are 11,500 ft long, with additional flight paths of twice that distance at either end. Standing at the edge of the dense woods at the eastern end of the field you look down six miles of cleared area—at the Blue Ridge Mountains. Mere buildings will disappear in this truly majestic setting, and so far there is no hint of what Saarinen will produce except for the bare functional outline, and the promise that the beginnings shown in the TWA terminal he proposed for New York's International Airport will be continued. One thing more is clear: the building will have to be expansible. Washington is expected to have 156,000 international passengers a year by 1965, and 464,000 by 1975!



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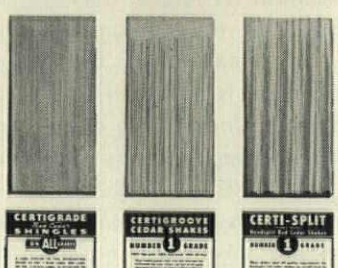

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EXPERTS' OPINIONS ON INFLATION ANALYZED

by William Hurd Hillyer

In the days when there were still country stores, the customary company of debaters usually included a visiting snap-gallus pundit who claimed the gift of telling the precise number of apples in a barrel simply by looking at it. Challenged for performance, he would announce, "That one there contains exactly two hundred and sixty-eight apples!" Out of evident caution he would add, "If it ain't that it's less." Then, walking away, he would fling back over his shoulder, "Or more!" Today's politico-economic outpourings provide a similar degree of nullity.

Refreshing by way of contrast with such vagaries is the forthright declaration of William F. Butler, vice-president of New York's largest bank. Speaking before the Institute of Investment Banking at University of Pennsylvania's Wharton School of Finance, the Chase Manhattan executive was explicit: "Inflation and economic growth are no more compatible than marijuana and individual health." Inflation, he explained, "produces a momentary exhilaration, as is the case with all narcotics, but successively larger doses are required." Butler believes that "we must learn how to avoid inflation if we are to achieve the growth . . . of which we are capable." This he estimates as a potential doubling of individual output every 18 years. He leaves his hearers to compare this modest rate with growth of inflationary media during the past three decades. Fifty-one members of Economists National Committee on Monetary Policy go still further and in a personally sponsored statement come out flat for re-establishment of the gold standard as the one effective anchorage against the inflationary spate. Only by re-establishment of gold convertibility can confidence in the dollar be restored both at home and abroad, committee members declare. While this statement is being digested by the money world, Uncle Sam is paying 4% for funds on Treasury Bonds and Notes.

Our page does not customarily go further than a terse recital of financial news as it affects architects. Butler's blunt fact-facing, however, makes opportune a home-wrought inflationary theorem, which may have the merit of novelty and hence be newsworthy: inflation reflects the time-lag between a cash economy and the transition to a credit economy. Such a transition falls into two areas: consumer credit and non-productive Government undertakings. Consumer credit, including the erection of buildings, may be bridged by means of self-liquidating bonds and mortgages; but the Government must needs create a recurrently mounting budget deficiency to bridge the chasm. Whatever may be said favorable to expanding credit in the consumer area, nothing but "creeping inflation" can emerge from the printing press devices to which Government is driven in its efforts to balance an impossible shortage. "Under these circumstances" the privately issued Biddle Survey finds it "shocking" to discover well known economists pushing for more inflation by means of budgetary deficits on a planned basis—this while "our gold reserves are slowly melting." In such a context permanent building construction of a capital type still tends toward stability.

● Plus signs predominate in Dun & Bradstreet's weekly business statistics report; the most recent shows a 102% rise in steel-ingot production above the '58 comparable period. Other hikes: electric power production, 9%; crude oil production, 15%; freight carloadings, 13.4%; bank clearings, 6.8%; stock prices, 38%. Of these, both steel and stocks reflect a hedging movement by buyers. Wholesale food prices and number of business failures, on the other hand, are respectively 6.7% and 9.2% down. In these mixed tendencies the architect should feel no cause for immediate worries. The picture is typical of a post-recession comeback with a pre-inflationary background.

● An overdue recovery has been effected in the lumber business. The Federal Reserve Bank of San Francisco reports a sharp reversal in the two-year downward trend of production and prices throughout the Pacific Coast District. This turnabout, says the bank, followed a nationwide upsurge in building, chiefly residential. Because hardwood is scarce, veneers for plywood and allied products are obtained almost exclusively through imports from the Orient. Increased construction costs in all categories using wood products are strongly indicated by such developments.

● A conservative view of the economic outlook was taken by mutual savings banks at their quarterly conference in New York. They see the gradually rising capital outlook as a good omen—though lags in auto and other industries, plus continued unemployment are still of some concern. They recognize "a little inflation" as "impracticable and harmful." Similarly minded is the First National City Bank of New York, which says "the outlook for business in 1959 continues favorable" and declares that most observers remain unshaken in the expectancy of an upward movement in production and trade, though "uneven and moderate." The Federal Reserve Bank of Chicago is impressed by the steel recovery and looks for progress "on a broad front." Business activity continues to upsurge and personal income is hitting a $362 billion adjusted annual rate; these are the factors cited by the Federal Reserve Bank of St. Louis.

● Fallacy of "growth" objective is exposed by the Guaranty Trust Company of New York in its current survey. What the Department of Commerce calls gross national product—the total estimated money value of all goods and services within a specified time—is subject to distortion. Money, we are reminded, is the only common denominator available to measure the wide variety of goods and services produced. It is, however, an imperfect unit of measurement, because the purchasing power thereof changes as prices rise and fall. Variations in the gross national product are therefore reflected in two sets of changes. They are warped by changes in the amount of goods and services and in their prices. Like other catchwords, says the trust company, "economic growth" does not hold up under analysis.

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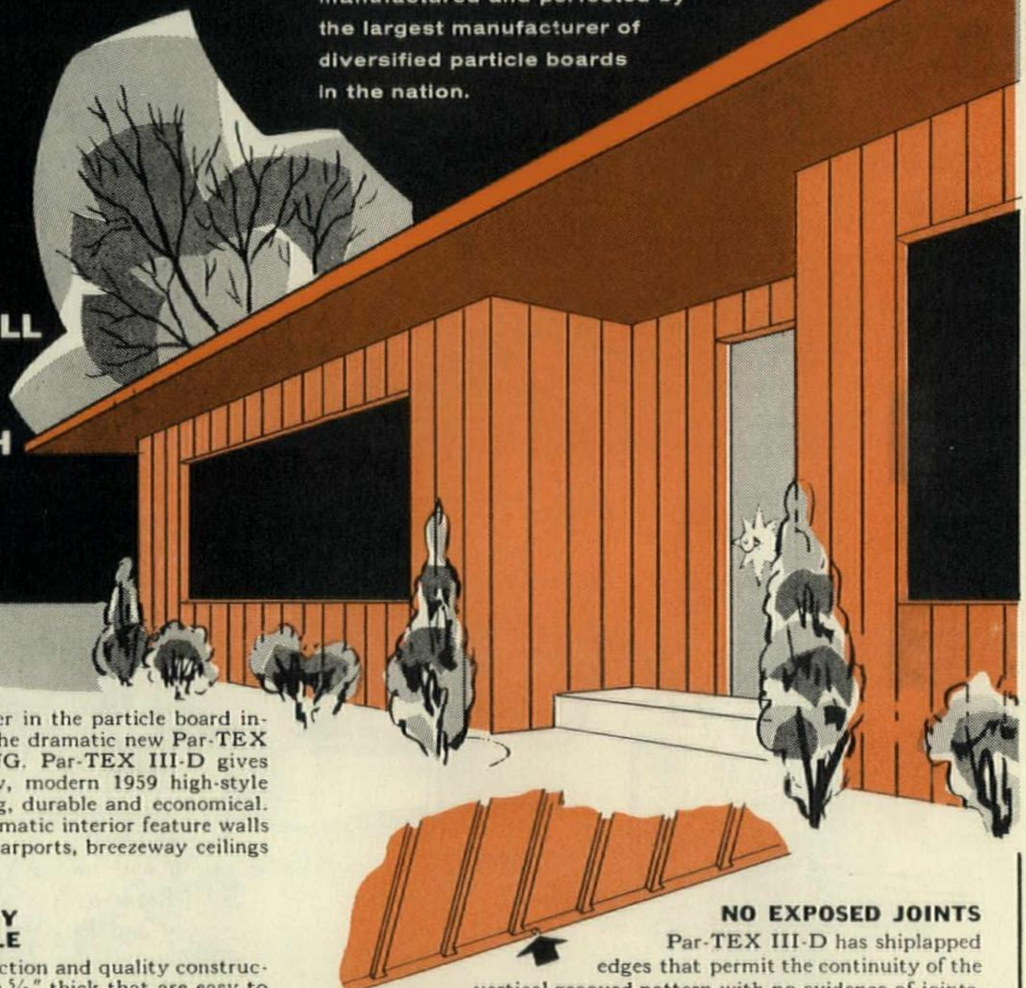

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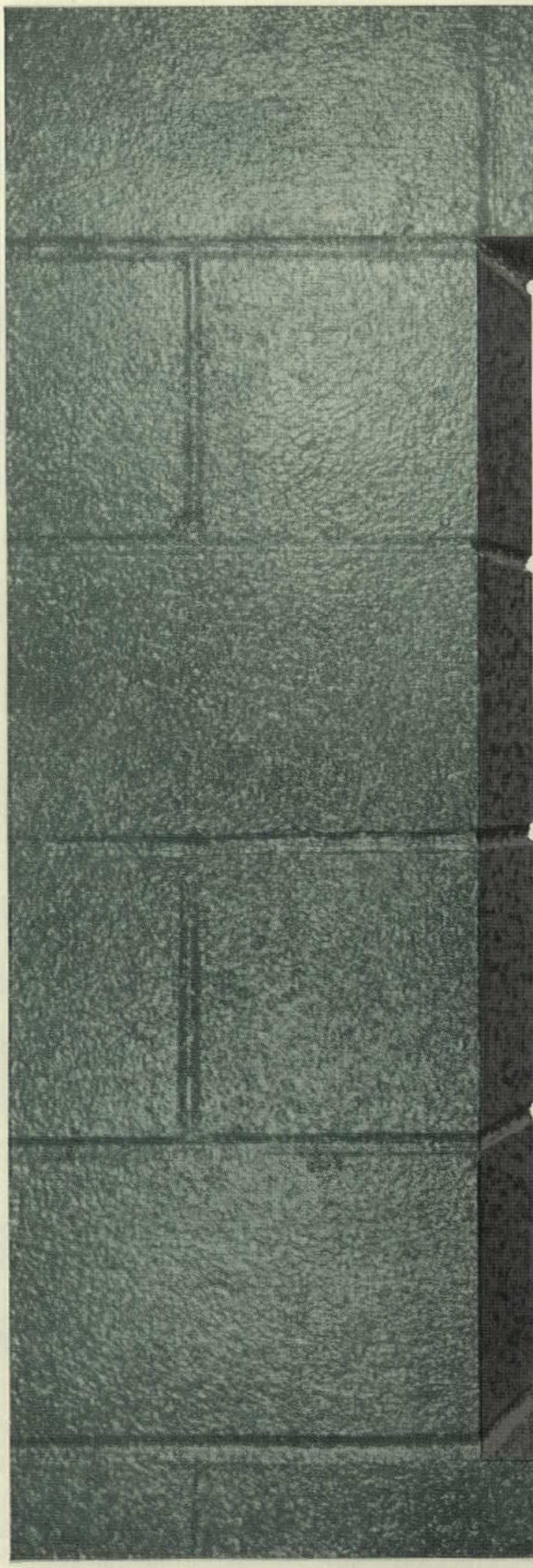

Outlasts conventional paint coatings by many years

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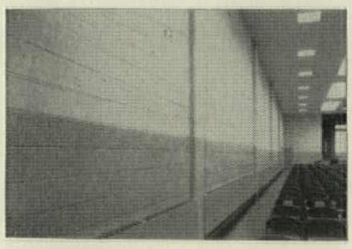
It pays to specify GLID-TILE for heavy traffic areas in offices, schools, institutions and plants, and for problem areas in food processing plants because of its resistance to impact, abrasion and most chemicals. GLID-TILE is a special polyester resin spray finish that lasts a lifetime. It is comparable in beauty and durability to glazed, ceramic or structural tile, yet the initial cost is substantially less.

GLID-TILE gives masonry block, concrete, plaster, wallboard, metal and wood surfaces a tough, protective finish nearly twenty times as thick as the average paint film in a standard two-coat system. And it is far more durable. For example, tests have shown that under heavy impact, a sub-surface of concrete broke before the GLID-TILE finish was destroyed!

It's almost impossible to scratch or mar GLID-TILE. Most acids and solvents, plus alkaline detergents, grease, oil and hot water won't harm it.

New GLID-TILE is available in eggshell or glossy finishes of almost any pastel color—in plain, spatter or web effects.



The tile-like finish seals and smooths the entire wall including mortar joints—for fast, easy maintenance.

Walls in high-traffic areas retain their tile-like beauty for many years.

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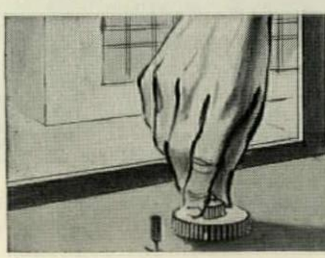
LUPTON unites personalized Comfort-



NEW SYSTEM COOLS, HEATS, VENTILATES

Now, you can not only cool and ventilate, but heat as well with LUPTON's new Comfort-Conditioning Curtain-Wall System. LUPTON Comfort-Conditioning units, operating as heat pumps, are satisfactory for all heating purposes during change of season, and wherever winter design temperatures are not extreme. Furthermore, these units can be furnished with supplementary heat to take care of all heating requirements, regardless of winter design temperature.

INSTALLATION COSTS DROP 40 TO 60%

Unlike central systems, LUPTON Comfort-Conditioning requires no unsightly, expensive cooling towers, ductwork, plumbing connections, or condenser units . . . only electrical connections. Each unit has single control for temperature, fan, and exhaust for odor- or smoke-removal, allowing individual room regulation. This provides a major rental feature and lowers air-conditioning costs. Wide separation between outside air intake and discharge prevents air from re-circulating . . . results in faster, more efficient operation for heating or cooling.

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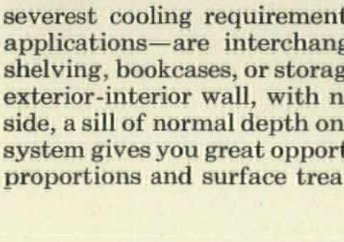

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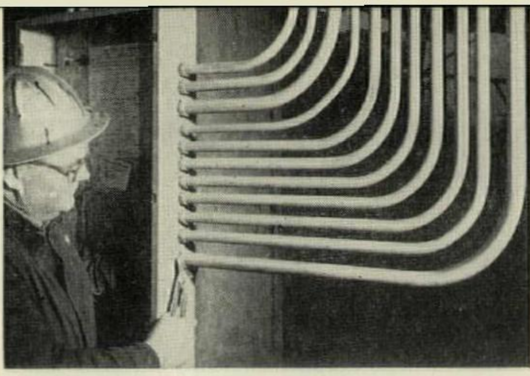

At Detroit's Pavilion Apartments, Youngstown "Buckeye" Conduit is being attached to electrical control box.

Accent on Excellence

Youngstown "Buckeye" steel conduit

Detroit's new, modern-as-tomorrow Pavilion Apartments, designed by architect Mies Van Der Rohe, has lifetime electrical wiring protection —thanks to Youngstown "Buckeye" Rigid Steel Conduit.

Electrical systems that function improperly are a bad investment. To be sure your installations are both safe and efficient, always specify "Buckeye" Conduit. It's been the consistent choice of leading architects, contractors and building owners over the years.

When you specify "Buckeye" Conduit, the high standards of Youngstown *quality*, the personal touch in Youngstown *service* will help you create electrical wiring systems with an "accent on excellence".

PAVILION APARTMENTS, DETROIT, MICHIGAN

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Metropolitan Corporation of America,
Chicago, Illinois

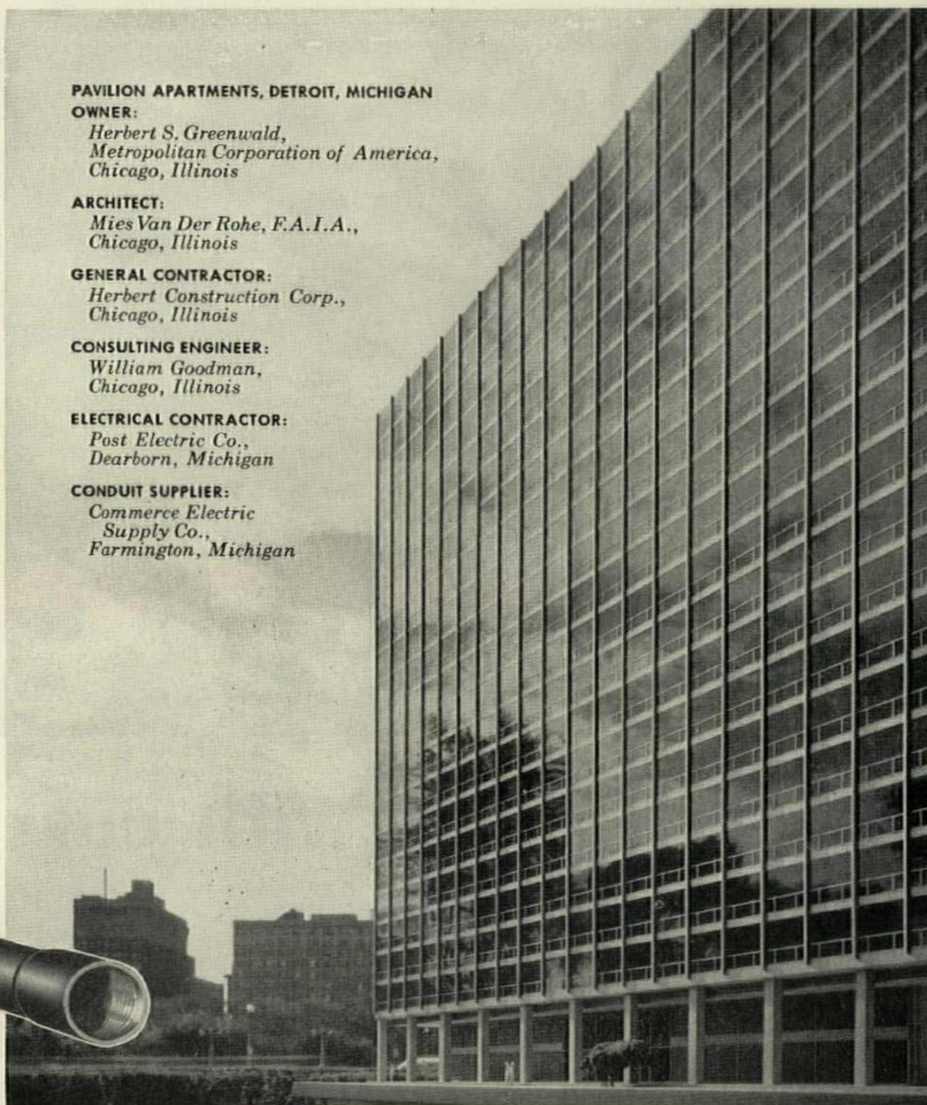
ARCHITECT:
Mies Van Der Rohe, F.A.I.A.,
Chicago, Illinois

GENERAL CONTRACTOR:
Herbert Construction Corp.,
Chicago, Illinois

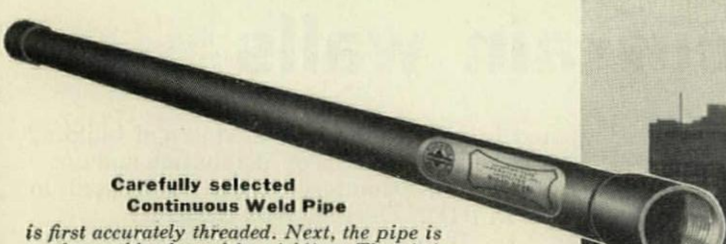
CONSULTING ENGINEER:
William Goodman,
Chicago, Illinois

ELECTRICAL CONTRACTOR:
Post Electric Co.,
Dearborn, Michigan

CONDUIT SUPPLIER:
Commerce Electric Supply Co.,
Farmington, Michigan



Scale model of new Pavilion Apartments.



Carefully selected Continuous Weld Pipe

is first accurately threaded. Next, the pipe is thoroughly cleaned by pickling. Then it is immersed in a bath of molten pure zinc. A special process is used to remove it from this bath so that a clean, smooth zinc coating remains on both inside and outside. Then a coating of tough, transparent lacquer is baked on both inside and outside surfaces, providing a smooth raceway through which wires may be easily fished. This is Youngstown's long-lasting, trouble-free, easy bending hot galvanized Buckeye Conduit.

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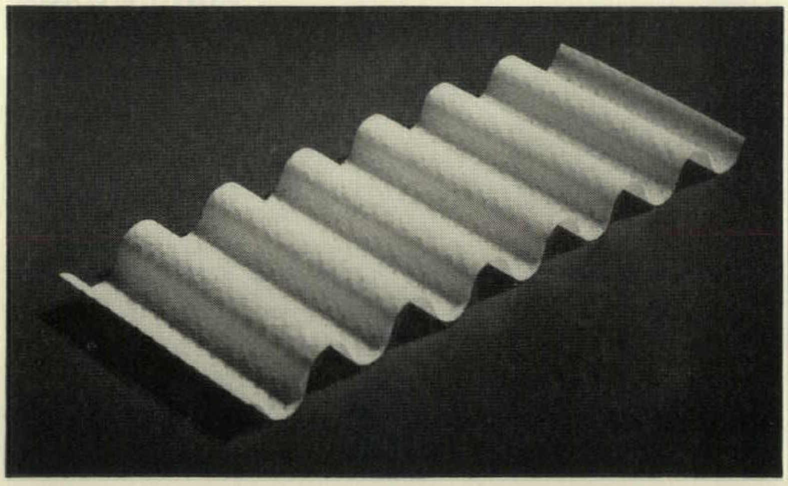


PLASTIC LAMINATE COMBINES LIGHT DIFFUSION, SOUND CONTROL

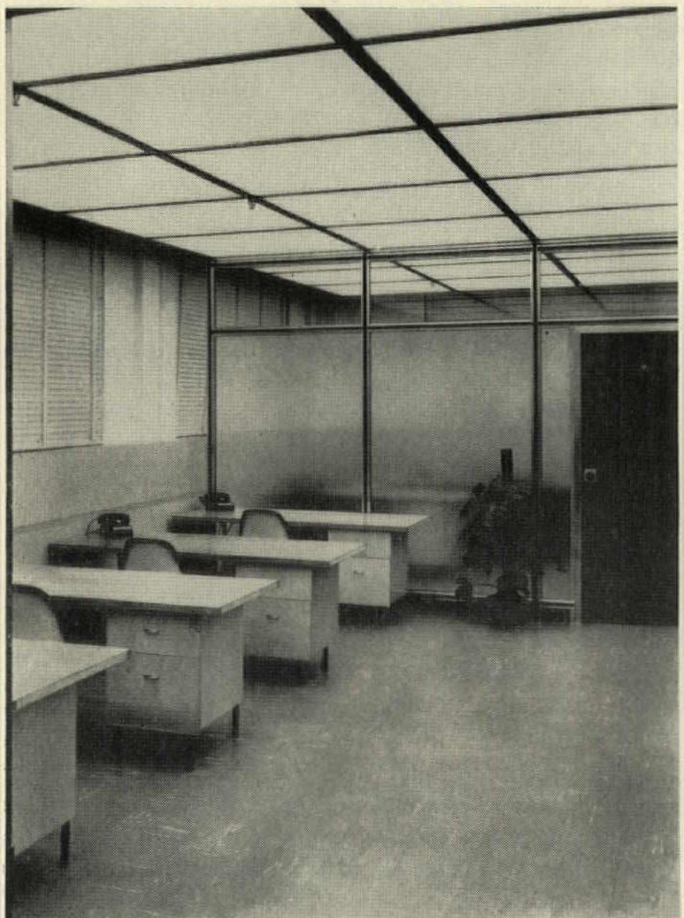
Noise-Reducing Luminous Ceilings Possible with Material

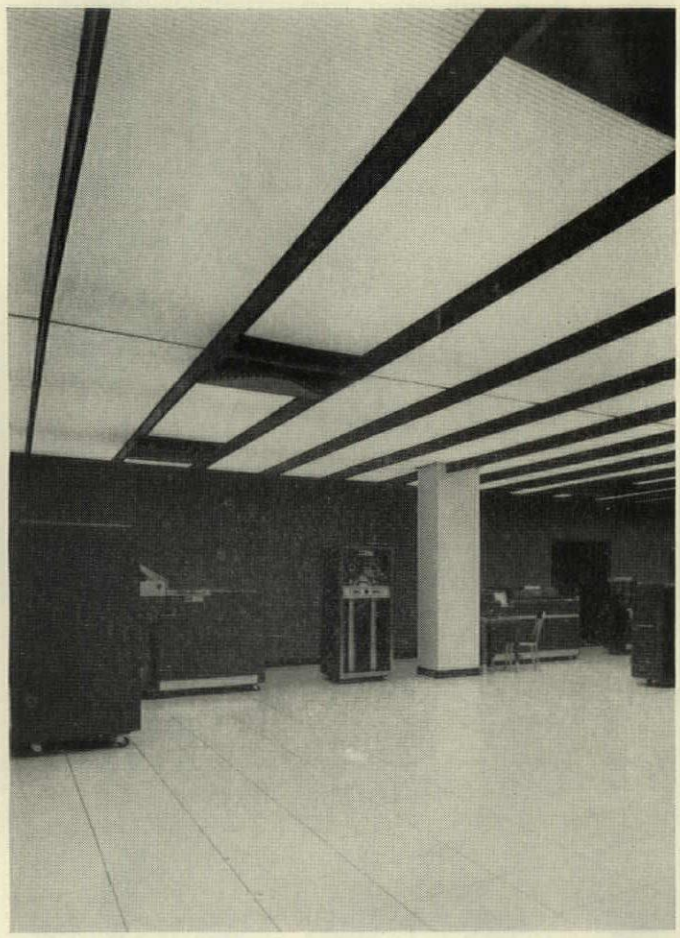
The problem of sound reflection and absorption by over-all luminous ceilings may have been solved with the introduction of a lightweight, translucent acoustical element containing a clear core of rigid vinyl plastic, faced on both sides with porous cellulose film. The core is about ten mils thick, and is perforated with holes about $1/16$" in diameter and $5/32$" on centers. Material developed by Bolt, Beranek & Newman.

Available in either flat or corrugated form, the material is offered as the acoustical equivalent of ¾" perforated mineral tile, while at the same time very satisfactorily diffusing fluorescent light over large areas. It has a noise-reduction coefficient of .70. A backing air space is required for ideal sound absorption; the depth should lie between two inches and three feet to obtain high coefficients. Uses aside from luminous ceilings include sound absorbers, duct lining, back-lighted wall lighting, space dividers and screens, and preformed acoustical units.

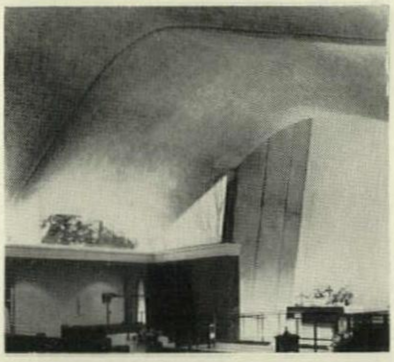
Contrex Company manufactures the material as "Soundsheet," and it is also available from the Wakefield Company as "Super Wakon."

Contrex Company **100**
Wakefield Company **101**





ACOUSTICAL PRODUCTS



102

Sprayed-Asbestos Insulation Aids Acoustics

Blanket of sprayed "Limpet" asbestos applied to inside of precast, reinforced-concrete shells forming vaulted nave and tower of St. Mark's Lutheran Church, Norwich, Conn., achieves desirable acoustical climate as well as satisfying primary thermal insulation role. Layer is 1⅝" thick, provides noise-reduction coefficient of .85, and "U" factor of heat transmission of .17 Btu/hr/sq ft/° F. John MacL. Johansen was architect.

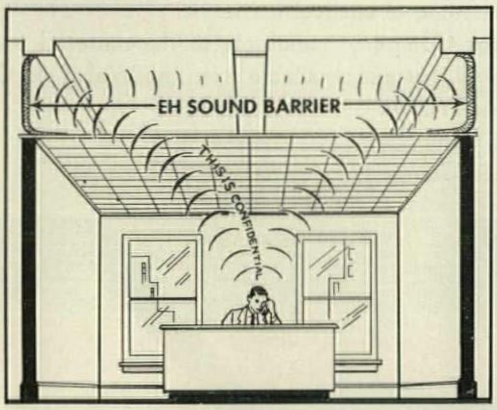
Keasbey & Mattison Company **102**

103

Wall Covering Insulates, Controls Sound

"Curon," a ¼" thick, multicellular plastic wall covering is said to offer effective insulation and noise control. Material comes in 10"x10", 10"x20", and 20"x20" tiles, 24" and 48" wide rolls 10 and 20 ft in length (the latter in tweed finish). Available in 24 standard colors and a number of scenic wall panels. May be used on both finished and unfinished wall surfaces. Reported to be inert to bacteria and fungus growth. Fabrics by Jack Lenor Larsen have been backed with "Curon."

Curon Division, Curtiss-Wright Corporation **103**



104

Sound Barrier Reduces Noise Transmission

Sound barrier increases sound insulation through suspended acoustical ceilings and over partitions between adjacent areas. Barrier is installed from underside of concrete arch or floor above, down to top of partition above acoustical ceiling, increasing sound-transmission loss through system to 40 decibels. Consists of flexible incombustible asbestos, aluminum, and mineral wool unit. Standard length, 36"; standard heights, 24", 36", 48".

Elof Hansson, Inc. **104**

105

Acoustical Tiles Installed on Grid System

Noncombustible, acoustical fiber-glass ceiling panels are said to reduce as much as 90% of room noise. "Panelglas" consists of lightweight (0.20 lb/sq ft), "lay-in" units with white-painted, leather-textured under surface. Panels are 2'x2' or 2'x4', and 1¼" thick. Can be used with simple, inexpensive grid suspension system. So constructed that glass fibers on front are always in tension and those in rear are always under compression, panels form smooth, taut ceiling. White, textured surface is capable of reflecting 78% of room light.

Johns-Manville Corporation **105**

106

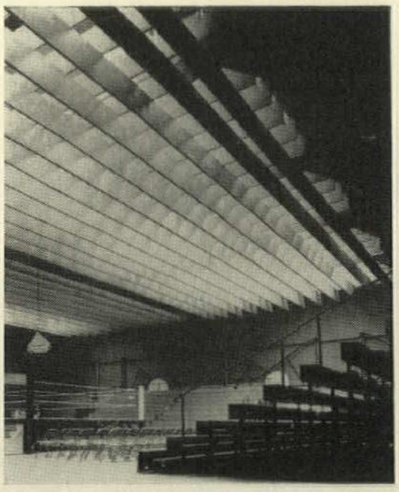
Acoustical Roof Deck Easily Laid

Standard drilled acoustical roof deck reportedly offers high sound-absorptiveness plus effective insulation and strong structural support. Long edges of roof decking have a tongue and groove joint which permits adjoining units to mesh readily. Taping with a wood block fits the panels snugly.

Simpson Logging Company **106**

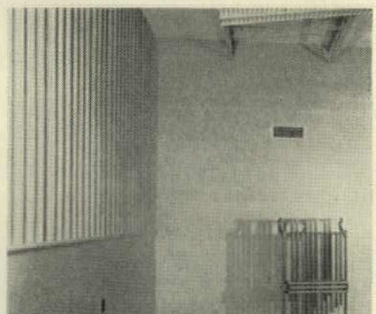
Insulation Baffles Enhance Gym Acoustics

Long strips of "Ultralite" glass-fiber insulation hung in crisscross fashion form interesting and acoustically effective grid pattern for ceiling of Foster High School Gymnasium, Seattle, Wash. Strips are 24" wide and 2" thick. Openings between strips permit natural light to come through from translucent roof panels. Metal clips hold material to wires pulled taut with turnbuckles. Architect of school is Ralph H. Burkhard.
Gustin-Bacon Manufacturing Company **107**


107

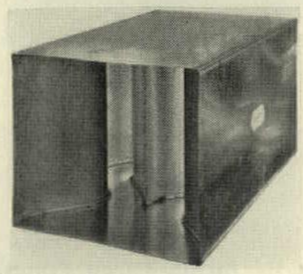
Hardwood Provides Band-Room Acoustics

Hardwood in various forms was selected for wall and ceiling acoustical applications in the band room of a Bremerton, Wash., high school by Architects Branch & Branch. Simpson 3" roofdeck was used as the ceiling, Evanite perforated "Corru-board" was installed on two opposing walls, flat surface hardboard at far end, and angular, sound-deflective walls of polished fir wainscot were used. "Corru-board" was applied directly to studs over a 2" mineral wool blanket. Hardboard was applied by nailing through the perforations with sheet metal screws.
Evans Products Company **108**


108

Sound Trap Silences Air System, Duct Noises

Design of "Aircoustat" sound traps is based on principle developed to silence noise of aircraft jet engines. System consists of fibrous sound-absorptive materials to suppress high frequencies, an intricate steel structure to silence middle frequencies, and special resonators to retard low frequencies. All elements encased in a galvanized steel shell. Smallest unit is 2' long, largest is 8' long. A 2" metal extension on all units permits them to be installed like ductwork.
Koppers Company, Inc. **109**


109

Cork Tile Subdues Indoor Pedestrian Noise

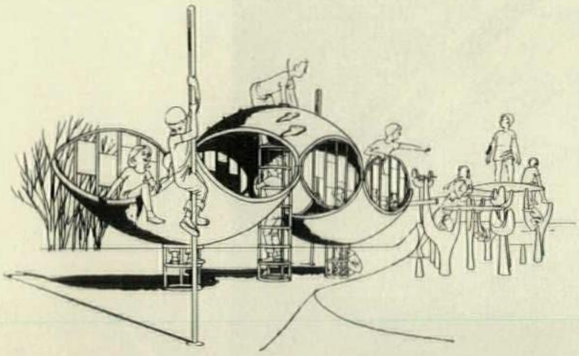
Cork tile, said to be most highly resilient of floor coverings in hard surface group, is composed of 200 million air cells per cubic inch, resulting in an air content of 50% of the mass by volume. Improvement of structural materials making possible thinner floor structures calls for consideration of floor covering materials, such as cork, which absorb the noise of traffic footfall. Installation shows 5/16 gage cork tile used in National Housing Center, Washington, D. C.
Dodge Cork Company **110**


110

Steel Deck Aids Acoustics, Is Loadbearing

Perforations in "Milcor Acoustideck" are located in vertical webs as close to neutral axis as possible, enabling minimum loss in section properties and loadbearing capacities. Deck yields high sound-absorption with only about 2½% open area and equivalent of ½" thickness of sound-absorbent blanket. Available in several finishes: bonderized and baked epoxy-base synthetic-enamel primer; Ti-Co galvanized; Paint-Tite galvanized; and aluminum. Acoustical batts are quickly placed in voids by erection crews after steel deck has been welded into position.
Inland Steel Products Company **111**


111



Playground Furniture Has Sculptured Look

"Senior Space Station" is one of 31 age-graded play devices. The three shell-like forms are made of aluminum, and accessory parts are made of plastic-coated steel. Device accommodates 25 children playing at the same time in a minimum space of 18'x9'. Cost is $1000.
Playground Corporation of America **112**

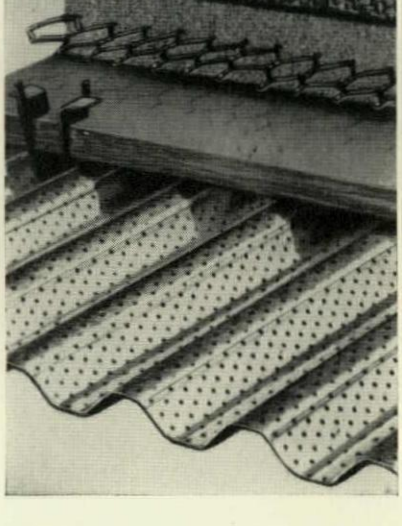
New Construction Molds Seating

Formpressed upholstered seating from Denmark uses lightweight frames cast to form. Durable, comfortable, 3-person

sofa, lounge chairs, and occasional chairs designed by Hans Olsen are available.
Mills-Denmark **113**

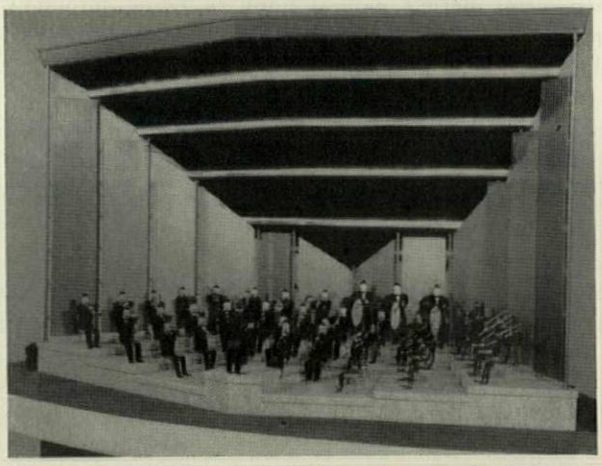
Roof Deck Performs Three Functions

"Structur-Acoustic" roof system acts as structural deck, acoustical ceiling, and poured insulation. Can now be used with rigid board insulation also. In addition to ceiling application, product can be used for interior liners of curtain walls, soundproof partitions, and surfaces of existing partitions. May be ordered in wide range of pastel colors; ceiling version is vinyl-primed for field painting.
Granco Steel Products Company **114**



Prefabricated Band Shell Is All Aluminum

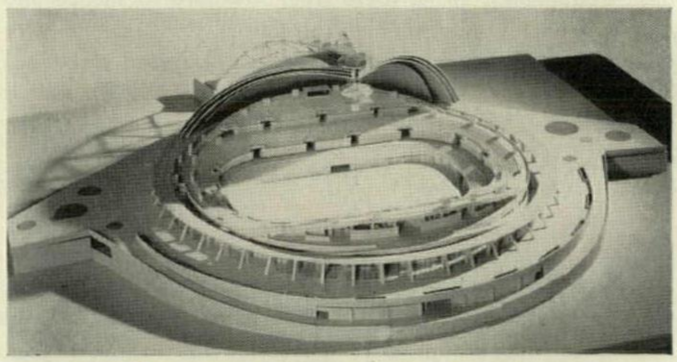
Overly "Hi-Fi Band Shell" employs baffles on sides and ceiling to diffuse rebounding echoes; is suspended from rear by three aluminum cantilevers. Inner and outer sides of shell are of structural aluminum and plastic sandwich



panels. Size of shell may vary to accommodate 40 to 120 musicians. Co-operating with Overly in design of shell were Aluminum Company of America, Pittsburgh Architects Schell & Deeter, and bandmasters throughout the country.
Overly Manufacturing Company **115**

Acoustical Treatment Given Auditorium Dome

The vast retractable dome of Mitchell & Ritchey's new Pittsburgh Civic Auditorium will be covered inside with perforated metal sheet for noise-control purposes. "Diamontex"



lay-in panels are available in either 23¾" x 23¾" or 23¾" x 47¾" sizes. Larger panel has a deep center groove, assuring satisfactory stiffness and the appearance of two ft sq module. Company's "Acousti-Vee" panels can be used for wide spans with a tee-bar suspension system.
Diamond Manufacturing Company **116**

Bricks That Stay Clean

Silaneal 772 retains original color of brick, prevents development of efflorescence (green or white stains on finished masonry walls) caused when water enters brick—treatment consists of dipping or spraying each brick when it leaves the kiln with a dilute water-solution compound which bonds a thin, invisible, silicone deposit to the pore surfaces of the brick, rendering it completely water-repellent. Reduced suction rate allows faster laying up of courses of brick—finished walls can be cleaned without acid wash; thereafter, normally collected dirt easily washes off with water.
Dow Corning Corporation **117**

(Continued on page 116)

Sealed for a Golden Age with the "ADHERENTLY" DIFFERENT SEALANT

Polysulfide sealant custom-tinted gold for America's first golden skyscraper — 575 Lexington Ave., N. Y. C.

based on

THIOKOL LIQUID POLYMERS

"575" reflects architecture's contemporary golden age — the era of the curtain wall. Its gleaming spandrels, mullions and window frames are made of gold-anodyzed aluminum. They are beautifully and lastingly sealed with a THIOKOL polysulfide base compound tinted gold to blend with the golden hue of the structure.

Only THIOKOL polysulfide type sealants "live" with a building . . . bond tenaciously to its surfaces, bend, stretch and compress with its movement. They join together any combination of materials with weld-like strength, while their rubbery give-and-take quality withstands the stress of traffic, wind, weather, aging and thermal change.

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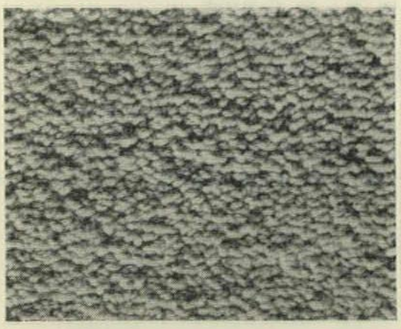
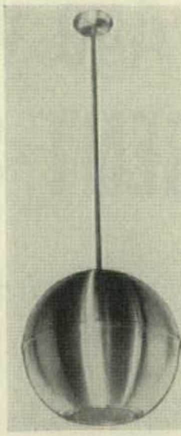


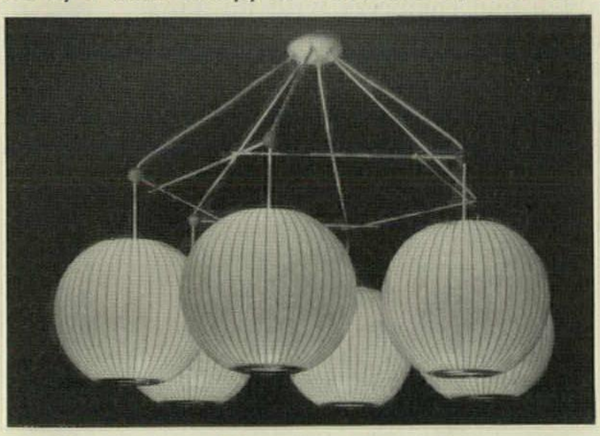


Texture Livens Wool Carpet

Available in 11 colors or custom-dyed in minimum lengths of 60', Town and Country is a random loop round wire carpeting in 12' or 15' widths. Mitin mothproofed, Dura Bond backed, it retails for approximately $13.50. (Above left)
Katherine Rug Mills **118**

Bubble Lamps In Clusters Are Introduced

A variation of George Nelson's bubble lamps—of plastic and steel—is available. From two to six round or elliptical bubbles on the fixture may hang at different levels. Supported by a metal canopy in white, chrome, or brass which



is marked with decorative spheres in birch or walnut, they retail from approximately $50 to $90.
Howard Miller Clock Company
Richards Morgenthau (National Distributors) **119**

Carpet Has Custom Colors, Durability

Woven of 70% wool and 30% nylon yarns in an interestingly varied cut-pile surface, Forecast is available in Lacquer Red, Shantung Beige, Bamboo Beige, Ming Green, Tonkin Beige, Canton Blue, Cathay Beige, Mandarin Gold. Approximate retail price: $14.95.
Archibald Holmes & Son **120**

Acoustical Plaster Is in Two Shades of White

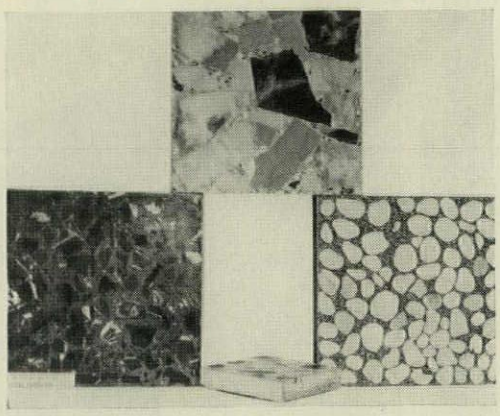
Spray-on gypsum acoustical plaster has noise-reduction coefficient of .55 to .60; will not burn or support combustion. In application, it gives coverage of eight to ten yards per 1/2" thickness. Comes in two shades of white: Super White, which has light-reflective coefficient of .70; and White, with a rating of from .67 to .69.
Bestwall Gypsum Company **121**

Sound Baffle Suitable for Large Areas

Spherical suspension baffles feature new method of rear horn loading which spreads sound evenly throughout large areas. Use of bass reflex principle brings out natural full range in bass frequencies. Baffles originally designed for special needs of New York's Roosevelt Raceway; now on general market. Company's other models include acousti-louvered trim rings, trim squares, and baffles louvered to match air diffusers. (Left)
Soundolier, Inc. **122**

Precast Marble Tile Easily Installed

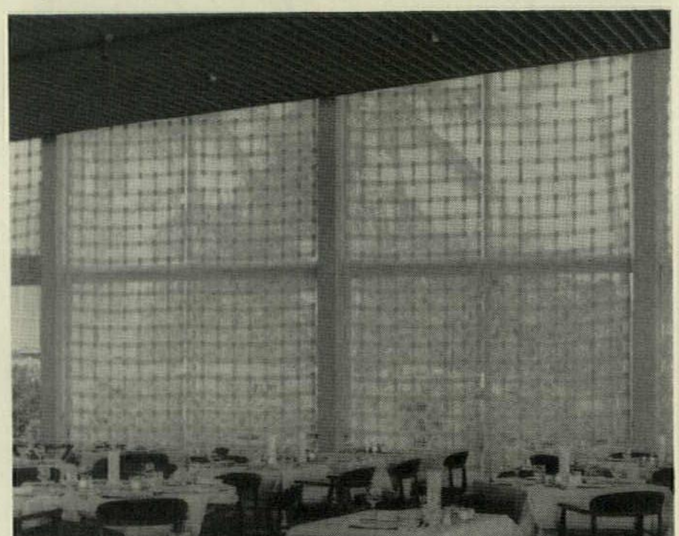
"Venezia" Italian marble tile consists of colored-marble chips cast in colored cement. Installation is simple; there



is no need for grinding, polishing, or metal strips—tile is just placed on one inch bed of mortar. Available in a number of colors including black, off-white, pink, and gold. Suitable for floors both indoors and outdoors.
Continental Agencies **123**

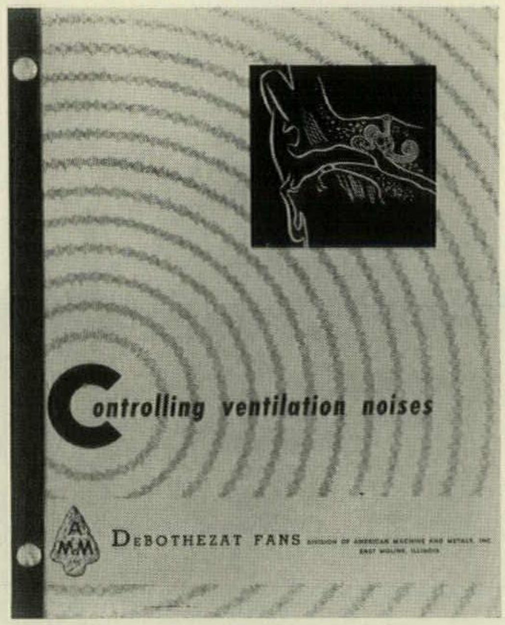
Decorative Asbestos Blind Is Developed

A new yarn of asbestos fibers reinforced with glass fibers, developed by Johns-Manville, was used in this handsome, fireproof, mildew-resistant, insulating drapery. Installed at



Dorado Hotel, Puerto Rico, by Ann Hatfield Associates, the white, open-weave blind now may be custom-ordered.
Lozano-Fisher Studios **124**

For more information, turn to Reader Service card, circle No. 309



***Controlling Ventilation Noises** presents the results of a research project undertaken by Armour Research Foundation to develop a complete noise-rating method for fan units. Brochure presents data which will enable the selector of fan units to use fan noise ratings to predict noise levels in areas being ventilated. Areas of problem discussed are: physics of noise; fan-noise prediction methods; fan-noise reduction (ducts, turns, splitters, plenums, etc.; outdoor noise (made by fan exhaust). Examples are thoroughly documented in text, tables, and charts: example of fan-noise calculation for a factory office; and examples of fan-noise calculation for a gymnasium used as a sports arena (basketball games), as a dance floor, and as an auditorium. Other tables and charts give additional data on noise control and its requirements. An extra set of noise-problem and calculation worksheets is included with each booklet.*

DeBothezat Fans, Division of American Machine and Metals, Inc. (Bulletin A78, 50-p.) **200**

ACOUSTICS

Controlled Product Noise Measuring

Brochure describes advantages of indoor 'controlled' free-field noise-measuring rooms. Anechoic (echo-free) prefab rooms provide one pre-engineered unified package, create most satisfactory environment for accurate measurement of complete acoustical characteristics of any product; eliminate extraneous noises; have nonreflective surfaces, minimum vibration; can easily be shielded against radio frequencies. Illustrated.

Industrial Acoustics Company, Inc. (AIA 39-D, 18-p.) **201**

★ **Sound-Absorption Coefficients**

Bulletin contains comprehensive data on sound-absorption coefficients of acoustical materials. Includes explanation of tables and terms, types of mountings used for test samples, summary tables, producers' tables, installation recommendations, coefficients of general building materials. Also gives member companies and addresses, and alphabetical list of trade names and marks.

The Acoustical Materials Association (AIA 39-B, 44-p.) **202**

Acoustical Products and Services

Bulletin describes Lo-Stat and standard sound traps, interwall sound barriers, and nationwide acoustical services. Modular sound traps use four standard sizes singly, in tandem, or in multiples to get any required attenuation with low cost and easy handling. Also included are illustrations of buildings which employ company's mechanical and architectural products and sound-attenuation systems.

Insul-Coustic Corporation (Bulletin IT-59 4-p.) **203**

Editor's note: Items starred (★) are particularly noteworthy, due to immediate and widespread interest in their contents, to the conciseness and clarity with which information is presented, to announcement of a new, important product, or to some other factor which makes them especially valuable.

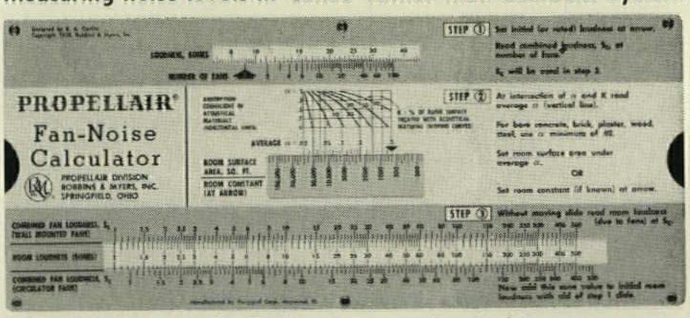
Continuous Blanket Acoustical Treatment

Folder describes versatile Cafco sound-shield—a proportioned blend of highly-refined mineral fibers and inorganic binders, machine applied to form a fissured, level, continuous blanket which may be textured or colored as desired. Incombustible, has low thermal conductivity, is clean and easy to apply, offers wide design flexibility. Surface may have smooth, fine, medium, or coarse travertine texture, and monolithic application provides a surface uninterrupted by joint patterns, dropped corners, and grid systems.

Columbia Acoustics and Fireproofing Company (4-p.) **204**

Calculating Room Noise Levels

Prediction of room noise levels caused by internal noise sources is subject of paper which describes method of measuring noise levels in 'sones' rather than decibels. System



takes into account both frequency and sound pressure, more accurately measures effect of noise on the human ear. Specifically, paper deals with fans, but system is applicable to other noises, providing they are similar to one another. Manufacturer also offers a Propellair fan-noise calculator slide rule (illustrated), which can be used for other noises, so long as they are similar to one another.

Propellair Division of Robbins & Myers, Inc. (12-p.) **205**

Design Versatility in Acoustical Ceilings

Presentation investigates noise problems and corrective principles—covers properties, purposes, suggested application of

acoustical ceilings, available in various "appearance" groups which offer attractive ceiling designs for many kinds of interiors. Finishing and maintenance information, specifications, installation methods, included. Fully illustrated.
Armstrong Cork Company (AIA 39-B, 35-p.) **206**

Acoustical Paneling in Various Materials

Folder presents comprehensive data on Epco acoustical materials. Products include perforated sheets available in hardboard, steel, aluminum, galvanized, stainless steel, and plywood. Properties, fabrication, surface treatments, etc., are explained—suggested recommendations for specifying, installation data, new paint information, are included.
Erdle Perforating Co., Inc. (7-p.) **207**

Wall and Ceiling Acoustical Products

Catalog describes line of acoustical materials: Styltone (non-combustible, fissured, mineral tile); Panatone (non-combustible, perforated, metal-pan, acoustical system); Claritone (hollow-core, drilled, wood-fiber tile); and Perforated Asbestos Board. Patterns available include random-fissured, regular and random-perforated, unperforated, and spatter effect. Complete physical, acoustical characteristics of each product provided, including flame-resistance, light-reflectance, sound-absorption coefficients,—also sizes, thicknesses, installation instructions.
Baldwin-Hill Company (AIA 39-B, 8-p.) **208**

Integrated Radiant-Acoustical-Ceiling Package

Brochure describes Simplex aluminum flush-panel acoustical ceiling—direct suspension-type ceiling specially suited to commercial, institutional buildings. Some listed features are absence of all cross furring for ease of installation, 100 percent accessibility to concealed overhead utilities, flexibility of size for latitude of design; incombustibility, resistance to moisture, 85% noise-reduction coefficient, permanent finishes for lowest maintenance—panels are available in mill-waxed, anodized (clear and colored) and baked white enamel, in 12" widths, lengths to 5'. Drawings show installation procedure; photographs of current uses, included.
Simplex Ceiling Corporation (AIA 39b, 8-p.) **209**

AIR AND TEMPERATURE CONTROL

Sound Traps Silence Air-Systems Noises

File sheet illustrates Aircoustat air-system noise silencer, balanced to silence noise in all frequencies—of all-galvanized, corrosion-resistant, maintenance-free, and fireproof heavy-gage steel construction, with 2" metal extensions mounted like ductwork. Comes in convenient sizes and small units easy to handle and install (from 25 lb, 2' length to 500 lb, 8' length)—stock models form multiple units for meeting unlimited airflow requirements.
Koppers Company, Inc. (2-p.) **210**

Easy to Install Air-System Filter Frames

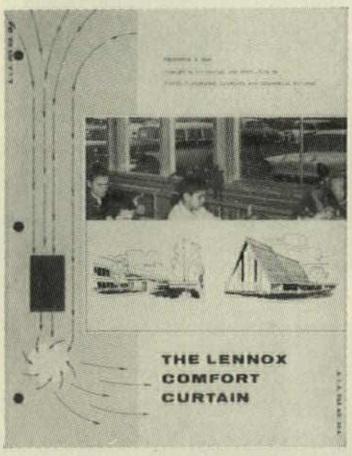
Folder details installation procedure for Glasfloss improved self-locking steel frames for central air-filtration banks in commercial and industrial air-conditioning systems. Die-fabricated from 18-gage rolled steel, lightweight frames are made in 20"x20" and 20"x25" sizes to receive standard Glasfloss filters—both available for 2" and 4" filtering depth, finished in black enamel. Can be assembled into either flat or V-banks. Drawings show succession of steps in assembling.
Pittsburgh Plate Glass Company (2-p.) **211**

Air Diffusers Offer Application Flexibility

Catalog illustrates concealed air diffusers especially designed for increased appearance appeal, and noiseless, draftless, air distribution in acoustical ceilings. Contains 16 sections dealing with operation and styling of Perfair outlets. Features include interchangeable cores for varied patterns; built-in Agi-flex direction controllers allowing downward air stream deflection in varying degrees; positive control. Available square or rectangular, in sizes to conform to standard tile dimensions.
Air Devices, Inc. (16-p.) **212**

Heating and Ventilating System for Schools

Brochure describes and illustrates operating principles and components of school heating and ventilating system. Comfort Curtain principle places air supply openings around perimeter of building. Special advantages are said to be:



elimination of underfloor piping channels, boiler rooms and flues; absence of central station boiler plant; easy servicing and maintenance. Other features are accurate, responsive temperature control—whisper-quiet performance. Although designed for classrooms, can be adapted to other building types.
Lennox Industries, Inc. (AIA 30-A, 28-p.) **213**

CONSTRUCTION

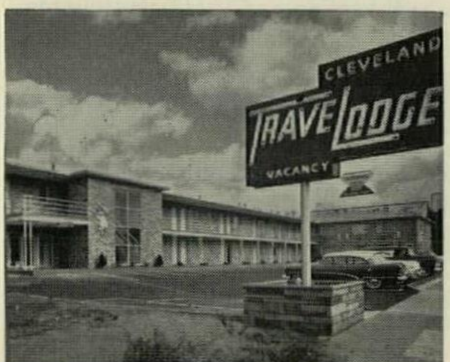
Custom Curtain Wall Adapts to All Building Types

Catalog discusses curtain-wall systems adaptable to every exterior design. Included are typical sections for large flat panels, designed for speedy enclosure of medium- and high-rise structures; light commercial grid for multistory buildings; structural aluminum grid, a versatile system for low-rise buildings—the latter providing wide variety of panel materials and window types. Descriptive material
(Continued on page 122)

DOW | **CHEMISTRY *creates versatile new building materials***

New materials created in chemists' beakers are taking their place among those produced by the saw, the refractory and the blast furnace. These new products supplement traditional building materials, giving architects improved flexibility in all types of building designs. They are polychemicals . . . lightweight, easy to fabricate materials that resist the attacks of moisture and time. One of them, a superior insulation manufactured by Dow, has many useful applications in creative construction for the progressive architect.

MOTEL CHAIN USES STYROFOAM® . . . CUTS INSULATION, PLASTERING COSTS 33%



A better building at lower cost is the aim of every architect and client. That's why Travelodge Corporation is "sold" on a new construction method using Styrofoam. Styrofoam is simply adhered to the interior of a masonry wall with a mastic adhesive and then plastered over. By thus eliminating furring, lath and batt insulation, Travelodge saves enough to *insulate and plaster every fourth unit free!*

Travelodge finds that Styrofoam provides a more durable base for interior plaster than ⅜" lath. They also find that Styrofoam has a permanently low "K" factor because this insulation stays dry. In their words, "Our selection of Styrofoam was based on tests of the insulating value of different materials. After two years use, we found that our heat and air conditioning costs stayed well within the predicted low range."

Styrofoam has been used in Travelodge motels in Indianapolis, Toledo and Cleveland and will be used in four new motels now under construction.

and project photos of features and appearances of each of three basic curtain-wall series, suggested specifications, provided.
Albro Metal Products Corporation (12 p.) **214**

Construction and Maintenance Products

Brochure contains thumbnail descriptions of 21 leading building "savers" for plant maintenance and restoration (products designed for floor treatment, waterproofing, dampproofing, roof-coating, as well as paints and protective coatings). Specifications, application data, information on product features facilitate selection of specific product to meet most frequent maintenance or construction needs.
L. Sonneborn Sons, Inc. (Brochure BP6030, 4-p.) **215**

Treated Wood Invulnerable to Termites, Decay

Presentation describes durability and versatility of wood as building product when pressure-treated with preservative salts. Wolmanized lumber and timber offer economical protection against termites and decay caused by moisture and humidity such as is found in tropical areas, are available in all conventional forms, in all standard sizes and thicknesses from ¼" to 1", for exterior and interior construction requirements.
Koppers Company, Inc. (AIA 19-A-3, 12-p.) **216**

★ Versatile Aluminum Mill Products

Brochure aids in pinpointing specific properties of aluminum products and applying them accurately to desired end use. Contained are sections on alloy and temper designa-

tions, fatigue and shearing strengths, various alloys available in foil, sheet and plate, wire, rod and bar, tubing and pipe, and extruded and structural shapes. Complete specifications included; fabricating and finishing techniques are summarized. Bibliography provides guide to available related literature and movies.
Reynolds Metals Company (18-p.) **217**

Precast Concrete Floor and Roof System

Catalog describes precast hollow-core concrete floor and roof system (monolithically cast, long-span slabs, reinforced with prestressed steel), claiming simpler design, less supervisory requirement; dry, fast construction; immediate availability of deck for subcontractors' work; saving of 2" to 8" per story in wall height; smooth slab undersurface that needs only calking and painting to produce attractive paneled ceiling. Included are photographs, design data, detail drawings on use of Flexicore system with steel and reinforced concrete frames; plumbing; heating and cooling systems; electrical wiring—also complete information on recommended specifications.
The Flexicore Company, Inc. (AIA 4-K, 8-p.) **218**

Recommended Practice on Concrete Finishes

Pocket "Manual of Recommended Practice for Cast-in-Place, Exposed, Architectural Concrete Finishes" provides standards for more accurately evaluating quotations for concrete finishing—prepared in specification form, to be used either in part or entirety, gives explicit detailed information regarding procedures to follow in accomplishing highest quality appearance for exposed concrete. In eight sections describing each phase of recommended practice from specifications through construction.
Concrete Industry Board, Inc. ($1.00, 15-p.)

DOORS AND WINDOWS

Alumilited Water-Tight Sliding Glass Doors

Catalog presents details on each model in Capri line of all-aluminum sliding glass doors—styles shown are Cadet (for 3/16" crystal and ¼" plate); Cavalier (for ⅝" insulating glass); Continental (for 1" insulating glass and ¼" plate). Available in 67 different stock types and sizes. Special sizes also furnished. All doors come in long-life Alumilite finish for maximum corrosion resistance.
T. V. Walker & Son, Inc. (AIA 16-E, 8-p.) **219**

Traversing, Non-Traversing Blinds

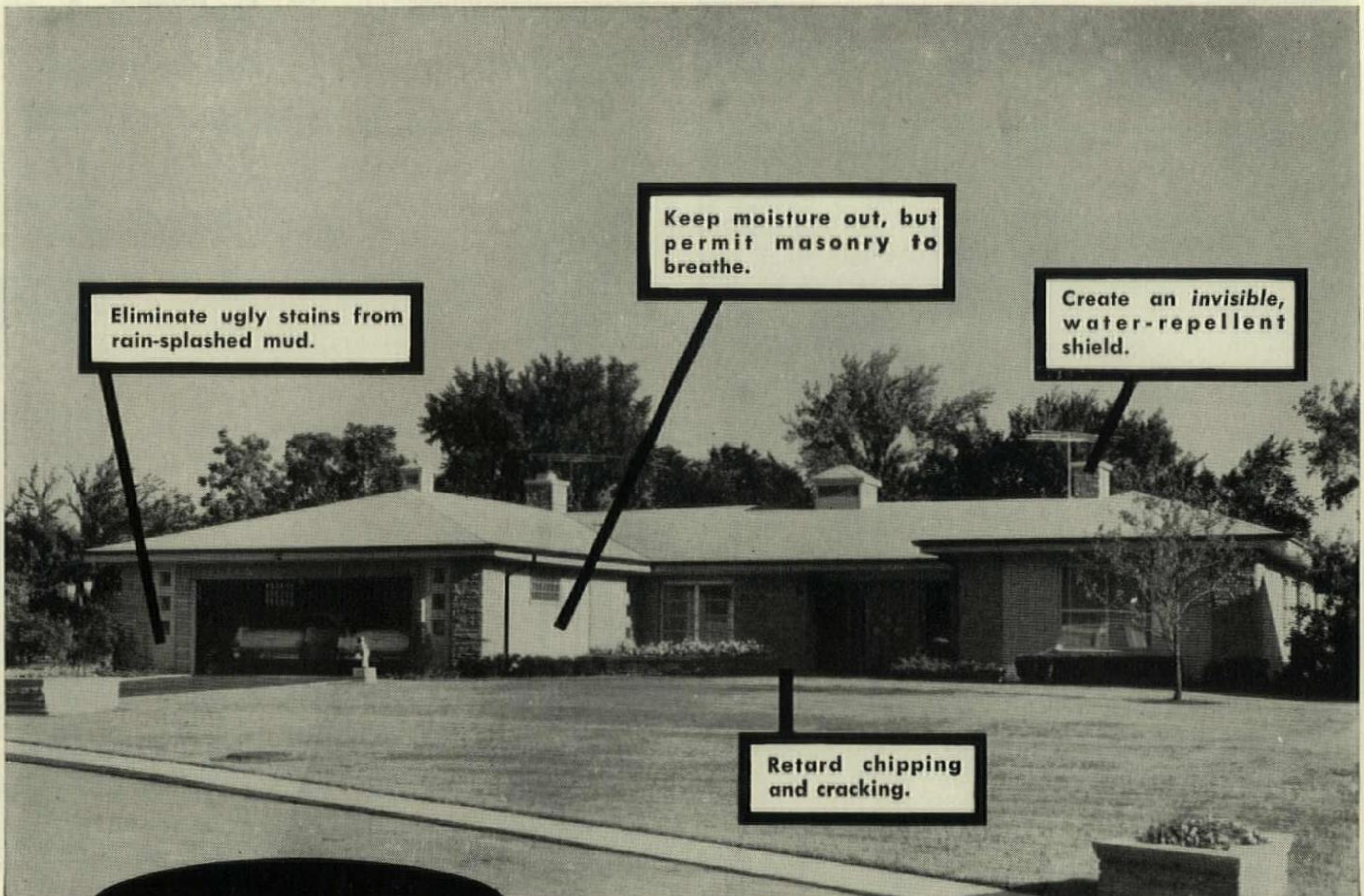
Data sheet provides general and detail specifications for custom-made blinds, principally designed for large-scale projects. Materials, size and shape, type of operation, are determined according to individual requirements, tested in full-size mock-ups prior to installation. Some typical louvre materials include fabric (plastic-coated), aluminum (enameled or anodized, any color), sheet metal (enameled), molded or woven plastic, and fiberglass. Louvre widths vary from 2" to 11", extend to 30 ft length. Available in flat, curved, S-shaped, and tubular sections.
Sun Vertikal Blind Company (AIA 35-P-3, 4-p.) **220**

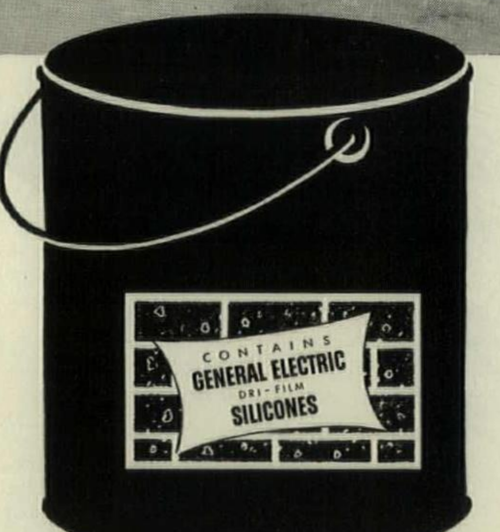
Customized Residential, Commercial Garage Doors

Literature pieces in single file sheets present specification data on line of overhead-acting residential and commercial-industrial garage doors—cover the many material, construction, operating, styling features of line. Complete information on: Marvel-Life, guaranteed for life, hardboard panels; edge grain Douglas Fir stiles and rails; bored dowel, pressure-fitted construction; torsion spring mechanism; and styling with customized design. Data is available in individual pieces or complete set.
Crawford Door Company **221**

(Continued on page 126)

G-E silicones help new houses look better, sell sooner





Masonry water repellents made with General Electric silicones are quick and easy to apply. They penetrate *deep* into the capillary pores of masonry, forming an invisible water-repellent shield. This eliminates those ugly stains caused by rain-splashed mud or by dust and dirt on the masonry surface. Rain runs right off, carrying dirt with it.

But that's just the beginning! Silicone water repellents help prevent surface salt deposits; retard chipping and cracking; minimize water penetration and resulting freeze-thaw damage. They keep moisture *out*, yet permit masonry to breathe—thus protecting interior surfaces against peeling and flaking.

A recent survey shows that home buyers expect to pay far more for this protection than the actual cost to you. Find out more about G-E silicones and what they can do for your new homes—in appearance, protection and *sales!* Mail the coupon today.

General Electric does not make a water repellent but does manufacture basic silicone ingredients for the finished product. Water repellents made with General Electric silicones are available from leading manufacturers.

Progress Is Our Most Important Product

GENERAL ELECTRIC

General Electric Company, Silicone Products Department, Section M4Q5, Waterford, N. Y.

Please send me all the facts on the application and performance of masonry water repellents made with G-E silicones, and a list of suppliers.

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THE ALL-NEW

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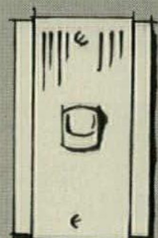
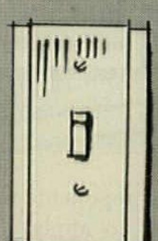
ROCKER-GLO SWITCH





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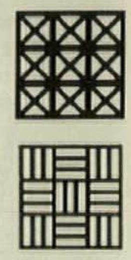
H&K PERFORATED METAL GRILLES

(Send for Grille Catalog)

H&K Perforated Decorative MATERIALS

(Send for Catalog 75)

Illustrations shown in reduced size



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H & K grilles are furnished in accordance with your specifications . . . in practically any type and gauge of metal . . . and in the finish desired. Perforations are clean and burr-free, margins are in alignment, and each grille is leveled and inspected before shipment.

H & K decorative patterns, from a vast selection of existing dies, are serving architects in many new and unusual ways. If your plans call for perforated materials, depend on H & K!

See Sweet's File—30f/Ha

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Just Published

PARKING

By Geoffrey Baker and Bruno Funaro

Here are photos and plans of parking lots, ramp garages, parking decks, underground garages and elevator garages. Examples are drawn from large cities and small towns. There are suggested zoning requirements for parking and freight dock space. To simplify the layout of parking space there is a special ten page section of easy-to-use diagrams and tables. These show parking patterns and stall sizes for most advantageous use of a given site under various parking conditions. *200 pages, 8½x 10½, 225 illustrations.* *$9.50*

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Monsanto Chemical Company (56-p.) **223**

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Vermont Marble Company (AIA 17-A, 8-p.) **224**

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Decorating Ideas for Bathrooms

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Kohler Company (20-p.) **225**

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The Grover Company (35-p.) **226**

Kitchen Travelog Floor Plans

Booklet presents 20 floor plans to suggest effective utilization of space in arrangement of kitchen furniture and equipment, in a variety of design layouts—decor types used include city apartment, ranch, Victorian, oriental modern, Dutch colonial, bungalow, among others.
Mutschler Brothers Company (40-p.) **227**

Bolted-Construction for Industrial Installation

Catalog describes Mult-A-Frame bolted rack construction system for industrial applications (electrical raceways, partitioning, etc.)—easy to assemble, produces completely salvageable steel racks of any size, shape. Features serrated channel, spring-T-bolts, embossed fittings, durable baked enamel finish. Components specially treated for rust resistance.
Mult-A-Frame Division, Ainsworth Manufacturing Corporation. (Catalog 102, AIA 35-I, 64-p.) **228**

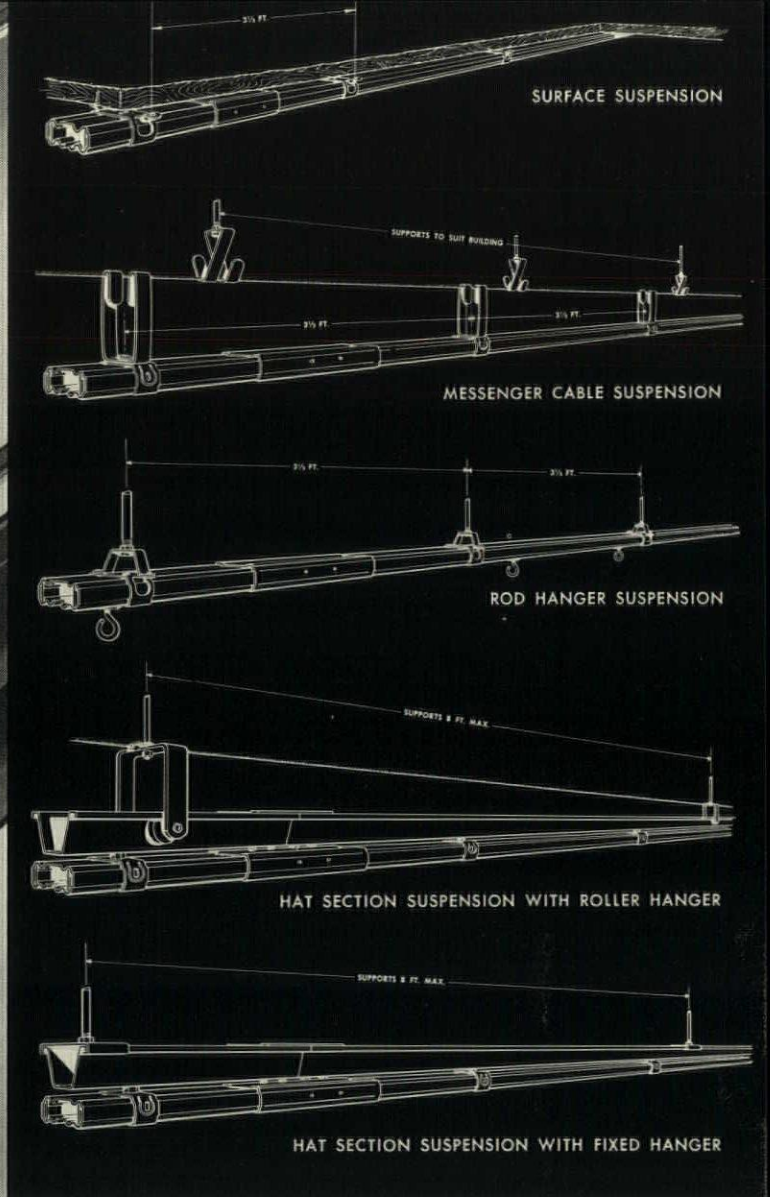
Student Science Furniture Saves Space

Educational science furniture catalog illustrates and describes Kem Tech laboratory furniture and equipment. Flexible and functional in use, furniture eliminates necessity for scattered installations—in some secondary schools can be combined to fit space of one or two rooms, and provide facilities for several or all science-study categories. Furniture shown in catalog is priced on basis of economical, large production runs. Also included are eight science room plans with equipment lists, and mechanical service roughing-in details for all items shown.
Kewanee Mfg. Company (AIA 35-E, 27-p.) **229**

SURFACING MATERIALS

Hardboard as Covering and Building Material

Booklet presents detailed drawings and descriptions on structural practices and principles in uses of hardboard—shows typical new-building, remodelling, attic, garage and farm applications. Available are: Weytex-all-purpose panel in standard, tempered and perforated types, thicknesses of 1/10", 1/8", 3/16"—width 4', lengths 8' to 16'; Weylite, a lower density economy panel, thicknesses 3/16" and 1/2"—width 4', lengths 8' to 16'; Weybase underlayment for floor coverings in 0.215" thickness, sizes 3'x4' and 4'x4'.
Silvatek Products Division
Weyerhaeuser Timber Company (8-p.) **230**



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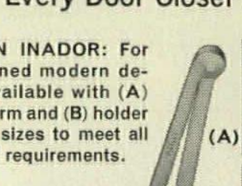
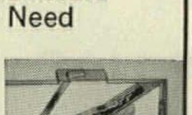

(A)

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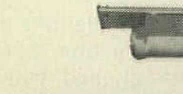

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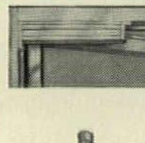

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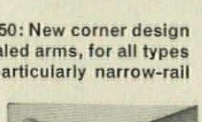

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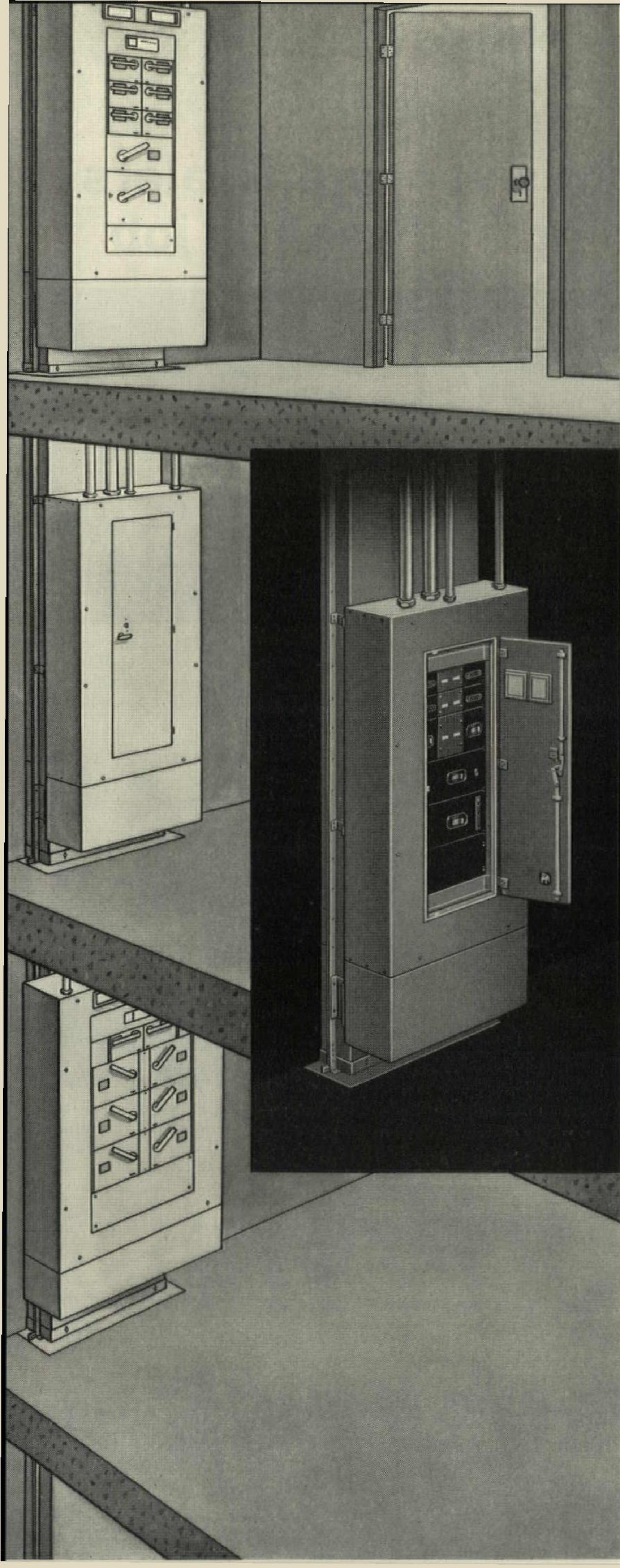

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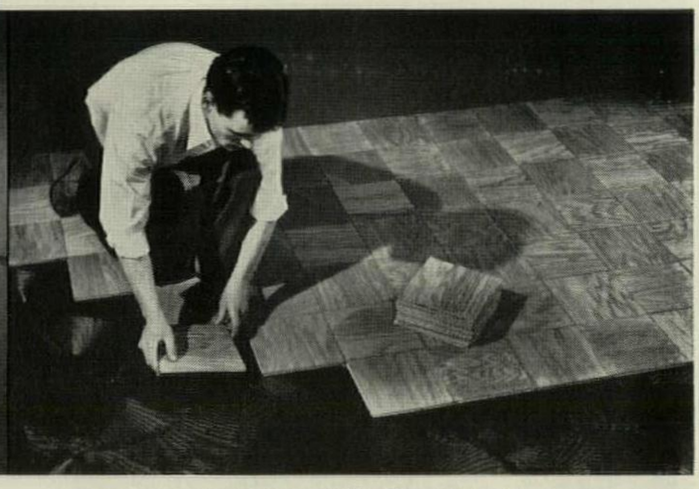

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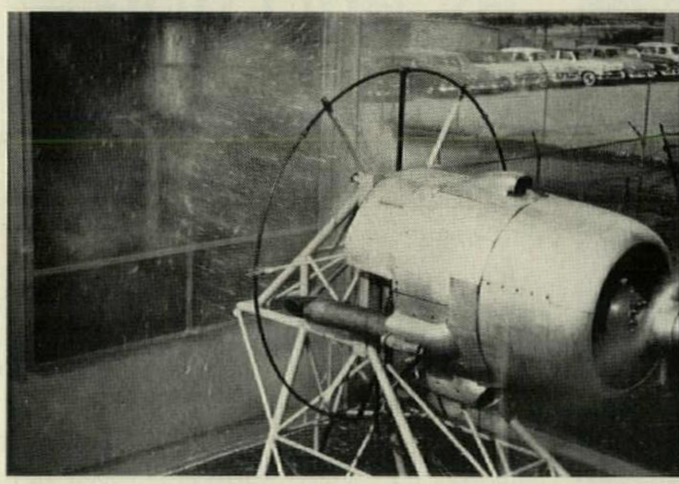

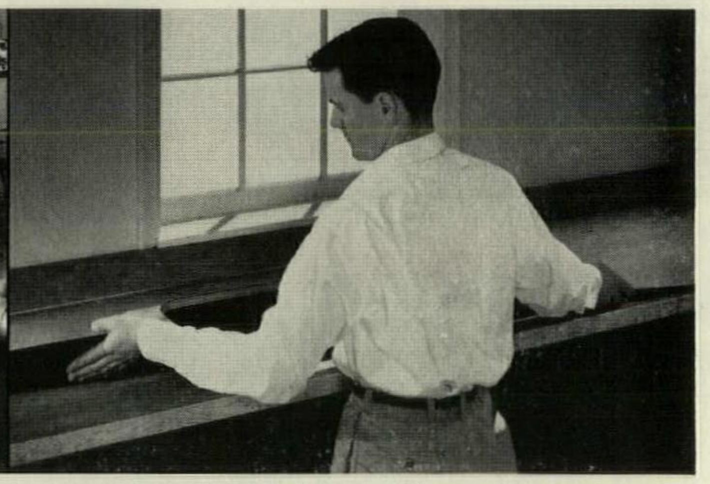

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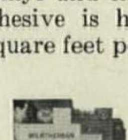

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Looking Forward to June
PROGRESSIVE ARCHITECTURE

FOUR HOUSES OF WORSHIP

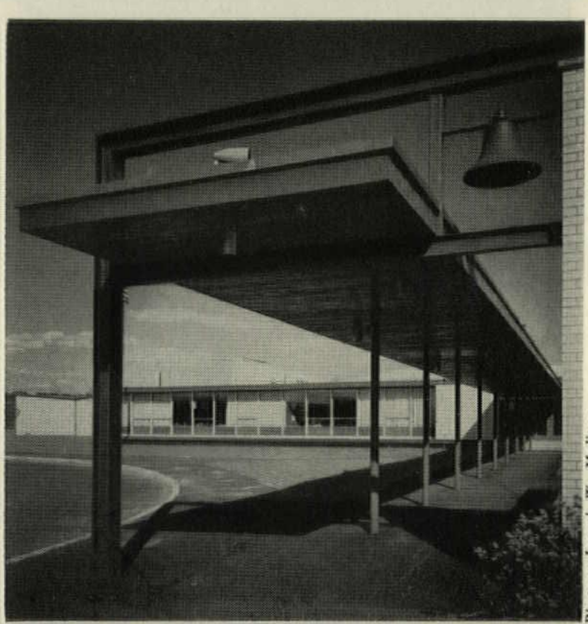
Perhaps our most noted designer of religious structures is Pietro Belluschi. In recent years, the Dean of the School of Architecture & Planning at MIT has done a number of new churches and temples, both alone and in collaboration with other architects, among them Skidmore, Owings & Merrill; Carl Koch & Associates; and Keyes, Leathbridge & Condon. JUNE P/A will examine four of the most outstanding of these recent structures.

THE CORPORATE NEIGHBOR IN THE SUBURB

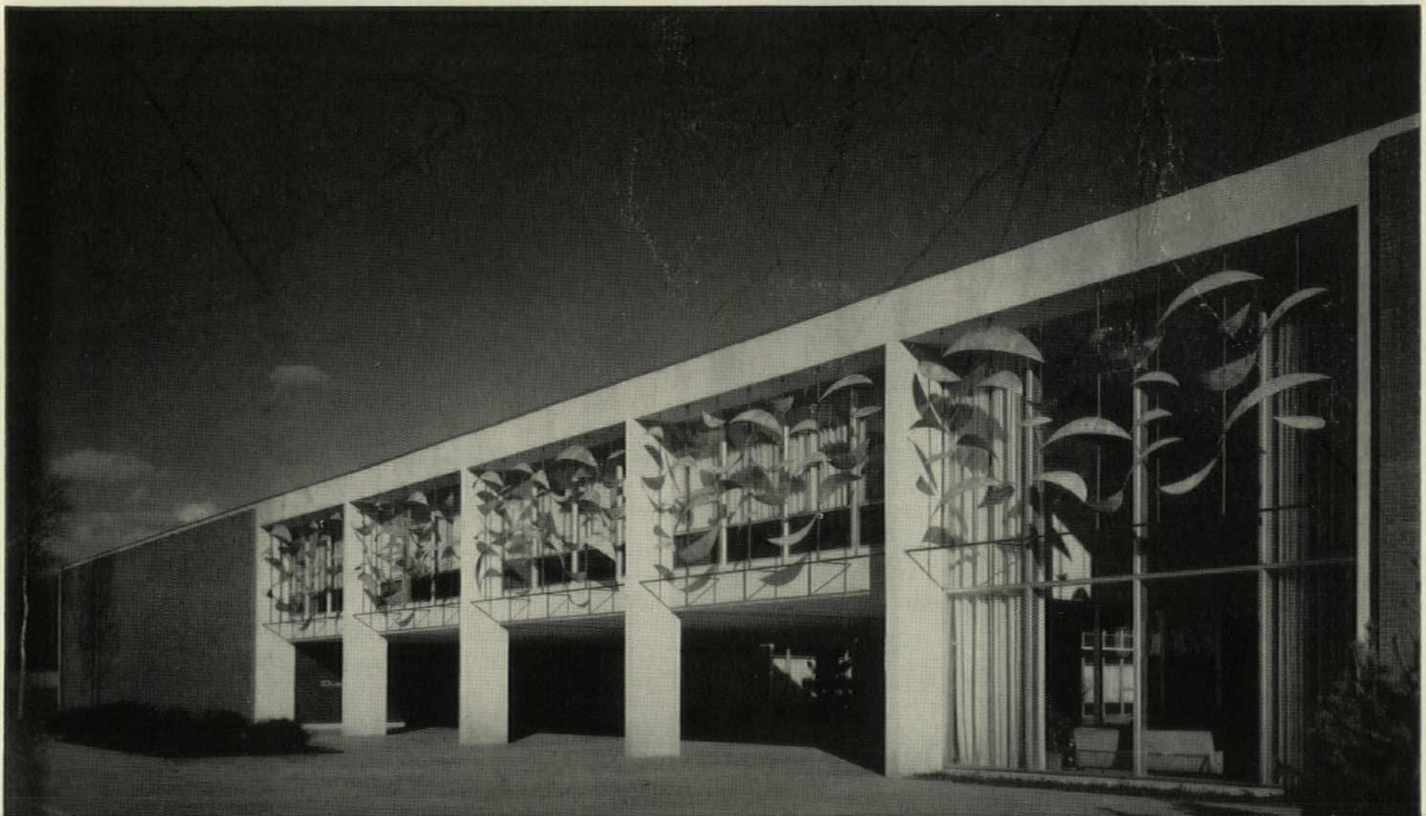
A building increasingly familiar in our suburbs and our countryside is the branch office building or the headquarters office building. Three well designed examples of this type are featured in JUNE P/A—the work of Sherwood, Mills & Smith; Garfield, Harris, Schafer, Flynn & Williams; and Thomas T. Haynes, Jr.

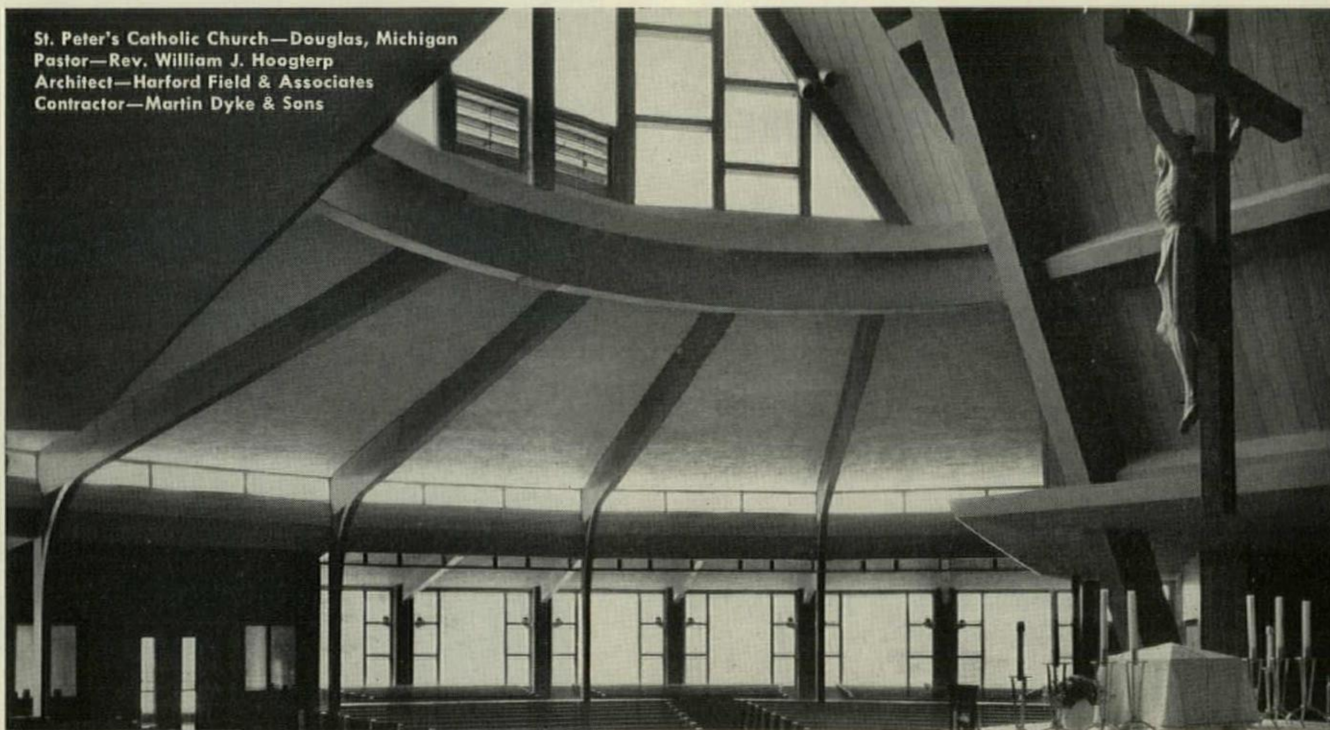
Two additional buildings to be presented in June are the office building of Architects King & Lewis of Detroit, Michigan, and Littleton, Massachusetts, High School by The Architects Collaborative. The latter will be the first *full* presentation of this distinguished school.

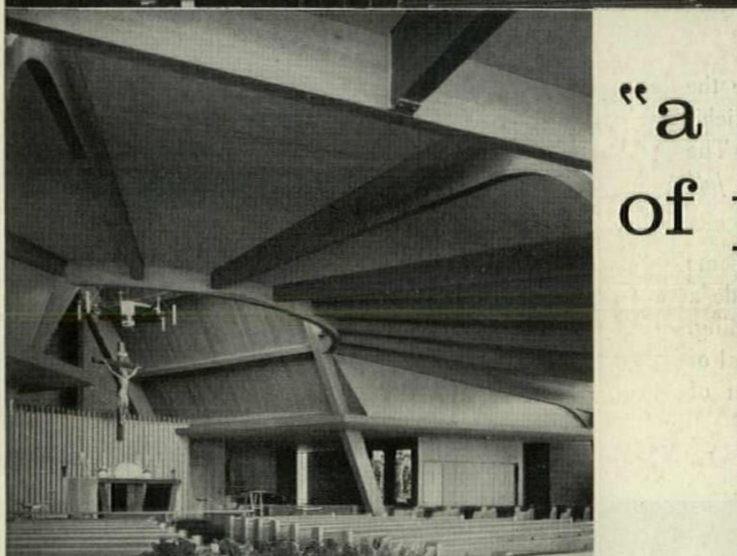
INTERIOR DESIGN DATA for June will be devoted to handsome bank interiors. Materials & Methods articles will include a mechanical-engineering report on the Dorr-Oliver Building, new methods for reinforced-concrete design, a reappraisal of seamless-roll terne roofing, and a technical discussion of venetian blinds.



Photos: Joseph W. Molitor







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Joe Monroe

FRANK LLOYD WRIGHT

1869-1959

The greatest architect that the United States has yet produced died on April 9. Frank Lloyd Wright's career, spanning the whole development of a modern architecture, encompassed also all possible relationships to that development: prime original innovator (influencing work abroad sooner than in his own country), credo maker (like Whitman, singing the nature of the country; preaching the nature of materials), active creator (producing architecture which will live in history), and finally, unhappily, polemicist (deprecating most concurrent architecture, denying its derivation from his own).

Uncritical evaluation of such a genius would insult his memory. The pages that follow estimate Wright's place in relation to the maturing—the ageing—of the movement he helped to mold.

F.Ll.W. and the ageing of modern architecture

by Sibyl Moholy-Nagy

The fall-out of genius, good or evil, is absorbed involuntarily by mankind. Hitler, Einstein, Freud, Picasso have affected our existence without personal contact, and scores of volumes have been written to denounce or acclaim their power. The imprint of *architectural* revolutions on the individual life is stronger, more immediate than any political or ideological pressure, yet it would be a most exceptional consumer of architectural form and space who would feel the need of addressing an architectural innovator: "Sir, I owe you much of my visual vocabulary and physical environment. The time has come to tell you how I feel about your influence!" Few would care, because buildings have an unalterable finality. They are accepted like predestination. This lack of architectural criticism deprives culture of two important ingredients: it lets the positive achievement vegetate unnoticed, without the ultimate joy that could be derived from it; and it lets failure spawn failure because inadequacies remain undetected.

The critic who has decided to offer his qualified devotion to the late Giant of the Taliesins finds himself exposed to a surprise—a fact so unanticipated that it bears out the earlier assertion that we are all sheep dwelling blindly. There is a sudden realization that the modern architecture of today, and Modern Architecture as a movement, can neither be identified nor judged in the same terms. By its semantic root the word "modern" means "just now"; but Shakespeare interpreted it as "Things supernatural and causeless made modern and familiar." These different definitions of as simple a word as *modern* contain the whole conflict between the Founders of Modern Architecture and their heirs. One evaluation implies relentless actuality, the other a concretization of values transcendental; or, on the one side, modern architecture justified by material progress and, on the other, Modern Architecture justified on grounds of personal vision.

Frank Lloyd Wright decided for the Shakespearean definition of *modern* almost as soon as he raised his own pencil. After he had shed both the tutelage of Louis Sullivan, so clearly evident in the 1894 playroom of his Oak Park house **1**, and the commission-hungry opportunism indicated by the 1892 Blossom House **2**, he never again presented any of his work without a transcendental message, linking it to Christianity, Ethnography, Democracy, Humanism. Anyone even superficially familiar with his multitudinous writing knows these invocations:

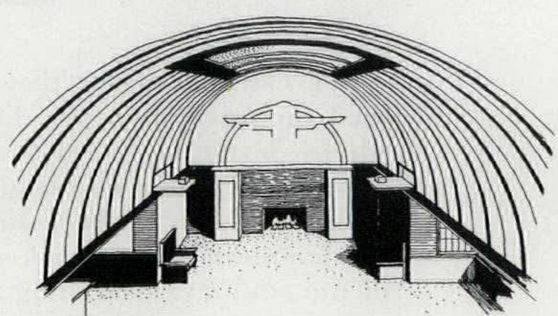
"Architecture I know to be a Great Spirit. It can never be something that consists of the buildings which have been built by man on earth. . . . Any building is a by-product of eternal living force. It is in architecture that God meets with nature in the sphere of the relative."

"The Kingdom of God is within You—it seemed to me that organic architecture was the only visible evidence of this."

This spiritual substructure of Wright's work forms one of the most conspicuous links between him and his peers, Le Corbusier and Mies van der Rohe. All three transcendentalized their design, and it is doubtful that God has ever been invoked so frequently in any profession outside the church. One only has to recall Mies van der Rohe's intense preoccupation with St. Augustine and his "God is in the details," or Le Corbusier's comment on his low-cost Domino Houses from 1915, ". . . beautiful, thanks to a soul which artistic creativity has given to these austere and pure organisms," and the Cartesian skyscrapers, 60 floors high, ". . . which allow the inhabitants to savor the good things which a bountiful God dispenses to man."

The Modern Movement in architecture was conceived as a religion with but one true prophet possible among the three patriarchs who challenged each other's states of grace like the three counter-popes in the 14th Century. When Wright said recently to his representative on the Guggenheim Museum site, "Bill, they will still try to figure this one out a thousand years from now!" he knew himself the possessor of the Architectural Tablets, revealed only to him.

What did the revealed truth of "things supernatural and causeless" in architecture "modern and familiar" do for Wright's design and therefore for us? It gave America an *American* architecture and Western Civilization at large the proof that residential design can be both modern and intensely personal. If one accepts as the prerequisite of the title Genius, a contribution of unprecedented originality, then Wright's claim to genius lies with his autochthonous design of the house. Through his architectural



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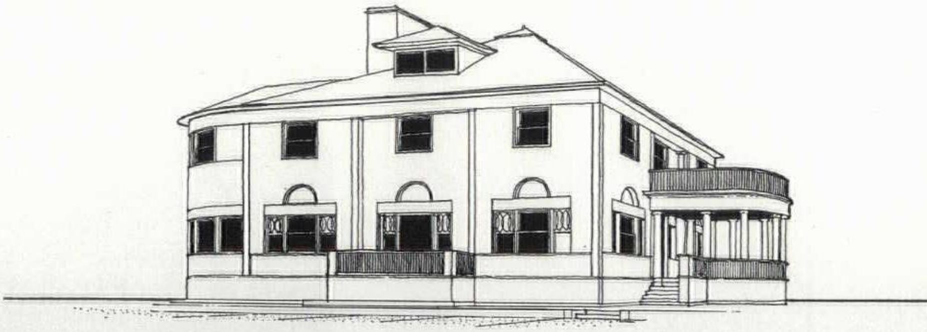
expression of the land, he raised regionalism to a new level, far above the sentimentality of Voysey or McKim. Never before had an architect been so fired by love for his country and his people. Out of this love he proposed to take on the whole subcontinent as inspiration and



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translate its finest features into architectural terms. Emerson, Whitman, and Wright form a unique trinity. They accepted their Americanness unselfconsciously, deriving from it not a feeling of inferiority but of strength. Wright's mature work has no trace of European influence, as has the work of almost every other American architect. Out of the profoundness of this love he could risk paraphrasing architecture in patriotic terms that would sound spurious in anybody else:

"How soon will we, the people, awake to the fact that the philosophy of natural and intrinsic building we are here calling organic, is at one with our freedom as declared in 1776. . . Solidly based upon the new humanities and modern sciences as the cornerstone of our genuine American culture . . . 20th Century architecture issued by way of the Hillside School, the Larkin Building, Unity Temple, the Coonley and Robie Houses. . . ."

The indigenous forms so created for mountains and plains, city and farm, hot climates and cold, are abstracts of the region where they stand, without ever stooping to folksy decor. Overhangs and garden terraces of the Middle West are as convincingly "local" as are the bleached planes and boxy wood frames of Taliesin West on the Arizona desert **8**. Wright's ideal of shelter as the specifically human condition proceeded not from social orientation, characteristic of our own day, but from a geocentric empathy:

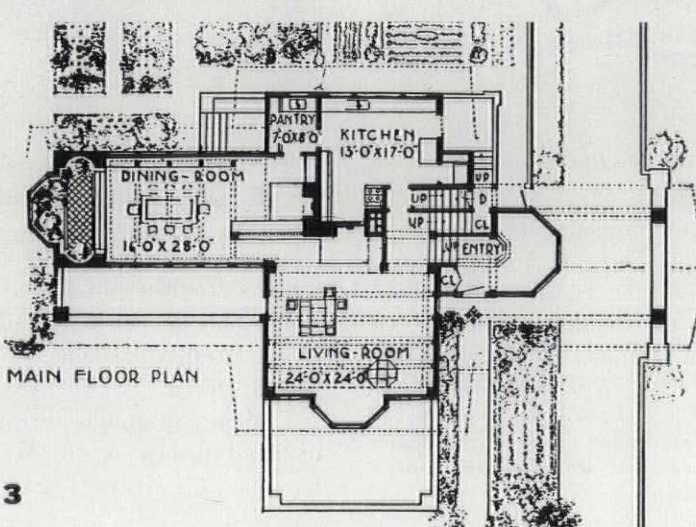
" . . . the true earth line of human life—indicative of freedom."
" . . . the house not ON a hill or ON anything but OF the hill."

climaxing in the Prairie Houses of Chicago and Buffalo. The best of them—Coonley, Robie, and particularly the beautiful Martin House in Buffalo—are uncompromisingly individual and yet uncompromisingly intrinsic. The stylobate delineates in a superior gesture of intellectual pride man's humanistic domain as against the supporting cast of organic nature. From this same fruitful first decade of the 20th Century date the original "open" plans, such as the project for *Ladies Home Journal* **3**—far removed from the witless all-purpose void of today—with spaces flowing into each other yet remaining clearly accentuated. A multitude of vistas supplies in a region of little natural variety a kaleidoscopic view of the grounds, included to the last shrub and pebble in the architect's design.

Le Corbusier's *piloti*, his rakishly open house façades and roof gardens, are of the same stuff as Wright's houses, despite seeming opposition. Wright's geocentric ideology is but the point to Le Corbusier's contrapuntal heliocentrism. Where Wright promised earthbound vitality, Le Corbusier assures the inhabitant of his *brise-soleil* loggia ("a portico such as Socrates advocated") that "here body and spirit will open like flowers to the sunlight."

The generation following Wright and his peers into architectural practice dropped this deep ideological implication of "modern." Contemporary design should be blamed for its conspicuous lack of ideas or, if some are proffered, for their simple-minded symbolism: the wingspread airport building, the fish-shaped church, the symmetry of Connecticut Palladianism. Yet there is virtue in the absence of esoteric double-talk. If contemporary architecture is poor in spirit, it confesses at least to its limitations. And this is something architecture as gospel never did. The commitment to architectural prophecy carried with it the danger of bending the empirical equation—structure equals function—to the preconceived ideological message.

Human life is infinitely inventive in its manifestations. As long as Wright designed for this limitless interplay of human desire and human habitation, his formal and



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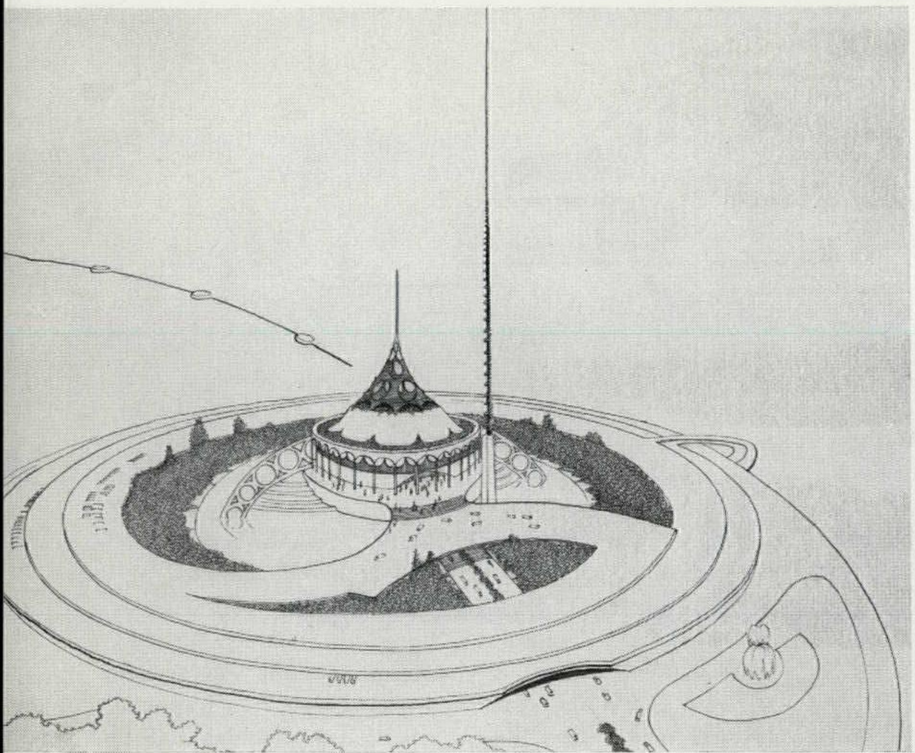

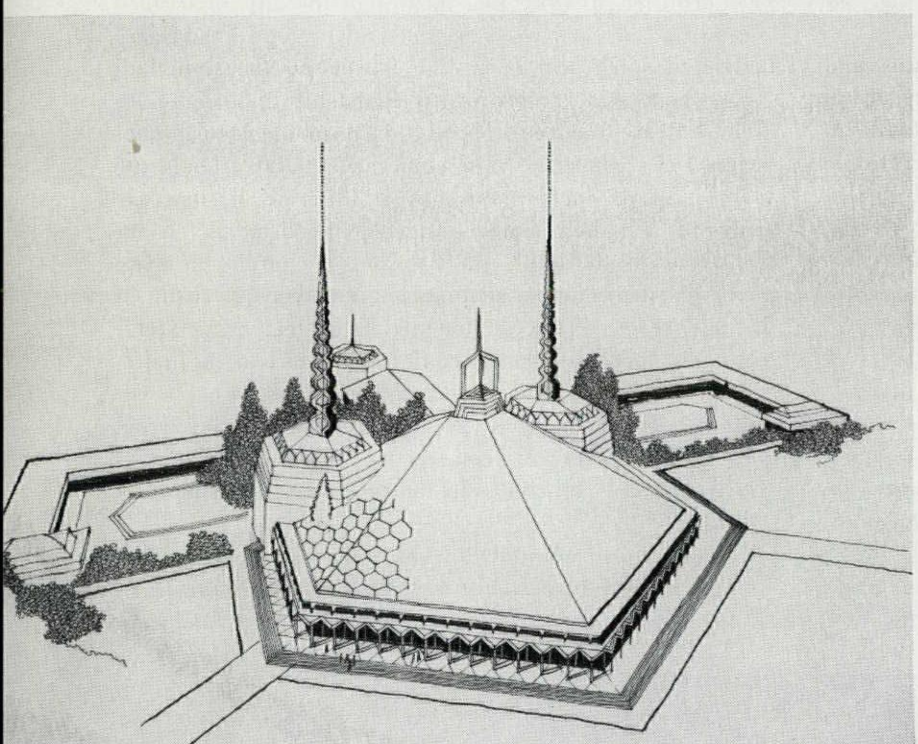

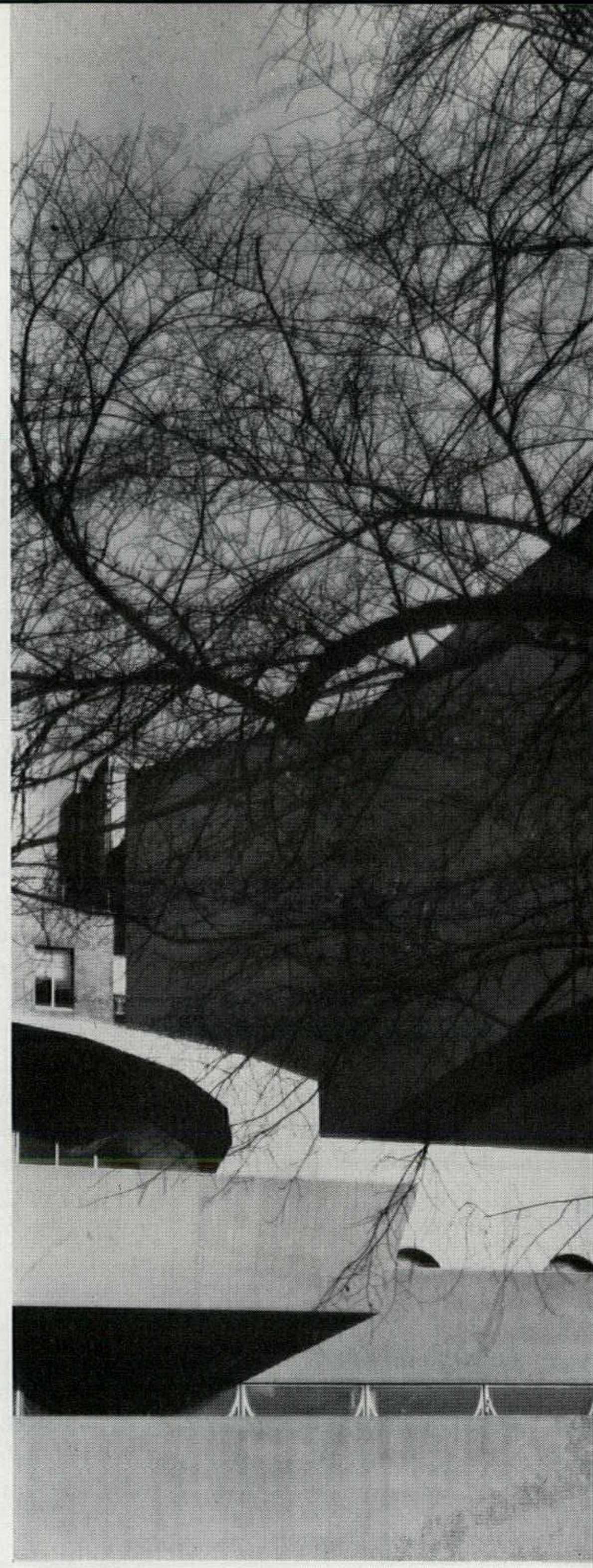

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verbal exuberance were magnificent. But when he left the sphere of individual commissions designed for specific personalities, the prophet and the propagandist often stood in the way of the architect. This became evident in two public projects recently designed: the Theatre and University District of Baghdad, and the Capitol in Phoneix. Of the Iraq State Opera House in Baghdad **4**, Wright wrote "in the land of Haroun Al Rashid . . . is to be a beautiful expression of historic nature . . . a crenelated dome of metal and glass sheltering a golden figure of Aladdin and his Wonderful Lamp and looking out over a new 'Garden of Eden' with 2 fountains symbolizing Adam and Eve."

The building for the Arizona State Legislature in Phoenix **5** seems almost identical in design concept and structure, yet here it

"is to be a ferro-concrete and metal and glass construction system that now constitutes the 20th Century body of our world."

The only conclusion possible is that either Grand Opera is a frustrated parliament or the Legislature a frustrated Grand Opera.

Examples of architecture justified by this literary sleight of hand turned up in Wright's work with disquieting frequency in recent years. The most conspicuous one is

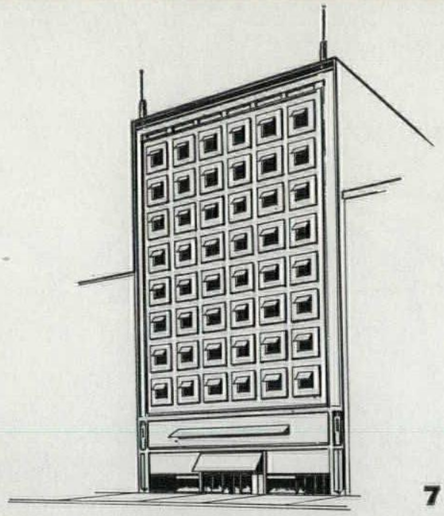
6

the Guggenheim Museum in New York **6** about which more will be said, once it is in operation. At this stage of near-completion it seems strangely hostile to its purpose, which is to display the largest possible number of paintings in surroundings most advantageous to the artist and to the beholder. In 1947, Wright designed a self-service garage with a continuous-ramp system which promised an excellently logical solution for "rolling stock." In a museum, the continuous ramp and tilted walls, justified by the architect as "the way a painter sees his picture on the easel" (whereas even the simplest easel has a head clamp to hold the canvas for viewing perpendicularly), the unhappy mixture of unreliable daylight and unadjustable artificial light, cramped space against a complete central vacuum, and other shortcomings, seem to bear out an oft-professed hatred of his against "the insufferable insubordination of the picture."

But even this impending defeat of art by structure is made to be sheer prophecy:

"a herald of *all* views that can be taken in the future of art, architecture and religion."

The divide between the Modern Movement and modern architecture—as two different epochs—is most evident in



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reactions to building technology. Here the world of the Old Masters and the young ones is irreconcilable. Wright, Le Corbusier, and Mies van der Rohe formed their personalities in the pretechnological age of building. Their earliest work is clearly derived from Renaissance prototypes. When they accepted "the machine," it was as an ideological protest against the Academy, a bold act of self-assertion flung at their spiritual fathers. Wright and his two peers did not turn to machine-produced materials and assemblage because they were cheaper and more efficient, but because this was a new means of expressing their personal convictions and giving form to their esthetic concepts. Le Corbusier's book, "*Vers une Architecture Moderne*" (1923), a hymnal dedicated to cars, ocean liners, and airplanes, is perhaps the most extreme expression of this attitude. Building Technology was not pragmatic but intuitive, as in Goethe's definition: "a revelation generating from the innermost man." Wright's 1894 glass and metal façade for the American Luxfer Prism Co.'s office building **7**, Le Corbusier's slab structure, Mies van der Rohe's glass-skyscraper projects from 1919, are programmatic, not actual. Today's architectural engineering derives from the static formula, the prefabricated unit, and the expedient purpose. If the results are beautiful, they are so by virtue of their adequacy. Even the delicate millinery of a Nervi vault proceeds from stress diagrams and aggregate formulas and not from religious, ethical, or social axioms.

For the Masters of the Modern Movement, technology never lost its spiritually transfiguring impact; they continued to justify themselves against the erring traditions of their youth. Inherent in this approach to industrialization is a violent conflict between personality and formula, between self-expression and manufactured conformity. This conflict can produce extraordinary creative energy. It also can increase the warping effect of verbalization. Of our three peers, only Mies van der Rohe did resolve the conflict early in his career. He wrote in 1924: "I consider the industrialization of building methods the key problem of the day for architects and builders." Being that rare specimen, a taciturn architect, his occasional pantheistic allusions do not intrude. But Le Corbusier has never healed in himself the trauma of structure versus phantasy; nor did Wright. In Le Corbusier, it is the creative artist —the sculptor—who tries to force building technology under his imaginative will. In Wright, a spiritual transfiguration of technology attempted to come to terms with the "organic" creed that was his inner substance.

This vexing conflict between devotion to pure nature and devotion to "the age of the machine" gave to the work of Wright's first creative period—up to 1920—its special power. He wrote then:

"In the nature of nature, I would come upon nothing not sacred. Nature became my bible."

Nevertheless, in 1901, he formulated his famous Hull House lecture on *The Arts and Crafts of the Machine* which has remained the brightest exposition ever made of machine technology in the service of architectural design:

"Rightly used the very curse machinery puts upon handicraft should emancipate the artist from temptation to petty structural deceit and end this wearisome struggle to make things seem what they are not and can never be . . . Yes, although he does not know it, the Artist is now free to work his rational will with freedom unknown to structural tradition." and later:

"Consider well that a house is a machine in which to live but that architecture begins where that concept of the house ends.... Standardization should be put to work but never allowed to master the process that yields the organic."

All of Wright's designs from that first period show him in full command of technological means as supporting elements auxiliary to the free choice of form and space: Unity Temple, concrete as Protestant affirmation, with the cantilevered roof slab and the emphatic corner stair towers as "features"—the personality of a nonconformist religious unit; Taliesin East, contentedly one with the Wisconsin landscape, Wisconsin building materials technologically used—the wood-truss structure of the long drafting room and the anchoring piers of native granite; but above all the sheltering cantilevers of the Prairie houses:

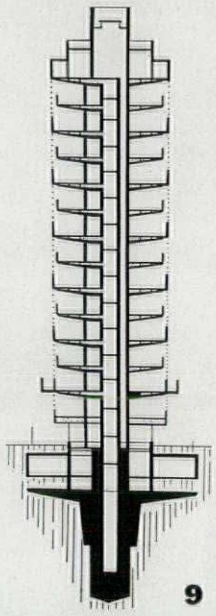
"the outstretched arm with dropping fingers as wall, stress patterns of continuous structure—the pull of intertwined hands."

When Wright reappeared on the architectural scene after a hiatus of 15 years, technology the servant had grown up into a dictatorship. What had been a dichotomy became open conflict between his organic roots and an obsessive want for structural originality at all cost. "Falling Water," the Kaufmann house above the waterfall at Bear Run, is still evidently organic, structure never encroaching on "the prime factor in any concept of building, man into his environment as a legitimate factor."

But already the singing rhythm of interior space is sacrificed to the cantilevered slabs that have to prove "the destruction of the box." The rooms of the house at Bear Run are chaotic and dark. The Johnson Wax Factory at Racine, from the same period, shows the conflict widening. In scale and formal composition, this factory and administration building in a semi-rural setting is masterly. The principal structural idea of stacked mushroom columns, upholding the horizontal divisions like open palms of many hands, is convincing enough. But the theme is overworked like an endlessly repeated refrain. In order to accommodate the visual repetition, form is coerced into tangled compositions, enforcing "organic interrelationships" where none exist. The Johnson Laboratory Tower **9**, 10 years later, demonstrates clear up into the sky that nothing but the word can reconcile technological and formal inconsistencies. The bedrock, taproot structure of

steel carries floor disks cantilevered from the core. But a square glass-curtain enclosure is wrapped around it, providing a clash between circular and rectangular space that arouses visual and functional protest.

There still continued to issue from Wright's drafting board shelters of true genius—Taliesin West of geometric perfection and spatial joy **8**, the elegant and beautifully proportioned bagatelle of the Morris Shop in San Francisco, the Harold C. Price, Jr., House in Bartlesville, Oklahoma, where the best of the Prairie House tradition is brought to a climactic refinement. But these were dying chords. Louder than a lifetime of noble regionalism grew the exhibitionism that had to prove to the world that the master was not OF his times but far out in the future. Le Corbusier's City of three millions, where 40,000 tenants are to be packed into "Vertical Villages" of "merciless grandiosity," seems a rural retreat compared to the Mile High Office Tower project by Wright, 528 stories high and inhabited by 130,000 people. In his literary descrip-



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tion of this "tallest structure ever conceived . . . wiping out the hateful spread of the city" the tree was invoked once more, as was the taproot, "drilling into bedrock for inserting the spinal core . . . similar in principle to the foundation system that saved the structure of the Imperial Hotel in Tokyo in the 1922 tremblor." That structure, however, had been the exact *opposite*—a magnificent achievement of Wright's autochthonous intuition:

"Long piles would oscillate and rock the structure. Therefore the foundation should be short and shallow. There are 60 to 70 ft of soft mud below 8 ft of surface soil on the site. Why not float the building on it like a battleship?"

Wright's final enthusiasms—"en theos," meaning inspired by the God—no longer generated from his American vision; they emerged from a vision of himself:

"It is an inflexible will, bridling a rich and powerful ego that is necessary to the creation of any building as architecture. Call it individual. And it is ever so! And any great thing is too much of whatever it is; it is a quality of greatness. Excess of contrast in genius brings about a mighty equilibrium."

The old incantations worked only on paper:

"Man's building in order to be architecture is the true spirit of himself made manifest, whereas the turtle had no freedom in making his shell."

In order to protect his freedom of design, Wright's latest projects—a Synagogue, a Greek Orthodox church, a Civic Center for Madison—all suffered from a disquieting duplicity of egomania and fitness. The skeletons got so intricate, the formwork and reinforcements so excessive that one was reminded of an observation made 40 years ago by the same architect, as a builder of human shelter:

". . . structure becoming a kind of cellular tissue stuck full of bones, complex now as the confusion of bedlam."

In spite of frantic attempts to remain in advance of the avant-garde, the ageing of Modern Architecture revealed itself in Wright's incomprehension of the one basic law that raises building technology to technological architecture. Technological architecture must eschew ornamentation and decoration because its one essential esthetic factor is the interaction of structural elements: in this alone lies the architectural justification of Nervi, Candela, Niemeyer and the whole *new* modern school. The criterion of their work is the demonstrable, objective compossibility of structure, form, and space—and not the transcendental philosophy of the architect. One can deplore or hail this new epoch, but it is here and now.

The Danish philosopher, Kirkegaard, remarked more than 100 years ago of the Industrial Revolution that where once fearful abysses had challenged the lonely wanderer, there now were railroad bridges, affording the traveling crowd smug glimpses into the depths, from the safety of their mechanical conveyances. As a lonely wanderer, taking on the challenge of an eclectic and mechanistic culture, Frank Lloyd Wright was a very great architect. Those who pause to look back at the courage and ingenuity with which he interpreted the greatest assets of his country to the unwilling eyes of his contemporaries will be moved and grateful. From the finest human shelter any epoch ever produced, we can derive a simple creed of humanism and responsibility:

"A conscientious architect learns to understand the nature of human nature so well that the character of his structural ability may eventually justify calling organic architecture *man's love of presenting man to man*."

It is thanks to Wright that the 20th Century has a concept of intrinsic architecture that neither shuns technological progress nor sells out man's unchangeable need for design environment. Future generations will forget his attempts to compromise with the stampede into architectural suicide. What will remain are the homes of the Prairie and the Desert, stone as stone, wood as wood, and concrete and steel as servants and not as masters of the architect as artist. The profound sense of order, of geometry as "presentation of the properties and relations of *spatial* magnitudes" which Wright possessed resulted in an architectural creed which established for modern architecture a tradition and an ideological basis:

"Today because of scientific attainments modern man clearly perceives beauty as integral order, order apprehended by reason and executed by science. With integral order established you may perceive the rhythm of consequent harmony. To be harmonious is to be beautiful, a platform from which to spring toward the moving infinity that is the present."

DESIGN FOR HEARING

For the last half century, the science of acoustics has been evolving so that, today, there are techniques applicable to analyses of the most complex acoustical problems. In recent years, many excellent papers and textbooks have been published from which the professional could learn more about the intricacies of the particular problems confronting him in his own practice. In the field of architecture, most architects out-of-school for two decades or so have had fundamental, if elementary, instruction in the phenomena of acoustics. Older practitioners who, perhaps, were not so well grounded in this subject during their academic years, have had the opportunity to learn the hard way—through their own research, deductions, and mistakes—about the fascinating, if sometimes elusive, characteristics of sound. Architectural journals, too, have presented their readers with the up-to-the-minute theories of leading acoustical experts, and with developments and applications of new acoustical materials.

Despite the stature of acoustics as a precise science, the description of the basic nature of acoustics conveyed to practically all recent students of architecture, and the opportunity all architects have had to become *au courant*, acoustically speaking—a disappointingly large number of structures have been recently completed only to reveal, on occupancy, that their acoustical environments are unhappy. For this prime reason, the principles of design for good hearing have been restated in this issue of P/A. This review of principles—not in any sense a textbook approach—has been authored by Robert B. Newman of the internationally known firm of acoustical consultants, Bolt, Beranek & Newman, Cambridge, Massachusetts. Except as otherwise noted, Newman has drawn on the consultant work of this firm to illustrate as Case Histories some of the solutions for today's most frequent acoustical problems in contemporary architecture.

In THE PRACTICE OF ARCHITECTURE section of this issue, Acoustical Consultant Lewis S. Goodfriend reports in some detail on "Quieting Air-Conditioning and Ventilating Duct Noise." Many of the latest refinements for acoustical materials also are reviewed in the NEWS REPORT.

That others have been aware of a lack of attention to this design element in buildings was evidenced by the recent conference—"Noise Control in Buildings"—held by Building Research Institute in New York. A key speaker at that meeting was Robert L. Geddes, of Geddes, Brecher & Qualls, Philadelphia architects. Geddes' words at that conference, reprinted with permission on the following pages, aptly set the scene for Newman's discussion.

INTRODUCTION

the ring of architecture

by Robert L. Geddes

Architects are always redefining architecture: introducing new ideas, and reconsidering old ones. Design is really the synthesis of important ideas. The priorities given these ideas, the hierarchy of their importance one to another, are apparent in what an architect builds, and sometimes in what he says. Unfortunately, and the cause for this issue of P/A, much contemporary theory and building either ignores noise-control, or treats it only as a surface esthetic.

One wonders what priority is given to noise-control within the following approach: "Architecture is an art and hardly anything else. The aim of architecture is the creation of beautiful spaces, and everything else is so subordinate to it that it just doesn't exist."[1] History is on the author's side. Architecture is essentially an art: a visual art, a plastic art, a spatial art. But one must realize that the experience of architecture is received by all of our senses, not by the eye alone. "The quality of a space is measured by its temperature, by its light, by its ring, and how a space is served with light, air, and sound must be embodied in the concept of the space itself."[2] How do we make the "ring of the space" part of the concept of the space?

It is ironic that the modern movement is called "functionalist." Some of the highest priority ideas in our architecture are not based on function but on poetry. The painters have had great influence. A modern architect says: "Transparency is definitely one of our objectives. It is one of the most fascinating new technological possibilities. We can do it with the means we have, with our materials, with our heating systems, with everything."[3] But can we do it and also control noise? The problems posed by transparency are many. Structure becomes light and thin. Space is not isolated, but apparently continues without a barrier through glass, grills, and gardens.

It is increasingy difficult to reconcile noise-control with other ideas in art and technology. For example, "continuity" is an important idea that underlies much contemporary architecture: the flow of space, the open plan that means continuity of space; and the flow of structural forces that leads to a continuous structure. The leaders of the modern movement, from Wright to Le Corbusier, have practiced and preached the importance of "continuity" as an architectural idea. How can we achieve it, and still control noise?

It is important to remember that architecture is always changing its set of priorities. Neither the architect of the next century nor the architect of the Renaissance would set the same emphases or priorities as we do. The Renaissance concept of space and structure, for example, was more static, isolated, and cellular; it would have solved some of our man-made noise problems. But, that opens the door to new possibilities again, doesn't it? Is there any hope for concepts that will admit noise-control, if not into the center ring, at least into the same circus tent?

Ever since man first crawled into a cave or made an enclosure, there has been a sense of the "operational" basis of architecture. The esthetic of structure has always been based upon the elegant solution and expression of an operation: the carrying of a load, the resisting of a force, the resolution of thrusts. A modern architect says that: "A space in architecture shows how it is made. Nothing must intrude to blur the statement of how a space is made. The joint is the beginning of ornament in architecture."[2]

In a similar way, one can consider the way the building "operates" to keep out water: the way water is made to drip from moldings, the way exterior materials join to be waterproof, the way waterstops are put in all joints. Watercontrol is part of the basic space order of architecture, and it is part of the detailing of all joints. The way in which water is controlled has become a basis for expression and enrichment in architecture.

These two examples—structure and the control of water—indicate the possibilities that can be found in an "operational" basis for architecture. They indicate the possibility that the control of noise might also enter fully into a theoretical basis as well as the practical needs of architecture. Ten years ago, an excellent presentation of this viewpoint was made by James M. Fitch in his book, *American Building*.[4] Fitch said that "the function of American Building must be the maintenance of those optimum environmental conditions essential to the health and happiness of the individual and to the peaceful, efficient development of American society."

In defense of our architects, it must be pointed out that until recent years a simple sound environment was the natural state of man. Our ancestors heard a few sounds and most of them were pleasant: the song of a bird, or the wind in the pines, the cry of a baby. Although some of these sounds might have been dangerous by implication (as warning signals), they were not themselves dangerous to health. All the more ironic, then, that today the man-made sound environment constitutes a real threat to the well being of urban America. For it is modern industrial society that has created new sound to the point where sound levels in many plants and offices are at the threshold of pain; and where most urban areas have an average loudness level that makes protection against it necessary. We have polluted our natural, quiet environment.

Architecture must develop more fully as an "environmental art." One purpose of a building should be to operate as a selective filter and barrier, taking the loads of the natural and man-made environment off man's body. One purpose of a building should be to contribute to a humane environment.

The control of the environment is not the totality of architecture, but it must be part of the basic order of design. The architect must make sound control his own problem.

Sound barriers can become part of the expression of architecture. They can be put around the source of the noise, or around the victim, or both. They can be incorporated in first thoughts about the nature of spaces. Like the water barriers, the sound barriers can contribute to the richness of expression in architecture. Sound-absorptive and reflective materials can be given a life of their own; and traditional materials can be reconsidered in terms of their sound qualities. This could happen, but hasn't, because "sound conditioning" does not yet have the status of "air conditioning" in our building program.

It is essential that "sound" be presented to architects in terms of operations, rather than as use of soundproof materials alone. After all, we understand heating and air conditioning in terms of insulation, ducts, cycles, humidity, and so forth. It seems incredible that most architects and most manufacturers' literature are so inarticulate about the basic operations of sound: transmission and absorption.

It is also essential that "sound conditioning" be predictable, within reasonable limits of accuracy and economy of effort, while the building is still being planned. It is held that any noise is acceptable as long as it does not annoy the occupants of the building; can this point of annoyance be predicted ahead of time? The architect can rightfully claim that noise is not the problem; annoyance is the problem.

What would the architect like to know about sound? For example, how can we predict the quality of sound, the "ring" of a space? How can we make a space feel more noble, or more gay, or more intimate, or more climactic, or more private?

What is the difference between sound-control techniques for large and small spaces? Can the quality of sound relieve the monotony of corridors? How can the quality of sound contribute to a sequence of spaces, a rhythm of spaces?

What does a wall need to be? What does a floor need to be? We understand these questions very well in terms of structure; why not in terms of sounds, impacts, vibrations?

It is ironic that the spatial ideas of our time have dealt so eloquently with structure and light, but so poorly with sound. If the problem of noise-control is clearly stated, so that it be given a high priority among the ideas to be incorporated in design, one can predict that new spatial concepts will arise.

And the other side of the coin: whereas the structure of building has become an expressive element,[5] the provisions for sound have generally remained inexpressive. Hung ceilings and other falsework are the most common images that come to mind when one considers sound control. But most false ceilings deny the structure and mechanical services of the building. False ceilings tend to "homogenize" architecture. The future direction of architecture lies elsewhere. How a space is made, and how it is served by light, heat, power, sound: this is the integrated technique that we seek in architecture.

But we must remember that technique is a means to an end, not an end in itself. Architecture is a social art and a spatial art: its essential function is to help solve some of man's problems and to enrich his spirit.

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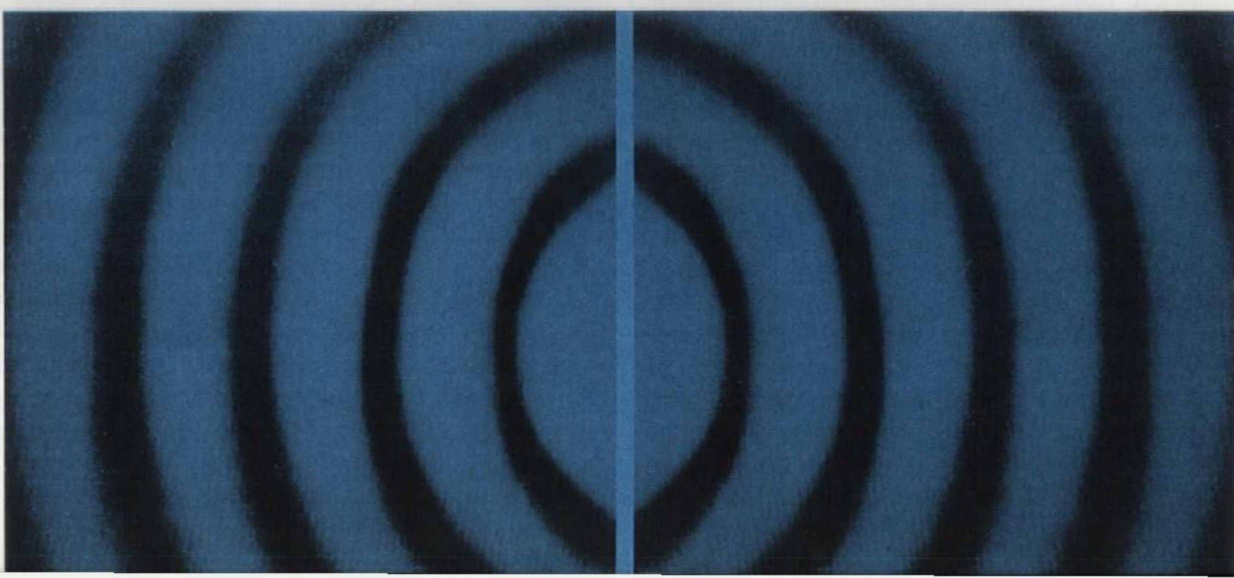
[1] *Philip Johnson*
[2] *Louis Kahn*
[3] *Marcel Breuer*
[4] *Houghton Mifflin Co.*
[5] *Nervi, Le Corbusier, etc.*



Robert B. Newman

PART ONE
every building has acoustical problems

Everyone knows that acoustics is important in concert halls, radio and TV studios, or churches. But, how often do we recognize that every apartment house, office building, motel—in fact, any building type we can name—has many acoustical problems? Each element of the design and construction of a building has some influence on its acoustical characteristics and, unless all of the factors involved are clearly understood and properly incorporated during design of a building, we seldom achieve completely satisfactory results.

Many acoustical problems in today's buildings can be solved without any additional cost for acoustics by the sensible application of basic principles. The task of achieving really good conditions is becoming increasingly complex, however, as we move toward lighter building components and demand increased flexibility and mechanical services. While people may be growing more tolerant of noise and lack of privacy, there is still a very definite limit to what occupants will accept and still consider the building "good." The provision of really good acoustical conditions throughout a building is no longer a matter for hopeful guesswork and later fixing up. The provisions for good acoustics should, and can, be engineered *during* the design of the building—just as matters of heating, ventilating, structure, and lighting are now considered in the best contemporary practice. Unless there is this careful, initial integration, the cost of fixing up later is almost prohibitive, and the results are seldom as good as can be achieved with careful planning.

let there be no surprises

The theme of this issue might well be: "Let There Be No Surprises." That there are acoustical surprises in many new buildings (*Figure 1*) is not due to willful negligence on the part of the architect, or builder, but rather lack of basic understanding of the way sound behaves and the way it travels from point to point in a building. Recently, a large office building was completed for an insurance company. The executive office areas were subdivided with very handsome, beautifully detailed (for appearance) movable partitions. The secretary of one of the vice-presidents complained that she had difficulty taking dictation from him, because she often got mixed up with the dictation of the vice-president in the next office! These people solved the problem, at least temporarily, by vacating every other office—very expensive sound isolation! The owner of this building was surprised and disappointed to discover that, with the partition system he had, he could never have any degree of privacy in adjoining offices. "Maybe we would be better off with brick partitions," said the owner in despair. Yes, that would have been one answer, but not necessarily the only one.

Certainly, in today's buildings we do not expect to find brick partitions separating private offices; but we cannot hope to provide this old-fashioned privacy with paper-thin partitions surrounded with all sorts of built-in leaks and cracks. Only by careful integration of techniques at our disposal today can we achieve privacy *with* flexibility.

Another amusing incident comes from a large engineering building where one of the executives complained of excessive sound transmission between his office and his neighbor's. The new buildings were in the country where it was very quiet. There was no city traffic noise to provide the continuum of background levels which so often hide the minor intrusions from neighbors in city office buildings. In this particular case, sound was being transmitted over the top of the partitions through the lightweight ceiling into the plenum space above. Things were improved by placing plasterboard over the ceilings in question, and the executive noticed that he had much more privacy from his neighbor. However, he said: "Things are really not much better; in fact, they may even be worse now. This chap in the next office always tells his secretary a joke first thing in the morning, and now all I can hear is the laughter!"

How much isolation do we really need for privacy and freedom from distraction? We find that this is a really complex question, and one not answered with single numbers. It depends on whether we mean complete, confidential privacy or simply freedom from distraction. It depends to a great extent on how noisy the environment around the "listener" is. In the noisy city, for example, we can often get by with very thin, lightweight partitions; while in the country, where things are very quiet, we may need to have 8 in. of brick for adequate isolation, or else tailor the air-conditioning system noise output to match that which we find in the big city. Each case requires its own specification, but, in 1959, this can be done with engineering knowledge available.

"acoustical perfume"

The more we study the reaction of people to acoustical environment, the more we find that in many situations it is extremely desirable to have a certain amount of noise. We often refer to this noise as "acoustical perfume," since with pleasant, continuous, background sounds we often hide minor intrusions which interrupt our privacy, or which bring us distracting information about what is going on in the next room. We have learned what sorts of background levels people like, what they will tolerate, and under what conditions the lack of background noise makes a space unsatisfactory. Noise from the ventilating system, from traffic, from general office activities all contribute to making most spaces seem quieter than if they were, indeed, without these sounds.

Sometimes the designer of a building becomes intrigued with some particular aspect of the design, and seems to forget the interaction which this feature will have on other aspects of the total result. We had a desperate telephone call the other day from an architect whose new 10-story office building, designed primarily for doctors and lawyers, was nearing completion. One floor had already been occupied and the tenants were extremely unhappy with an almost total lack of acoustical privacy. Doctors and lawyers demand a high degree of privacy, because much of what they say in their offices is highly confidential. In this particular case, the architect had used a new system of ventilation, employing an over-ceiling plenum for the supply of air. Each office was supplied with air through a series of slots extending across the ceiling, with the partitions terminating at the finished ceiling line. Of course, these slots, in affording an excellent path for air transmission, also accommodate the transmission of sound very readily from room to room (*Figure 2*). Unfortunately, the building is finished, and achievement of any degree of sound isolation between offices will require rather major alterations; and unless the building's mechanical system is completely redone, it will never be possible to have the degree of privacy between offices which could have been achieved had required acoustical measures been properly designed in the first place. The designers simply did not recognize that even the ventilating system has a major effect on the building's acoustics.

But, architectural acoustics is not concerned entirely with matters of privacy and isolation—sometimes we want to have good hearing conditions. Great advances have been made in understanding how sounds behave, and today there is no excuse whatever for construction of an auditorium, or any listening room, in which hearing conditions are not excellent in every seat. The provisions for good hearing can be incorporated into the design of the building, and there is seldom need for modifications in shape or finished materials in the completed space. Sometimes achievement of good-hearing conditions will involve design of a very high-quality sound-reinforcement system. If such a system is needed, its design and integration into the room is just as important as any other architectural detail. There should be no occasion for an architect to discover, just two weeks before dedication, that in his new church it will be impossible for anyone to hear because the public-address system has been ineptly done! Such surprises have no place in architectural design today!

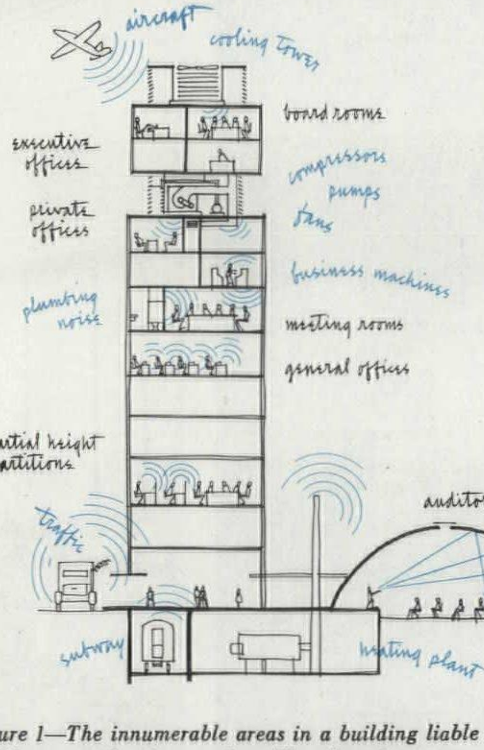
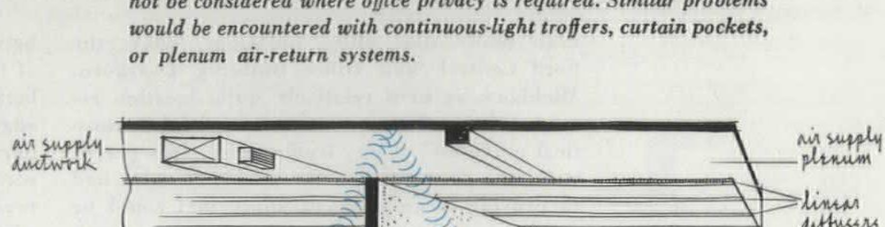
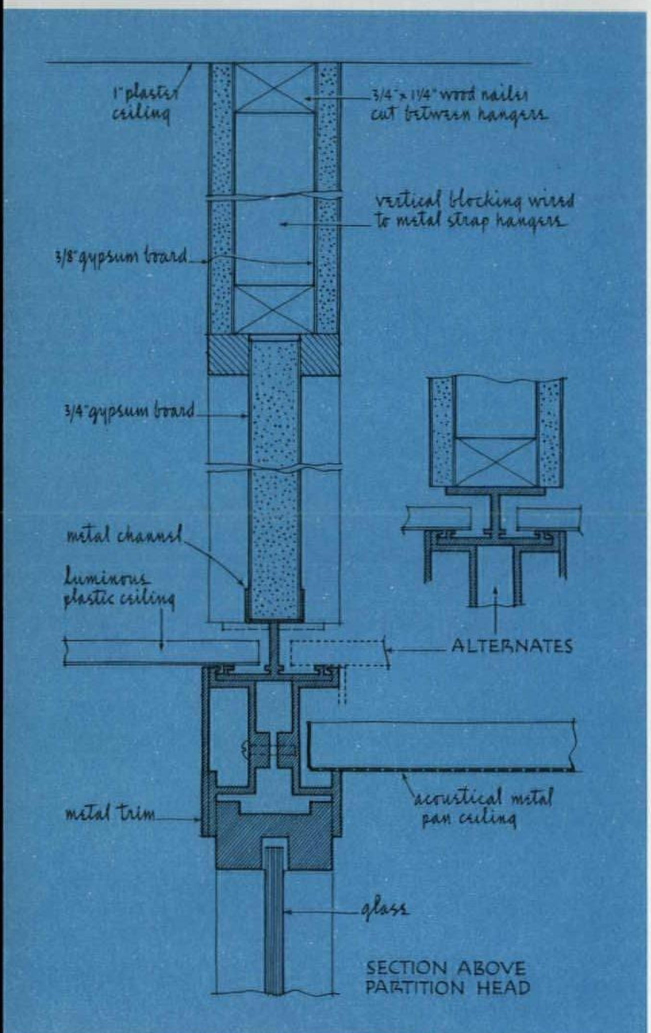


Figure 1—The innumerable areas in a building liable to acoustical problems provoke the warning: "Let there be no surprises."

Figure 2—Designers must realize the importance of considering all possible paths for sound transmission between adjacent spaces. An air-distribution system, utilizing continuous linear diffusers in the finished ceiling, can virtually negate the effectiveness of partition construction between adjacent offices. Sound can readily pass through openings on one side of the partition and down through to the adjacent space. Air-supply systems, such as these, should not be considered where office privacy is required. Similar problems would be encountered with continuous-light troffers, curtain pockets, or plenum air-return systems.



case histories: *General Problems*



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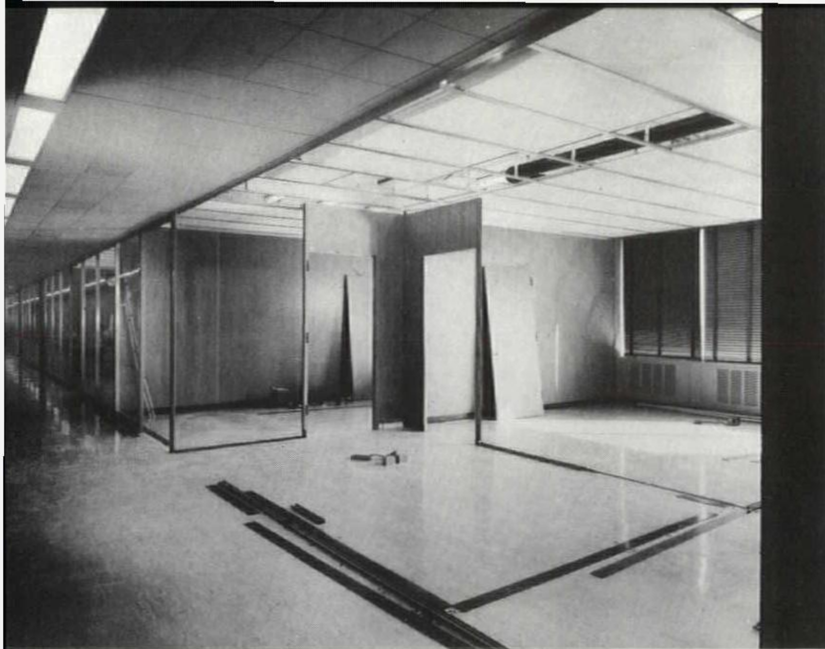
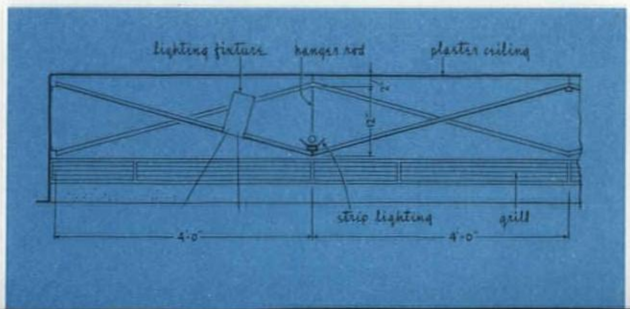
Like many new office buildings today, the Ford Central Staff Office Building, Dearborn, Michigan, is in a relatively quiet location removed from the sometimes beneficial "acoustical perfume" of city traffic noise. This placed stringent demands on the architect, who had to provide large areas of space that could be divided into private and semiprivate offices with adequate acoustical privacy. Careful detailing of the movable partitions included special closure elements at the tops of the partitions between the finished ceiling and the underside of the fireproof rough-ceiling construction, and between the window mullions and the partition edges at the curtain walls. Careful supervision during construction of these details result in reasonably satisfactory acoustical privacy between these types of offices. In certain areas where flexibility was not a criterion, permanent masonry partitions were provided, with equal care in detailing to avoid sound leaks in the construction.





Photos: Ezra Stoller

Aside from the problems of sound isolation between offices, detailed consideration was also given during the planning to the provision of a comfortable acoustical environment within the various office spaces, as well as the provision for good-hearing conditions in several large conference rooms.

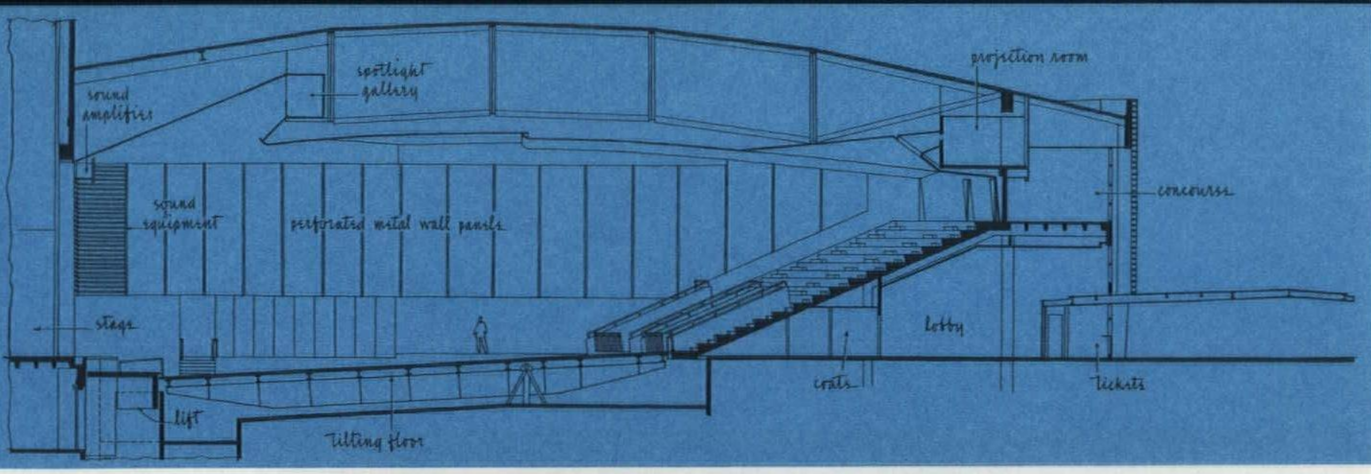
In the large management conference room (*above*) considerable study was given to the design of the undulating metal-paneled ceiling which serves as a sound reflector and scatterer, so that speech originating in any part of the room will be heard in other parts of the seating area without the aid of a sound-amplifying system. This is especially important in a large room of this type which serves audience-participation conferences. In addition, the design of the walls and their surface treatment avoid troublesome echo and focusing during programs of large meetings.

Skidmore, Owings & Merrill
Architects-Engineers.

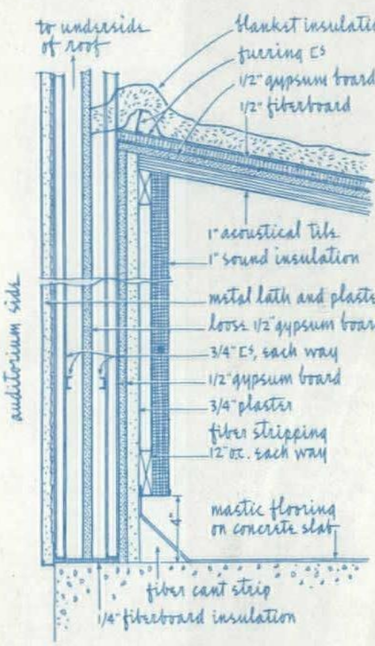
2

The building program for the Santa Monica Civic Auditorium, as set forth by the City of Santa Monica, California, specified the creation of a multipurpose building which could accommodate sporting events, trade shows and conventions, plus musical events, including symphonies, stage shows, and grand opera.

Acoustics were designed for the optimum conditions of symphonic performances, as well as smaller groups of soloists, without the use of sound reinforcement. The full, stereophonic, sound system, which was designed and installed by RCA Victor engineers, was provided to accommodate various public assemblies, popular musical performers, and pageants. Additional sound reinforcement was provided for sporting events by the use of a suspended, and removable, speaker cluster directly above the center of the tilting floor. In addition to insuring the optimum reverberation times for speech and music, specified materials had to be restricted to those which would take the heavy abuse and impact loads of basketballs, etc., during sporting events. Thus, metal acoustical panels were used on the side walls of the auditorium. These panels provide greater sound absorption in the higher ranges than comparable wood panels. The perforated-metal panels are 4 in. in width and are used on side and back walls of the auditorium. The splayed walls at the front of the house are of unperforated metal and serve as reflection panels to project and reinforce sound to the rear. The perforated panels are backed by rock-wool insulating material and an air space. The ceiling, of hard, painted plaster, is used to reflect and reinforce sound to the rear. Sound absorption is accomplished entirely by the side and rear walls of the auditorium.



Photos: Julius Shulman



WALL-CEILING SECTION
(for all fanrooms)

There are no vertical surfaces facing the stage from any direction, so that any echo characteristic will be diffused. All walls slant inward toward the ceiling. Further, there are no parallel walls, the side walls being slightly splayed, to prevent parallel surfaces which could have caused echo characteristics. In calculating reverberation times and acoustical spectrum curves, acoustical characteristics of every material in the auditorium were analyzed and computed. The reverberation time is approximately 1.59 seconds at 512 cps with a full house.

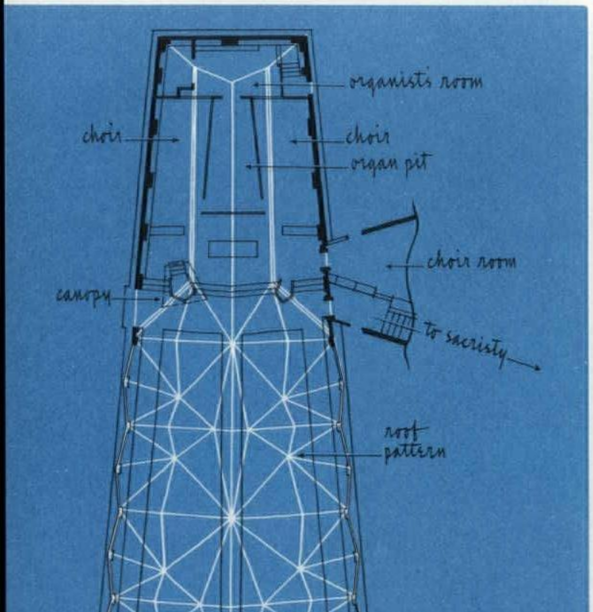
Seats throughout the auditorium are upholstered for sound-absorptive characteristics. Critical, potential, reflective areas, such as the wall area of the projection booth, were eliminated by poly-cylindrical diffusion. The area was treated with acoustical-tile panels placed at a 1-to-4 angle from the wall in opposing directions, to resemble a brief accordion pleat.

Because of its varied usage, some experts believed that echoes would be a major problem within the building. However, since the opening of the building in June, 1958, the auditorium has stood many tests and received many compliments. "Acoustically speaking," states Dr. Vern O. Knudsen, one of the nation's leading acoustical engineers and Vice-Chancellor of UCLA, "the Santa Monica Civic Auditorium meets its wide range of functions in a highly satisfactory manner. In respect to its reverberation properties, it deserves a rating even higher than that of the Royal Festival Hall in London, which has been highly acclaimed by acoustical critics and conductors for its superb acoustics." Welton Becket & Associates, Architects-Engineers; Kent Attridge, Project Chief; Dr. Vern O. Knudsen, Consulting Acoustical Engineer.

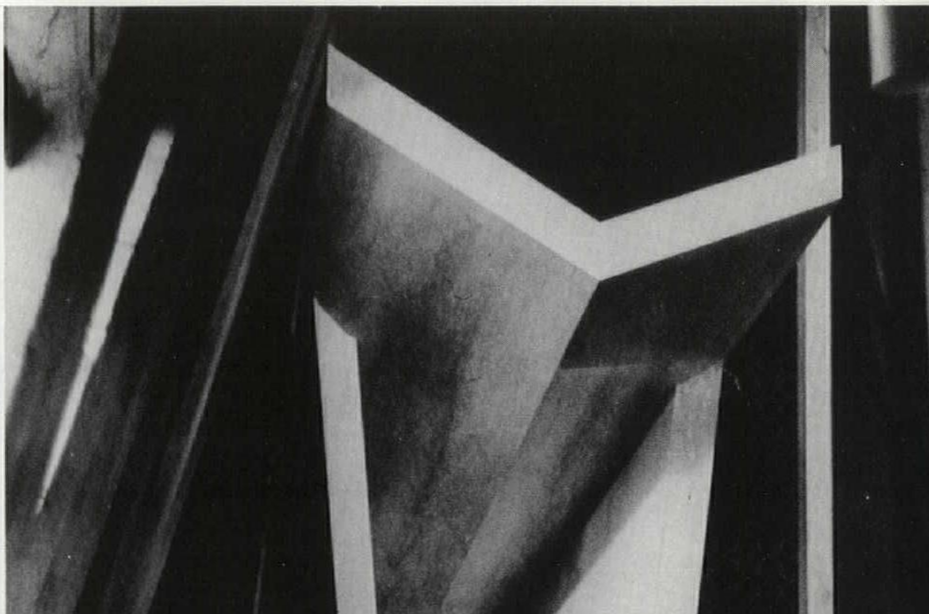
Photos: Joseph W. Molitor

3

A major problem in acoustical design for churches is the reconciliation of high speech-intelligibility requirements with those for proper presentation of liturgical music. According to commonly accepted optimum reverberation-time curves, conventionally shaped churches comparable in size to The First Presbyterian Church, Stamford, Connecticut—220,000 cu ft—should have a reverberation time of 1.1 or 1.2 sec for speech, and about 2.0 sec for music. (Other dimensions of this space-frame structure of precast-concrete facets (*see detail*) are: length of nave, 164 ft; distance from pulpit to rear seats, 114 ft; high point of interior, 60 ft.) Although it was observed from the start that this form of enclosure would provide considerably more diffusion than a rectangular or cruciform church, it remained to be seen how great an improvement in hearing this additional diffusion would provide. During consultation between architects and acoustical consultants at preliminary design stages, a compromise reverberation time of 1.7 sec was agreed upon to satisfy both speech and music. Initially, there-

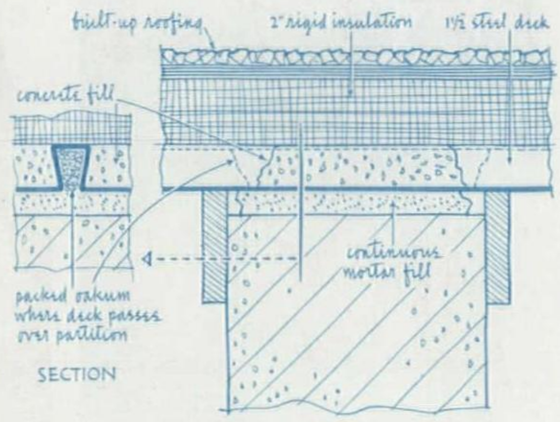


D. L. Klepper

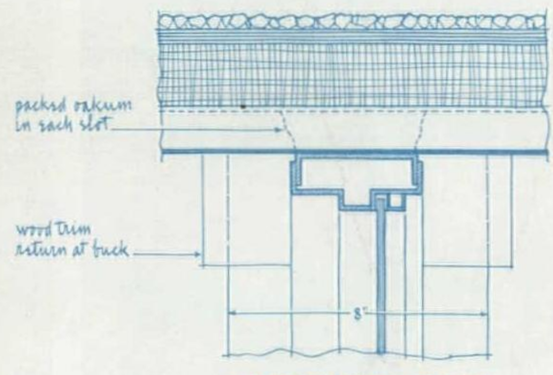


fore, about 400 sq ft of sound-absorptive material was considered adequate to provide 1.7 for full occupancy. It was decided, however, to postpone application of the sound-absorptive material until hearing conditions were observed in the completed, but untreated, structure. Prior to dedication and after carpeting had been laid —at altar and in aisles only, not under pews— tests revealed that the midband reverberation time with full congregation was approximately 2.1 sec at 500 cps. An inspection by the acoustical consultants—plus a poll of the members of the congregation—indicated satisfaction with the acoustical environment obtained—although in final form no "applied" sound—absorptive materials were used. A pulpit canopy—to increase the proportion of direct, reverberant sound energy—acts as a natural sound amplifier. The canopy allows a full-church reverberation characteristic averaging above 2.0 sec without noticeable sacrifice of speech intelligibility.

Harrison & Abramovitz, Architects; Sherwood, Mills & Smith, Associated Architects.



SOLID PARTITION SECTION

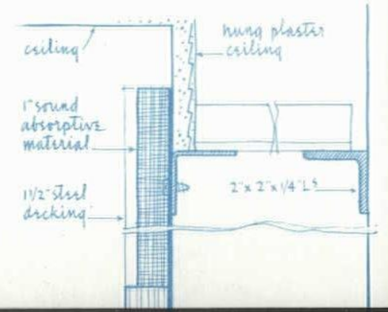


GLAZED PARTITION SECTION

4

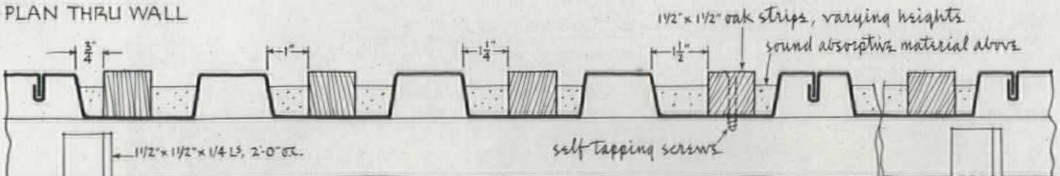
Irregular roof constructions present an extremely difficult problem when the acoustical requirements dictate that the partitions be tightly sealed against them. In designing the Morse School, Cambridge, Massachusetts, the architects recognized well in advance the problems to be encountered when the classroom partitions would have to terminate at the underside of a metal roof deck, having perforated-metal/sound-absorptive filler panels. Good detailing and careful supervision during construction eliminated this potentially serious acoustical leak. The tile-block construction in itself provides reasonably good acoustical isolation between rooms, but only because this by-pass for sound was avoided.

Good distribution of reflected sound is achieved in the auditorium of the Morse School by proper orientation of two relatively simple, hard-plaster ceiling planes: one rising upward from the proscenium opening and joining a second which slopes downward to the rear. The rear wall is finished in sound-absorptive material to control echo and consists of a 2-in. glass-



Photos: Alexandre Georges

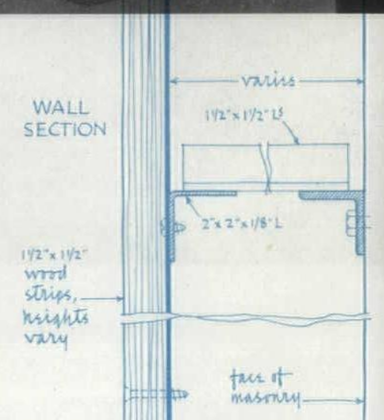
PLAN THRU WALL

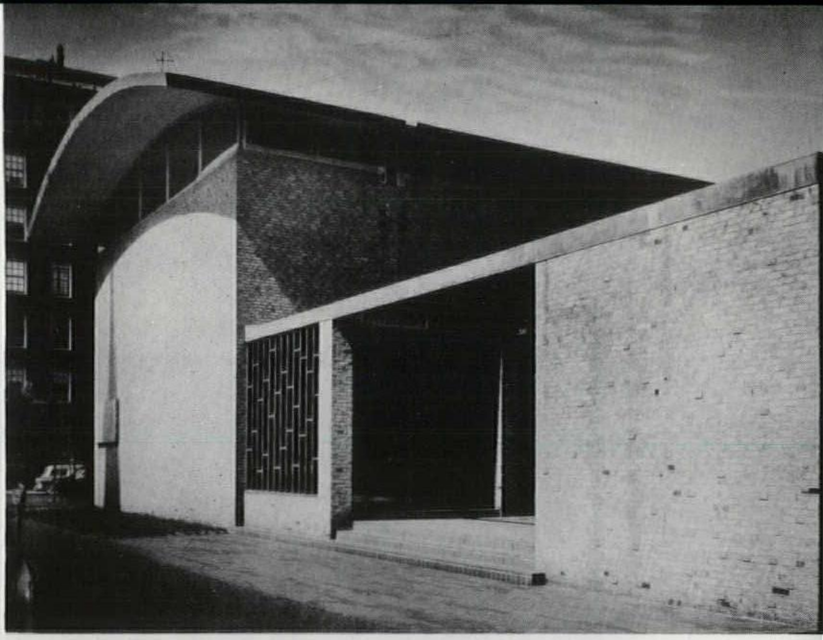


fiber blanket faced with flattened, expanded metal. The remaining sound-absorptive treatment needed for reverberation control is incorporated in the two upper side wall areas which are not useful in providing reinforcement of stage-emanated sounds. Strips of standard, perforated acoustical tile are inserted between the ribs of the metal deck—which forms the side walls—and results in an interesting decorative effect. The treated wall area absorbs sound very nearly as effectively as if the metal ribs were covered as well, due to the "edge" absorption effects.

The stage also serves as a band rehearsal room, and for this reason required some sound-absorptive treatment on the side wall areas. Most often, the stages of even small school auditoriums have far too much sound absorption in the form of heavy velour curtains, stage hangings, etc. In general, however, the "sending" end of an auditorium must be kept relatively hard and sound reflective to assure good results. Carl Koch & Associates, Architects; Frederic L. Day, Jr., Associate-in-Charge.

WALL SECTION

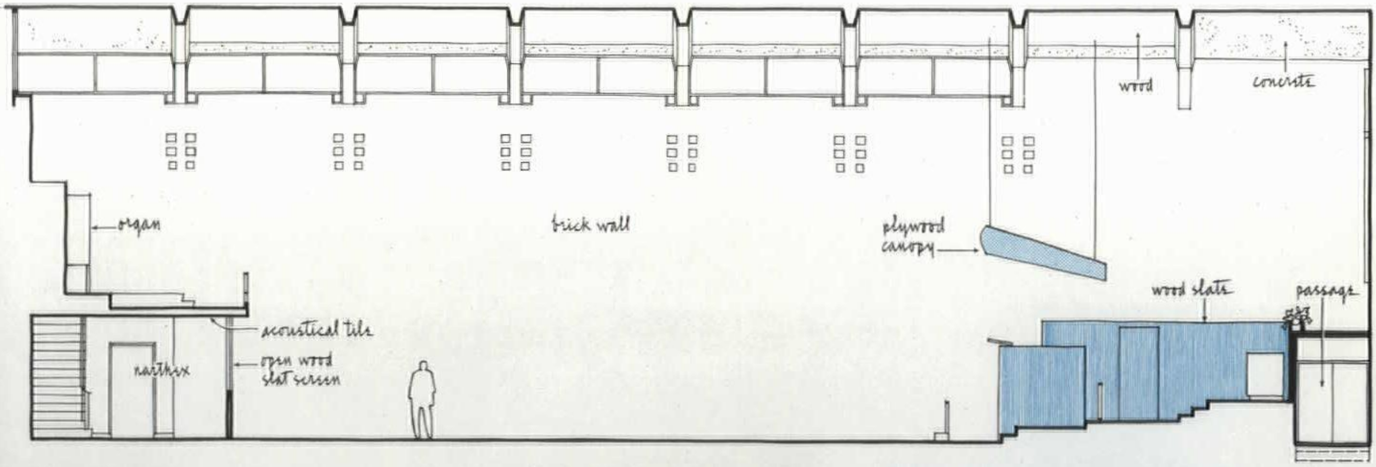


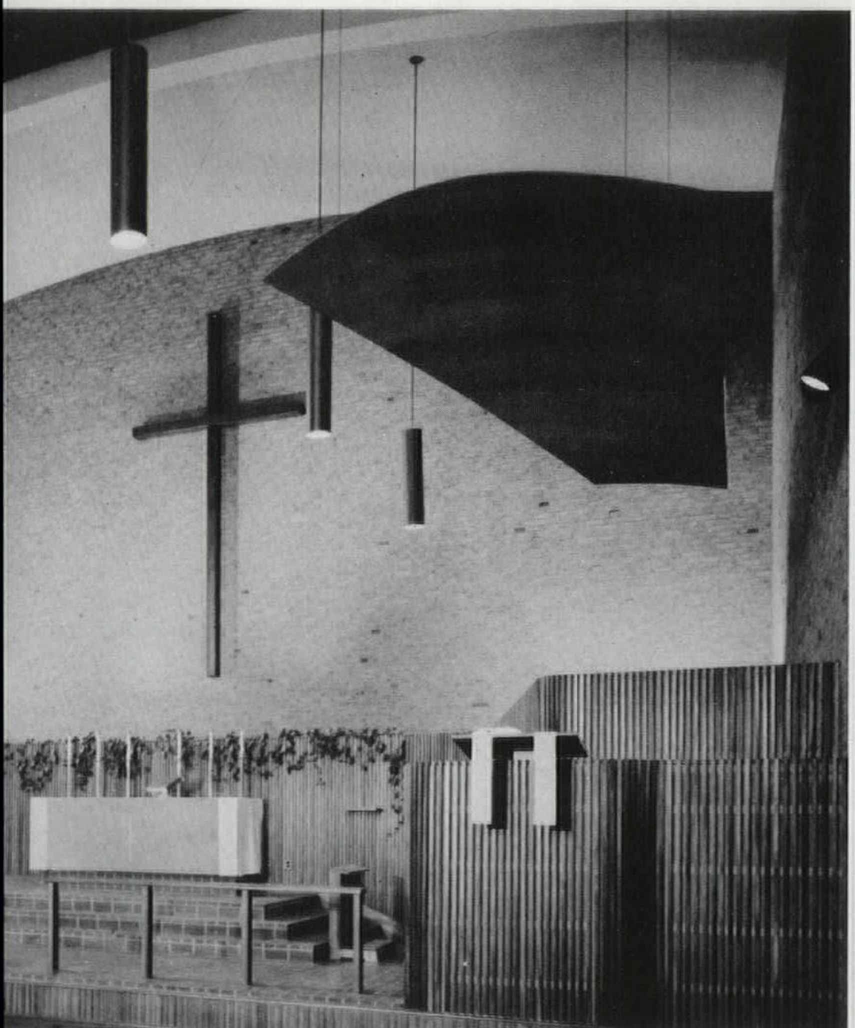


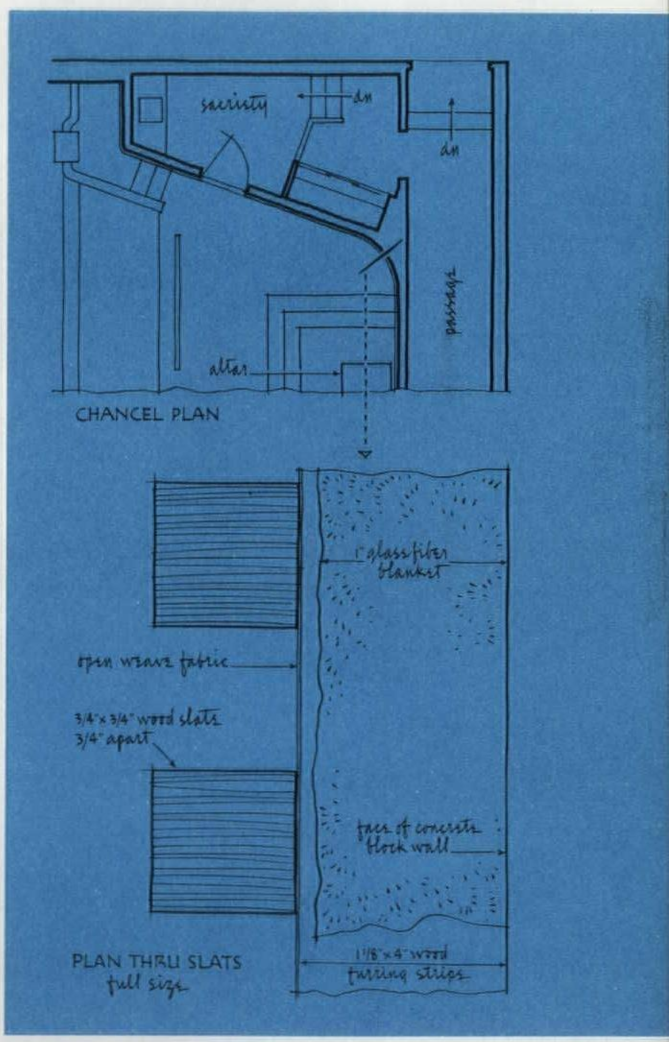
Photos: *Joseph W. Molitor*

5

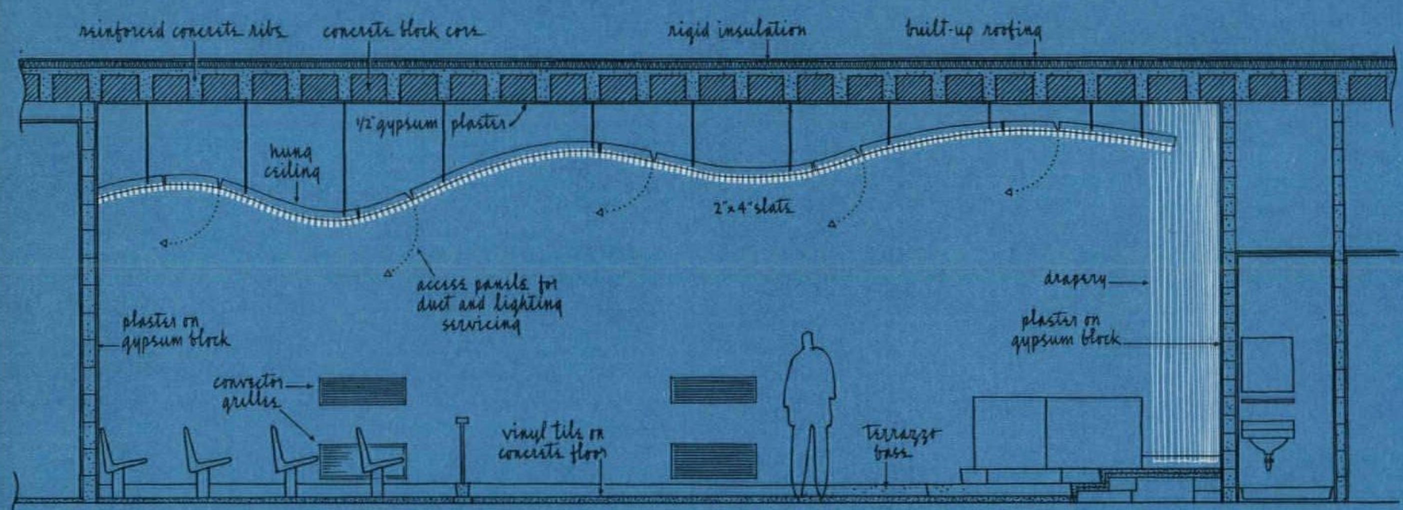
The First Lutheran Church, Boston, Massachusetts, provides a highly satisfactory acoustical environment for performance of liturgical music. At the same time, hearing conditions for speech are excellent throughout. There are no serious sound-distribution problems with the very flat vaulted-ceiling construction which is entirely finished in basically sound-reflective materials. The interior perimeter, including the overhang, is concrete (to satisfy the local fire code), with wood decking over a much larger central area. The small amount of sound-absorptive treatment required for reverberation control is confined to the side-gallery ceiling, the narthex ceiling (the narthex is acoustically open to the nave through an open wood-slat screen), and the space behind the altar screen. No rear-wall echo problems exist, due to the large-scale break-up of the rear-wall area provided by the balcony protrusion and the rear-gallery pipe-organ divisions. The need for sound amplification was minimized by the provision of a large, suspended, plywood canopy over the pulpit. Pietro Belluschi, Architect.


wood
concrete
organ
brick wall
plywood canopy
wood slats
passage
acoustical tile
narthex
open wood slat screen




sacristy
dn
dn
passage
altar
CHANCEL PLAN
1" glass fiber blanket
open weave fabric
3/4"×3/4" wood slats 3/4" apart
face of concrete block wall
PLAN THRU SLATS full size
1 1/8"×4" wood furring strips

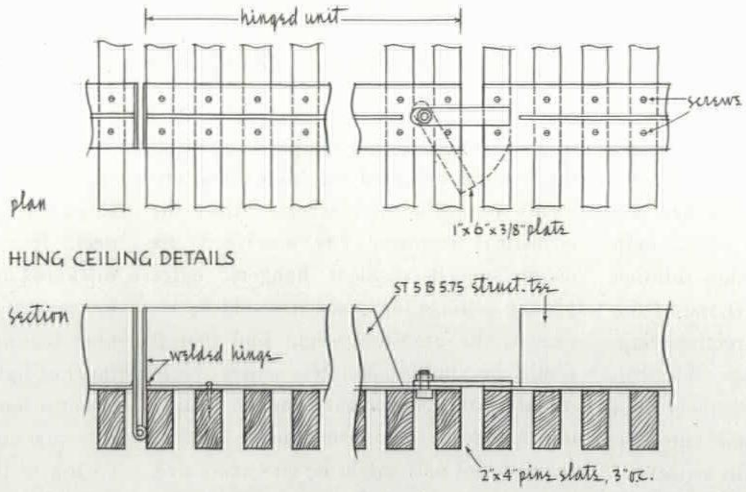
Photos: Warren Reynolds, Infinity Inc.



6

Basic acoustical requirement in designing a courtroom is to reduce the reverberation time of sound so that the spoken word can be heard in all parts of the room. For this reason, the courtroom at St. Louis County Court House, Hibbing, Minnesota, was given a minimum of absorptive surfaces. Aside from the draperies and the hanging wood-slat ceiling, no other devices were necessary to reduce reverberation time. With the undulating, hung ceiling which, incidentally, was also employed to obscure the ductwork and fluorescent light, the designers have avoided parallel floor and ceiling surfaces which might have given a flutter problem. At the same time, the slats act in unison as a reflective surface to give better distribution to the sound energy. A noise problem, stemming from the mounting of ballasts for fluorescent lights directly against the hard-plastered concrete ceiling was minimized by installing quiet-type ballasts and by changing a few of the light fixtures.

Jyring & Whiteman, Architects & Engineers. No outside acoustical consultants were required.



HUNG CEILING DETAILS

PART TWO

creative/corrective approaches

An architect often asks: "What is the ideal shape for an auditorium?" Fortunately, the acoustical engineer can answer: "There isn't one!" But he can help the architect arrive at a design solution which, because of the basic shape of the space, needs little added corrective shaping or treatment. Sometimes this collaborative effort between engineer and architect can lead to new, handsome solutions, with "reason" for certain aspects of design which have been determined by acoustical considerations. On the other hand, the architect may say: "I know this won't work from an acoustical standpoint, but this is the way I want the room to look. Won't you help me make it work?" The conscientious engineer may try to dissuade his client from an approach of this sort, but he is nevertheless obliged to do his best even in a difficult situation. Many of these "corrective" approaches have resulted in excellent auditoriums.

The creative aspects of design, however, are not confined entirely to the field of listening rooms. They are much more often applied to common, everyday matters in building design. For example, the architect of a new apartment house might ask what provisions would be necessary to make a mechanical-equipment room in the basement a good neighbor for apartments immediately overhead. After the acoustical engineer has described the many special resilient hangers, extra plaster ceilings, etc., which would be required, the architect might find that it would be simpler and less expensive to put all of this equipment in another building outside the apartment house. Such a solution not only might be less expensive, but also might well give a more satisfactory final solution to the noise problem for occupants of the first-floor apartments. When we insist on crowding a very noisy occupancy next to one which must be quiet, we inevitably find ourselves with enormously complex, expensive construction which could have been completely obviated if the noisy occupancy was simply moved far away.

On the other hand, as in Warren Petroleum Building in Tulsa, Oklahoma, the architect and his engineers felt that the only sensible place for the mechanical equipment was on the top floor (*see* **PART TWO** *for Case History*). Just underneath would be executive offices for the company; and the owner had required that these offices be "completely quiet." In this case, the floor slab on the mechanical-equipment floor had been designed as 2-in. concrete on ribbed-metal deck. It was necessary to increase this thickness during the design stages to 6 in., to cover it with a 3¾-in. layer of glass-fiber blanket, and then with another 8-in. layer of lightweight concrete, thickened to about a foot wherever machines occurred. The machines were then to be mounted on top of this double-slab sandwich with special rubber-in-shear mounts. This treatment of the problem has proved to be entirely satisfactory and, in the offices on the floor below, one is not at all aware of the operation of mechanical equipment. Certainly there was some added expense in providing this type of treatment, but everyone recognized in advance that it was necessary. Later patch-up treatment *could not* have corrected the noise problem which inevitably would have resulted.

Often, we cannot decide which is the proper way to go about the design of a building, but we can say that, whether it be creative or corrective, from an acoustical standpoint, the provisions for good acoustics must be thought about ahead of time. Ex post facto correction is almost never economical or satisfactory.

"facts of life" about acoustics

In architectural acoustics we are interested in two very simple objectives: (A) provision of a satisfactory acoustical environment; (B) provision of good hearing conditions. In many situations we are concerned only with the environment, but often good hearing is an equally important objective of design.

It is essential in any discussion of architectural acoustics to understand some of the basic facts about sound—what it is, what makes us like it or dislike it, how we can control its transmission from one place to another, and, most important from an architectural viewpoint, how we can incorporate this knowledge into the finished building.

Sound is simply a physical wave motion in air. It consists of to-and-fro motions of molecules in the air which create a series of compressions and rarefactions. Actually, a given molecule does not move very far—it merely moves back and forth as it is pushed and pulled by its neighbors. The sound wave, which travels at about 1100 ft per sec, spreads out from the source in a spherical wave, spreading its energy over an increasingly greater area as it moves farther away from the source. This is true in outdoor or "free field" conditions. In a room, sound waves are reflected many times from the enclosing surfaces and, at some distance away from the source of sound, intensities are more or less uniform throughout the room. In free field, the intensity of sound obeys the inverse square law which we find in all sorts of wave propogation (light, heat, etc.). This is quite important when we begin to estimate the effects of noise in community planning, as, for example, from aircraft or industry. While maximum separation between noisy activities and residential areas is desirable, we learn very quickly that for each doubling of distance between source and receiver, we decrease the perceived loudness of the sound by only about one-third. This often means resorting to techniques other than separation alone to reduce the noise.

When a sound wave encounters a sizable obstacle, such as a wall or ceiling, part of it will be reflected, part of it will be absorbed, and part of it will be transmitted to some adjoining space. The relative magnitude of these three parts of the original sound is determined by the physical properties of the obstacle. A hard-surface, dense plaster, for example, will reflect a great deal of the sound which strikes it, while a soft surface, such as a heavy carpet, will reflect very little back into the space. Absorption and reflection may be all that we are concerned with, if we restrict our interest to the space in which the sound originates. But, most often, we are also concerned with the part that is transmitted to the adjacent space. A porous, or lightweight obstacle, will transmit a large part of the original sound energy to an adjoining space and give very little sound isolation. The mechanisms governing absorption or reflection and isolation are quite different, and must be clearly understood if we are to predict accurately the acoustical environment in a finished building.

absorption

Useful absorption of sound in buildings is provided by all sorts of porous, fibrous materials. Carpets, draperies, upholstered furniture, and specially designed acoustical blankets and tiles, all provide significant sound absorption. The sound waves in the air move into these porous materials and, by frictional drag of air particles on fibers of the material, energy is lost in heat and this fraction of energy is never recovered as sound. This mechanism of frictional loss is present in all really useful sound-absorptive materials, although we do get some losses by panel flexure in things such as thin wood, metal, or plastics. Absorption by panel action is confined primarily to the low-frequency end of the spectrum, and seldom provides the efficient absorption over a wide-frequency range exhibited by many of the thick, fuzzy-cored materials.

When porous materials are placed within a room, the reflected energy is greatly reduced, and sound dies away rapidly rather than being reflected many times from the enclosing surfaces. If reflected sound dies away very quickly, we say that we have a short reverberation time. On the other hand, if surfaces are highly reflective and sound continues to reflect from surface to surface—with little more appreciable loss than we always get as sound energy spreads itself thinner after each reflection—we say that the room has a long reverberation time. The "feel" or quality of space, as sensed by occupants, is determined largely by the amount and type of sound-absorptive finish. We have all sensed this "feel" on going into an empty apartment, and we contrast it with the sound we hear after the place has been furnished. The "furnished sound" comes with the addition of large amounts of porous, sound-absorptive materials.

Sound absorbers, because they are porous and admit moving molecules in the sound wave, will also transmit a great deal of sound—we find that a good sound absorber is almost always an excellent sound transmitter. There is much confusion on this point, partly because we so commonly refer to standard sound-absorptive materials as "insulating" materials, since they are good heat insulators. We must *never* confuse heat insulation with sound isolation!

isolation

The sound-isolating properties of a barrier are determined largely by its weight or inertia. If we remember that sound waves consist of back-and-forth motion of molecules in the air, we can readily understand that when these particles encounter an obstacle they will attempt to move it back and forth. If the obstacle has a great deal of inertia it will resist this attempt at being moved, whereas, if it is relatively lightweight it may move quite a lot. When the obstacle is moved back and forth by action of the sound wave on one side, it will reradiate a new sound wave on the other side. In a sense, a wall may be considered as a loud-speaker diaphragm, being activated by sound waves on one side of it rather than by electrical energy. The new sound wave created on the other side of the obstacle is the transmitted sound wave, and this is what we hear in the adjoining space. The energy is merely transferred from one side of the partition to the other by direct motion of the obstacle. The heavier the obstacle is, the less sound gets through.

We can also understand that, even if a sound-absorptive material did not permit actual migration of the sound wave through it, most of these materials are much too lightweight to have any significant inertia. We all know that a curtain hung across a room gives very little sound isolation between halves of the room, so why expect any other material designed primarily for sound absorption to give significant isolation? A great deal of thought is being given to development of materials which combine the properties of isolation and absorption. Many of these materials are actually on the market today. For example, some acoustical, metal-pan ceiling units come with an impervious backing, and can be used to solve the very difficult problem of sound transmission between offices via the ceiling path where partitions must, for practical reasons, terminate at the suspended ceiling. A relatively lightweight barrier behind or built into a sound-absorptive material may be all that is required when one considers that the sound must travel through the barrier twice (through the ceiling in one office, along the furred space above the suspended ceiling, and through the ceiling of the adjacent office). But one must never forget that, even with these composite sound-absorptive/sound-isolating materials, we are talking about two entirely different mechanisms.

Another point worth noting here is the rather different order of magnitude of reduction of sound energy involved in sound isolation as compared with sound absorption. A good sound isolator, for example a 4-in. brick wall, will provide a sound transmission loss of approximately 40 db in a significant frequency range. (This means that you cannot ordinarily hear speech and probably can just detect sound of someone shouting in the adjoining room.) A transmission loss of 40 db represents a reduction in transmitted energy of 10,000 fold, or only 1/10,000 of the energy which strikes one side of the wall is reradiated on the other side. A good sound absorber, on the other hand, may absorb as much as 70 or 80 percent of the incident sound energy. The other 20 or 30 percent will be reflected back into the room to be absorbed at another contact—or perhaps transmitted on through if the sound-absorptive material is not backed up with a heavy impervious material. This transmitted 20 or 30 percent is certainly in orders of magnitude greater than the 1/10,000, or 1/100 of 1 percent, that got through our 4-in. brick wall. If the sound-absorptive material does transmit 20 percent of the incident sound energy, its sound-transmission loss would be about seven db which is about the kind of isolation that would be provided by very thin (less than ⅛" thick) plywood walls. Thus, we again see that not only the mechanisms of absorption and isolation are very different, but also the results achieved are of very different orders of magnitude.

We must also realize the tremendous importance of leaks and cracks in separating obstacles. All the sound energy that strikes the hole goes right on through. A very simple calculation will show us that a hole of approximately 1 sq in., in the middle of 100 sq ft of 40 db sound-isolating partition construction, lets through the same amount of sound energy as the rest of the wall! For this reason, we are greatly concerned with making any sound-isolating obstacle completely airtight and with avoiding any porosity whatever in the construction.

Weight alone is not enough! While the mass of a partition is the prime controlling factor in its performance as a sound isolator, we have found in recent years that its performance can be considerably modified by its stiffness. A very stiff partition will not perform nearly as well as we would expect it to on the basis of its weight alone. The ideal sound-isolating partitions are those which are heavy and "limp," or not stiff. On the other hand, structures such as those so often used in modern construction, using lightweight structural cores with thin lightweight skins, give much less sound isolation than we would predict from their weight alone. In addition to its simple to-and-fro motion, a partition may also have certain other modes of motion. It has, for example, depending on its stiffness and mass properties, certain favorite or natural frequencies for bending waves. If one of these favorite resonances happens to coincide with a sound wave approaching the partition at a certain angle of incidence, we have a situation similar to the one that Caruso and other singers experienced when they were able to shatter a drinking glass by producing a certain note. The partition will be very easily excited in its natural bending wave behavior, and it becomes almost transparent to sound at this frequency. A dip, occasioned by a wall resonance on a plot of transmission loss vs. frequency for a 4 psf partition material, is shown (*Figure 3*).

The more limp the partition, the higher will be its natural bending frequency and the less disastrous will be reduction in isolation in the over-all performance of the wall. We can readily see the effect of

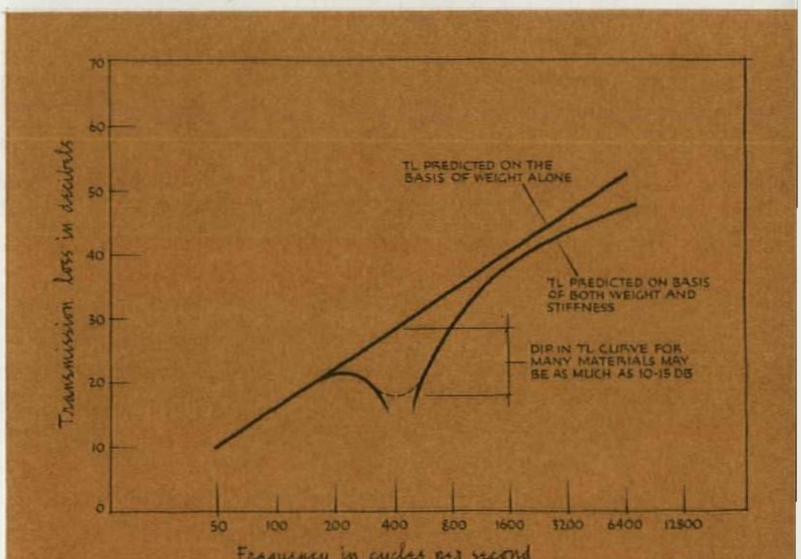


Figure 3—Effect of stiffness on the transmission-loss characteristic of a partition. In theory, a partition should become increasingly better, from a sound-transmission-loss standpoint, with increasing frequency. In practice, however, large panels exhibit a significant dip in their transmission-loss characteristic at a particular range of frequencies depending on the size of the panel and bending stiffness. For a great many, common, building materials, this dip occurs at a frequency range which is most important for the understanding of speech sounds. When this occurs, speech will be heard readily through the partition.

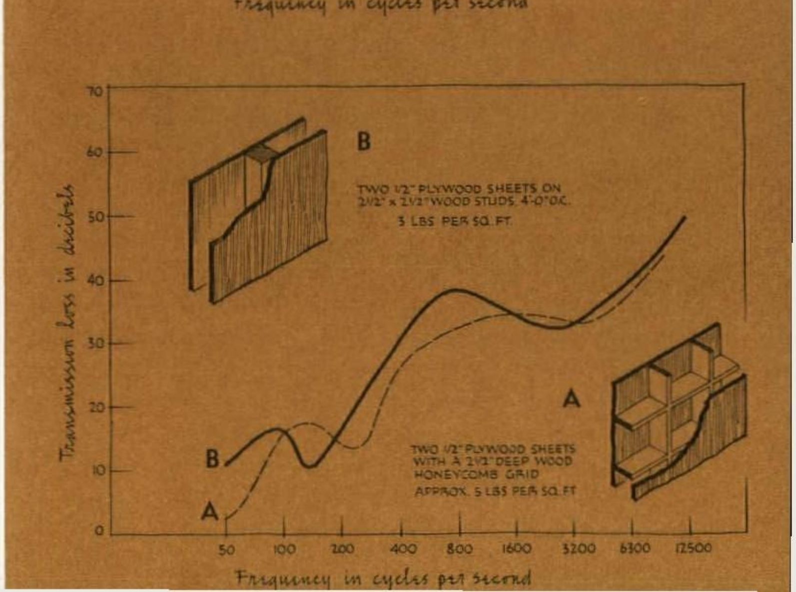


Figure 4—Measured transmission loss of two types of partitions having essentially the same total weight, but with considerably different stiffness characteristics. The higher sound-transmission-loss exhibited by less-stiff construction in the 200 to 1200 cps frequency range may, in some instances, prove to be just sufficient to provide adequate speech privacy between two adjacent spaces.

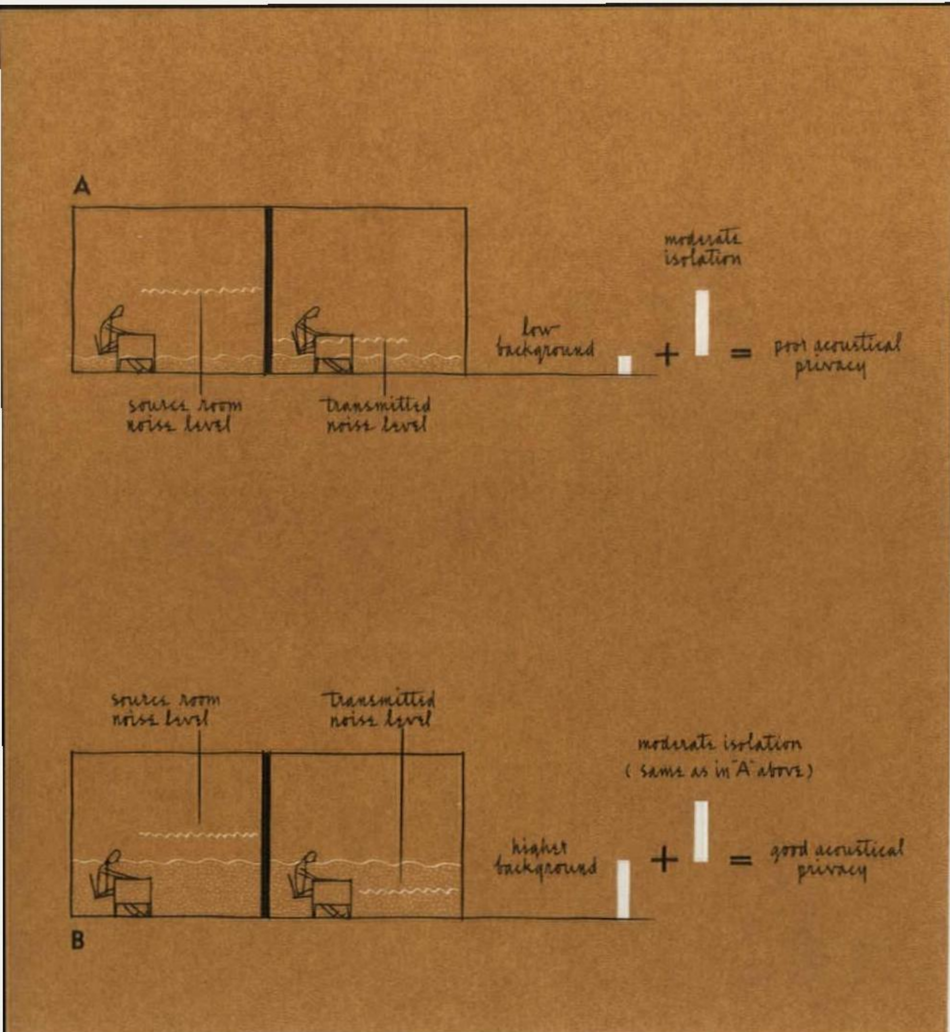


Figure 5

stiffness by looking at the results of measurements made on two partitions having the same facing material but different stiffness (*Figure 4*). Partition **A** is made of two sheets of plywood, cemented to both sides of a wood grid core, and weighs 5 psf. Partition **B** is the same facing construction with the core removed, and the plywood face is simply nailed to wood studs about 4 ft apart and weighs somewhat less than the honeycomb construction. We can see that the performance is better *without* the core, even though this construction is actually lighter, because when the plywood stands alone it is much less stiff than in combination with a grid core; in fact, only about 1/500 as stiff. The two partitions are almost equally satisfactory from a structural standpoint. However, additional sound isolation provided by the less stiff construction in the 200 to 1200 cps range may mean, in many instances, the difference between adequate and inadequate isolation.

Various new types of partitions are now being developed with an understanding of the problem of stiffness in lightweight panels. Relative values of stiffness and mass can be controlled to solve any acoustical isolation problem with a minimum amount of weight.

The role of background noise must not be neglected in the selection of construction types to satisfy acoustical-isolation requirements between spaces. The importance of this element is shown schematically (*Figure 5*). Simply stated, the amount of acoustical privacy between spaces is equal to the sum of the background-noise level and the isolation provided by construction. Architects have often been amazed to find that a partition type that worked perfectly well in a city office building was far from satisfactory in an office building in a quiet, rural location. The continuous levels of traffic and ventilation-system noise have been removed in the new location, even though the partition is performing just as well as it did in the big city.

The kind of background noise we are talking about is not the objectional roar of a ventilation fan, nor the whistle or whine of a circulating pump. Rather, the background noise itself must be bland and continuous so that people will scarcely notice it. Steady traffic noise of the big city or the characteristic sounds of many

Figure 6

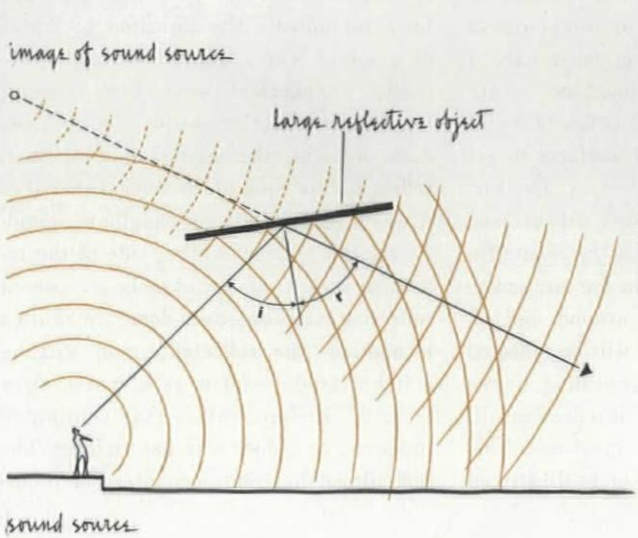
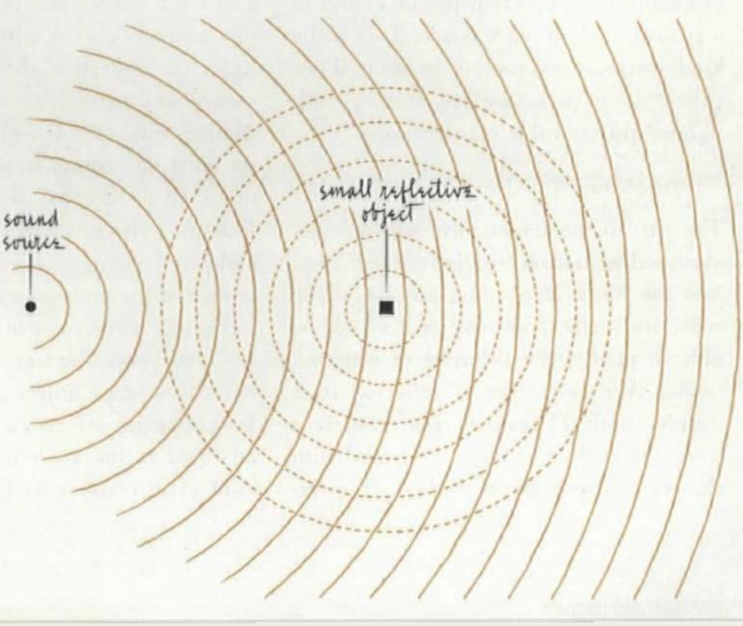


Figure 7



case histories: *Special Techniques*

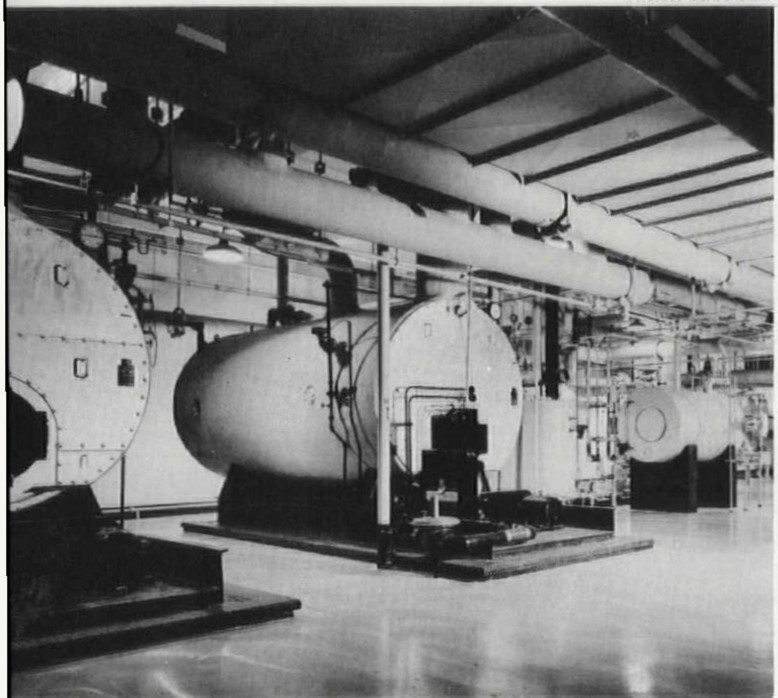
1

A notable example of effective noise control accomplished during the design stage is the Warren Petroleum Building, Tulsa, Oklahoma. Consideration of mechanical and other factors dictated location of the major mechanical equipment on top of the building, directly over the executive offices. To assure near-complete exclusion of air-borne and structure-borne mechanical noise in these offices, special multiple floor and wall constructions (*details across-page*) were required in addition to the conventional vibration-isolation mounting of the various pieces of mechanical equipment. Careful supervision of this necessarily elaborate construction proved to satisfy the owner's requirement that noises be inaudible in the executive offices. The control of difficult noise and vibration problems of this sort can only be accomplished by a combined, massive impervious barrier and proper vibration-isolation techniques —features not readily incorporated once a building has been occupied.
Skidmore, Owings & Merrill
Architects-Engineers.

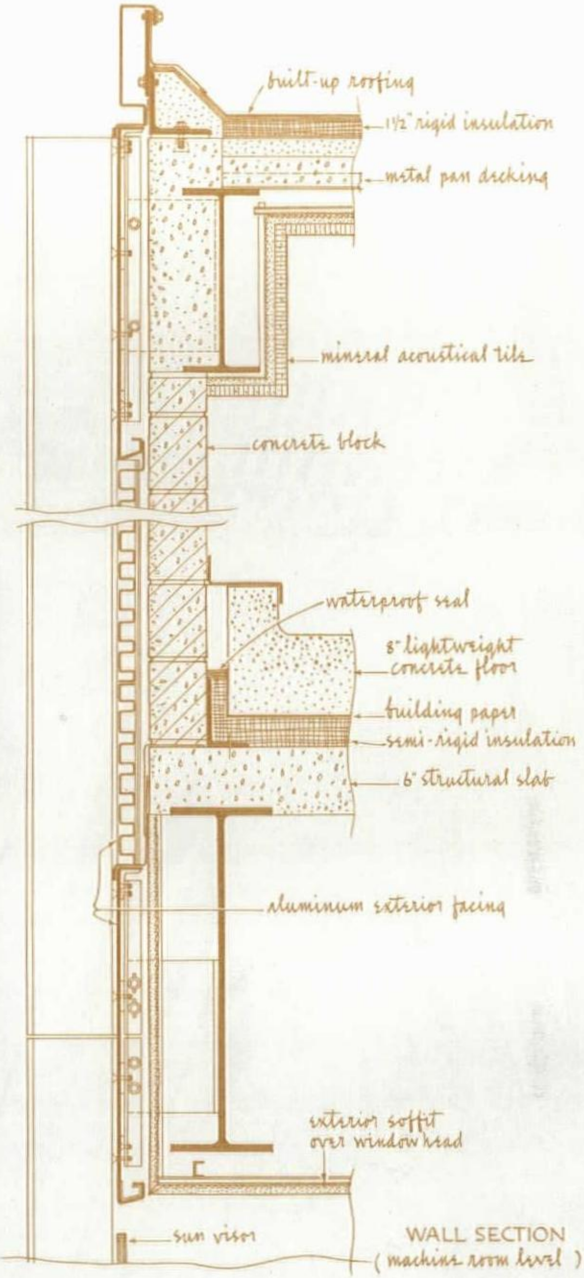
types of air diffusers represent the kind of unobtrusive noise that people expect in a typical modern office space. This is the kind we must be sure is present, if we expect to have acoustical privacy with lightweight, movable constructions.

reflection

The part of the sound wave which is not absorbed or transmitted is reflected back into the room. Depending on size of the reflective surface, we may or may not be able to predict the behavior of reflected sound. A sound wave is reflected in a simple "optical" fashion from a surface when the surface is large compared with the wave length of the sound. At a frequency of 500 cps the wave length is about 2 ft; therefore, to reflect sound at this frequency as a mirror would reflect light, the reflective object must have a somewhat greater dimension. Since we are dealing with sounds well below 500 cps, we must have quite large surfaces to get this kind of directive reflection. The surface must also be relatively hard surfaced and heavy enough to resist the to-and-fro motion of the molecules in the air, and to force the wave to turn around and go the other way. The wave will be reflected from this large object according to the laws of optics—the angle of reflection will be equal to the angle of incidence. This kind of directive reflection is illustrated (*Figure 6*). The important thing to note is that although we often draw straight lines to indicate the direction of travel of a sound wave, the sound wave is actually a spherical wave front moving toward the reflective object. Just as in the case of light, the reflective object will reflect that portion of the wave that strikes it—as a mirror with an imaginary sound-source image on the other side of the reflective object. If we have large, curved reflective surfaces—as in domed or vaulted structures—the reflected sound will inevitably tend to focus as it moves away from the surface, rather than continuing to spread as it does with flat surfaces. The difficulties that one encounters in rooms



Photos: Ezra Stoller

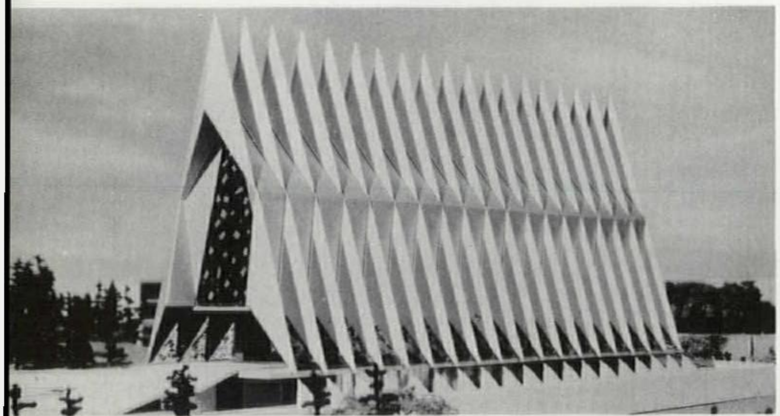


with curved, reflective surfaces are obvious, especially when we are attempting in most auditorium design to spread the reflected sound uniformly over the listening area.

However, if the object is small compared with the wave length (for example, a one-ft column in the middle of a room), there will be very little significant reflection of energy and the wave simply goes around such an obstacle, as waves in the water go around a single pile or small rock (*Figure 7*). We sometimes draw ray diagrams illustrating the reflections of sound from various surfaces in a room, and make the mistake of believing that even the smallest surfaces will give specular or optical reflections—they won't!

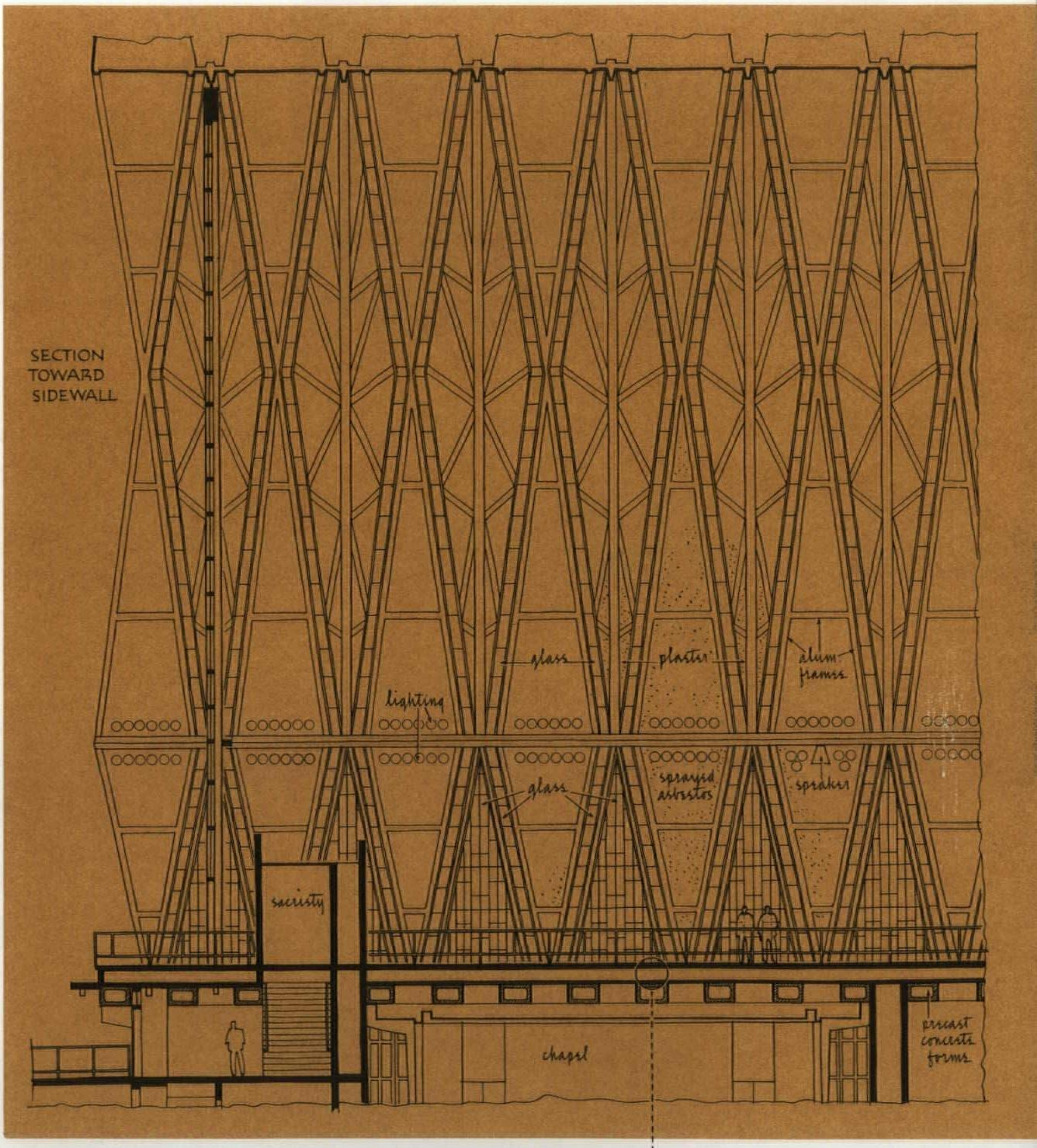
There are sometimes refinements in the detailed design of reflective surfaces in an auditorium or church ceiling. For example, where we need more than just simple, specular reflection for best listening conditions. One form of refinement—diffusion—will be discussed in detail later (*see* **PART FOUR**). Actually, diffuse reflection is simply enrichment of the reflected sound, so that the listener hears many rather than just one or two simple reflections; and it is introduced by large-scale surface irregularities on the surfaces of the room. We must remember, however, that effective diffusion of the sound wave results only with large scale elements 3 ft or 4 ft across and 6 in. or more deep, not with ½-in. or 1-in. irregularities which would affect only very high frequencies. It is important, too, to remember that diffusion or "breaking up" of the sound wave merely redirects the sound energy—it does *not* destroy any of it or absorb it. Diffusion of sound is of no value in a noise-control situation where we need absorption by porous materials.

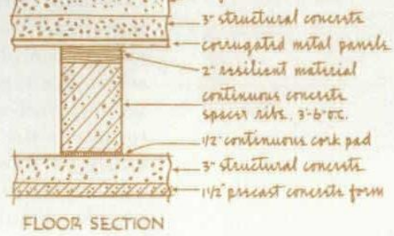
The reflection of sound from surfaces of a room is extremely important in auditoriums and rooms where hearing is important. On the other hand, where we want to reduce noise and control the spread of sound, we must treat surfaces to reduce the reflected sound energy.



2

Since there are actually three chapels in the Air Force Academy chapel now under construction at Colorado Springs, a prime design consideration was the isolation of the chapels, one from the other, so that simultaneous use is possible. Essentially, the floor slab of the upper level—for Protestant worship—is resiliently floated on the structure which forms the ceiling for the lower-level chapels—Catholic and Jewish. In addition, flanking of sound around this special floor condition, through open windows, will be minimized by achieving large distances between the operable sash. A completely separate ventilation system has been provided for the upper level. Treatment has also been specified for the ductwork, to reduce fan noise to the desired low-background noise level. Another problem which received considerable attention during design was the problem of impact noise due to rain or hail on the thin-metal exterior skin of the tetrahedron construction. A highly damped exterior panel construction minimizes this problem to the point that the impact should be no more serious

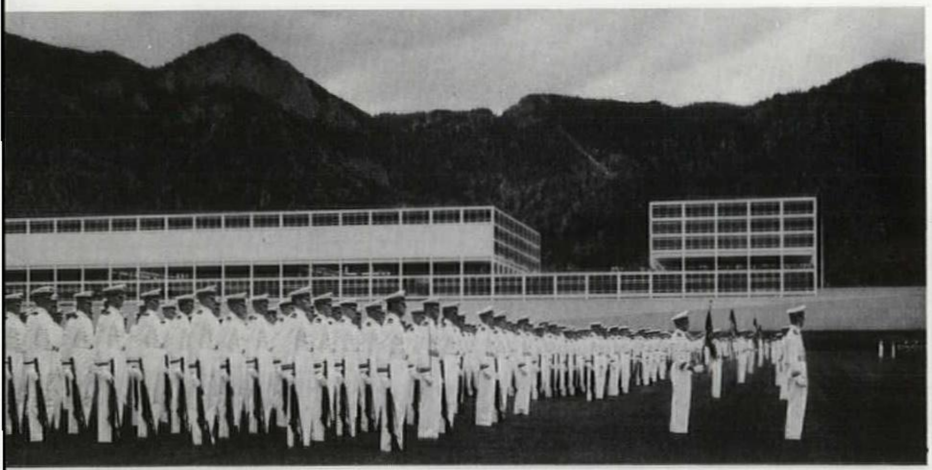




FLOOR SECTION

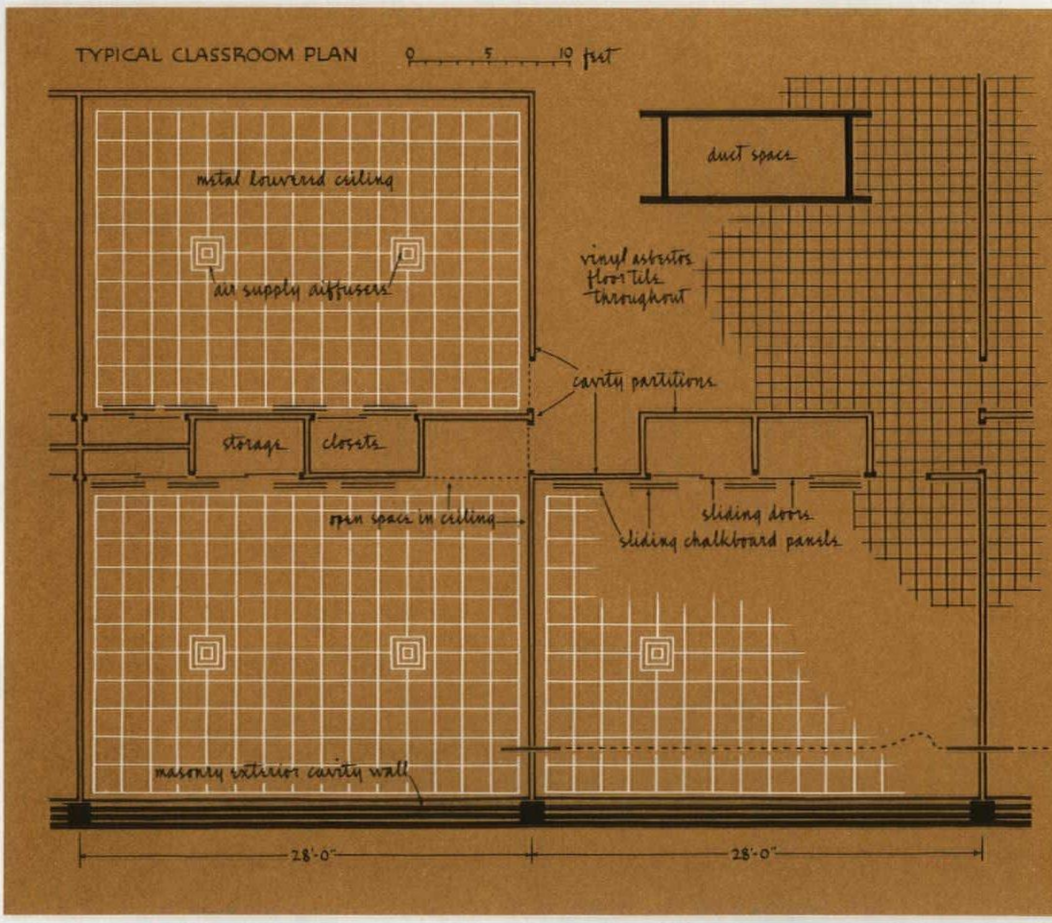
than in any other standard building construction. Noise due to thermal expansion has been anticipated by structural design considerations. To provide maximum reinforcement of music, extra-heavy plaster panels have been specified for the interior surfaces near the rear balcony.

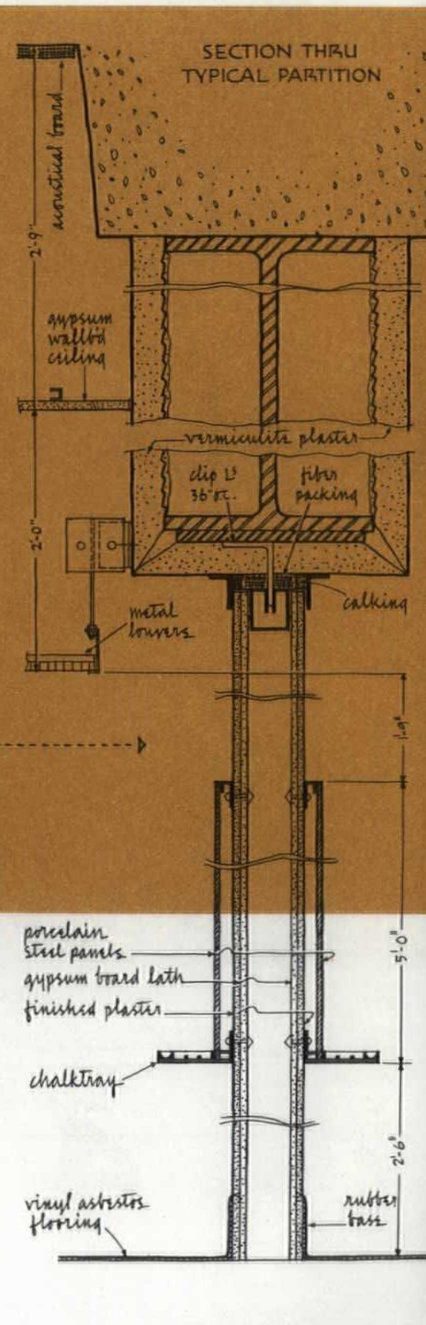
For the lower-level chapels, fully gasketed doors will be provided leading to both the Jewish and Catholic chapels, in order that the vestibule will serve as an effective sound buffer.
Skidmore, Owings & Merrill
Architects-Engineers.

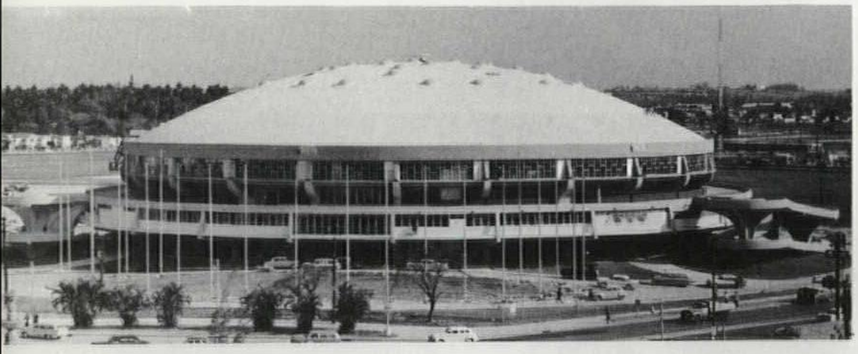


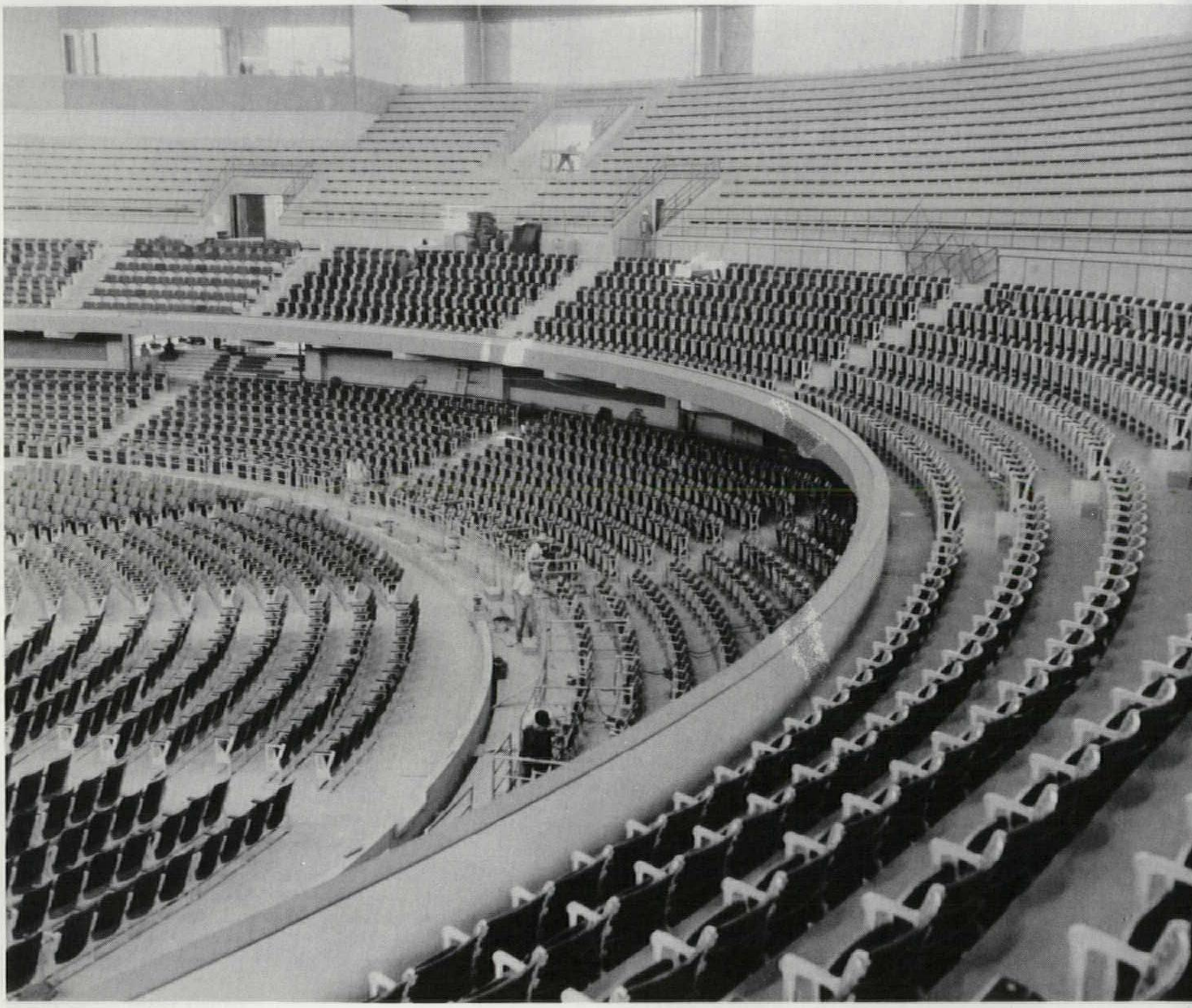
3

A relatively high degree of sound isolation was required between classrooms of the Air Force Academy's new academic complex located at Colorado Springs. Several partition types were investigated on the basis of acoustical performance in completed buildings, before the architect selected a type constructed of plaster and rock lath on steel-wire studs. Perhaps more important to note is the extremely careful detailing of the entire partition assembly which was required to achieve the maximum sound-isolation capability of this partition type. The actual partition extends completely above the finished light-diffusing ceiling and is thoroughly gasketed at its juncture with the structural slab above. All penetrations by electrical conduits, ventilating ducts, etc., were provided with packed and calked joints. The ventilation systems for the typical classroom clusters were laid out to avoid "crosstalk" between rooms, and suitable noise-control measures were incorporated in the individual ducts.
Skidmore, Owings & Merrill
Architects-Engineers.


TYPICAL CLASSROOM PLAN
0
5
10 feet
metal louvered ceiling
air supply diffusers
duct space
vinyl asbestos floor tile throughout
cavity partitions
storage
closets
open space in ceiling
sliding doors
sliding chalkboard panels
masonry exterior cavity wall
28'-0"
28'-0"

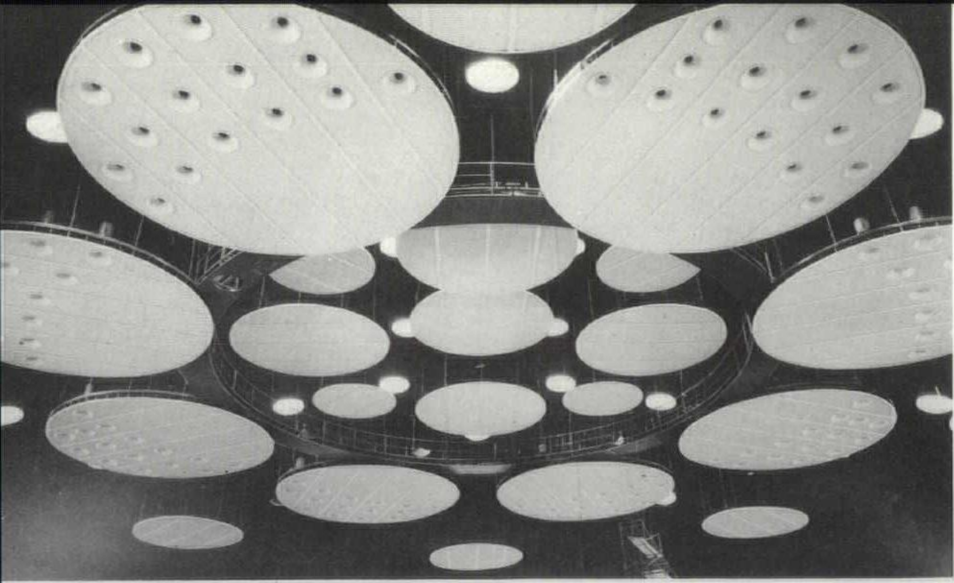

SECTION THRU TYPICAL PARTITION
acoustical board
2'-9"
gypsum wallbd ceiling
vermiculite plaster
clip Ls 36" oc.
fiber packing
2'-0"
calking
metal louvers
1'-9"
porcelain steel panels
gypsum board lath
finished plaster
5'-0"
chalktray
2'-6"
vinyl asbestos flooring
rubber base

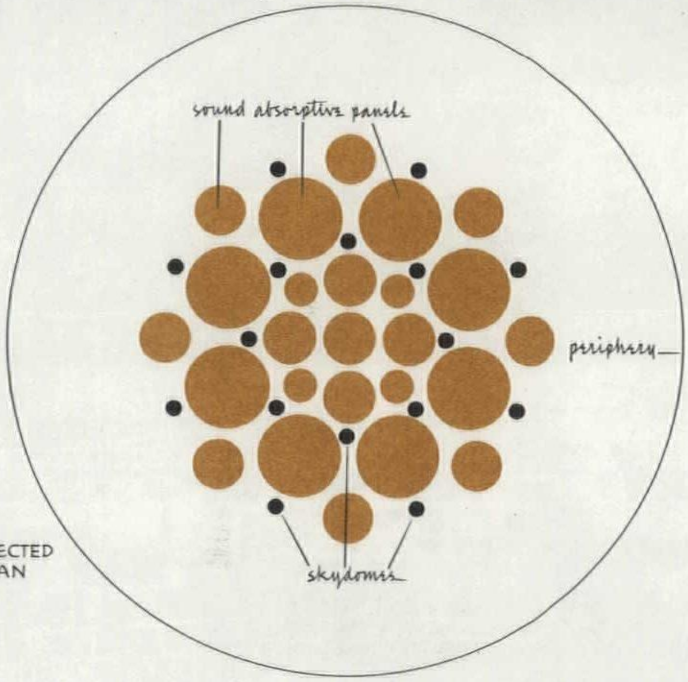




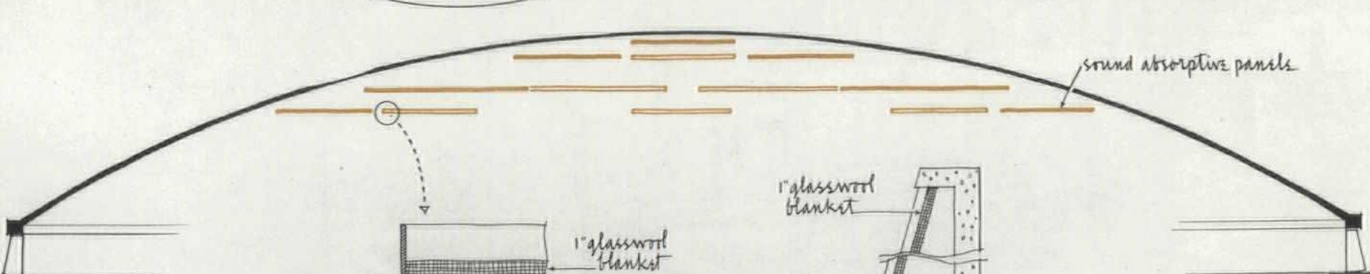
4

In this large sports arena—Palacio de los Deportes, Havana, Cuba—a wood-fiber/sound-absorptive material was placed in the formwork for the concrete and left in place. In addition, because the curvature and smooth, uninterrupted shape would give rise to a serious flutter-echo problem between floor and ceiling, additional sound-absorptive panels were introduced in the form of large hanging disks of perforated metal with a glass-fiber backing. The results are excellent. Two high-quality sound systems—one for circus bands and loud-live sources of that nature, and one for announcements—have been incorporated into the design





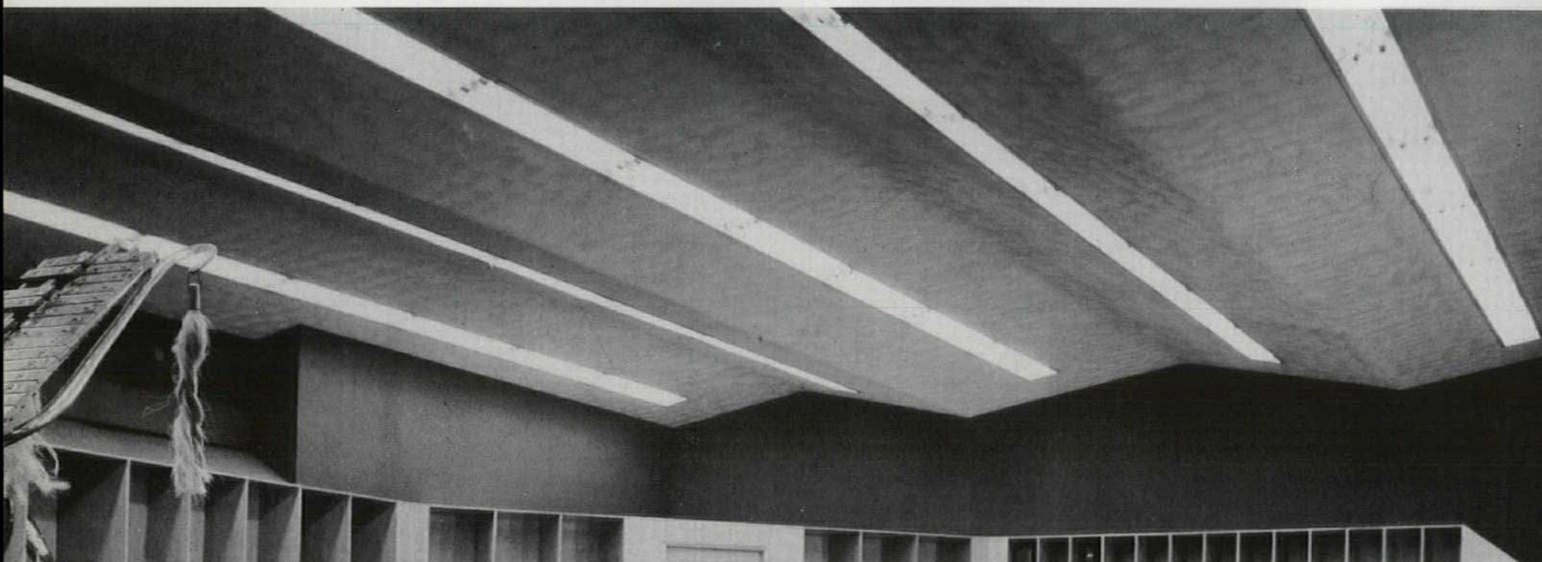
REFLECTED PLAN



TYPICAL SECTION

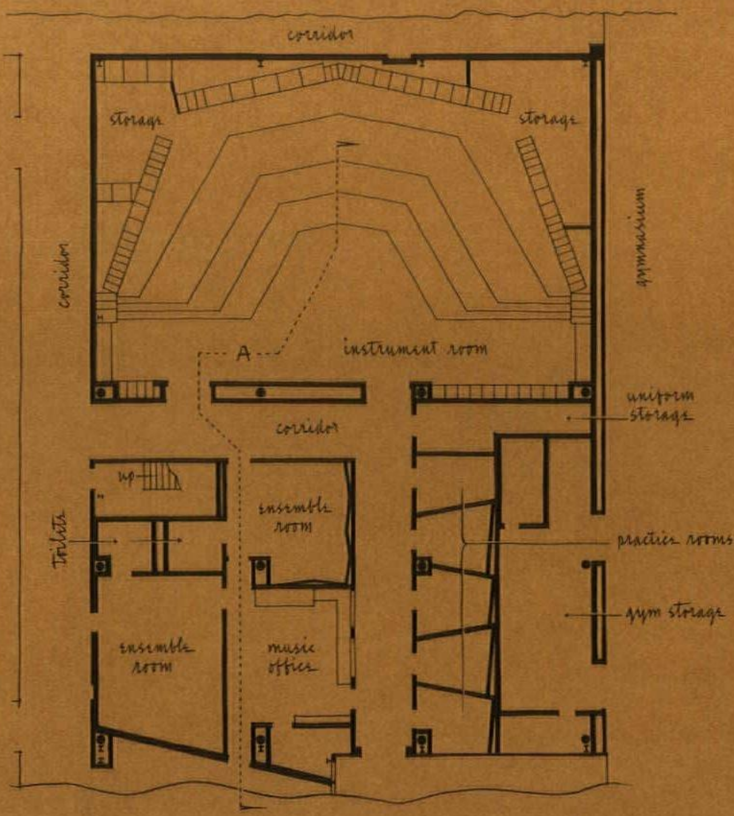
of the arena. The former consists of a full-frequency-range central cluster of high-frequency horns and low-frequency units located over the band platform. The latter, the announcing system, consists of horn-loudspeaker units distributed in a ring over the central arena. Arroyo & Menendez, Architects.

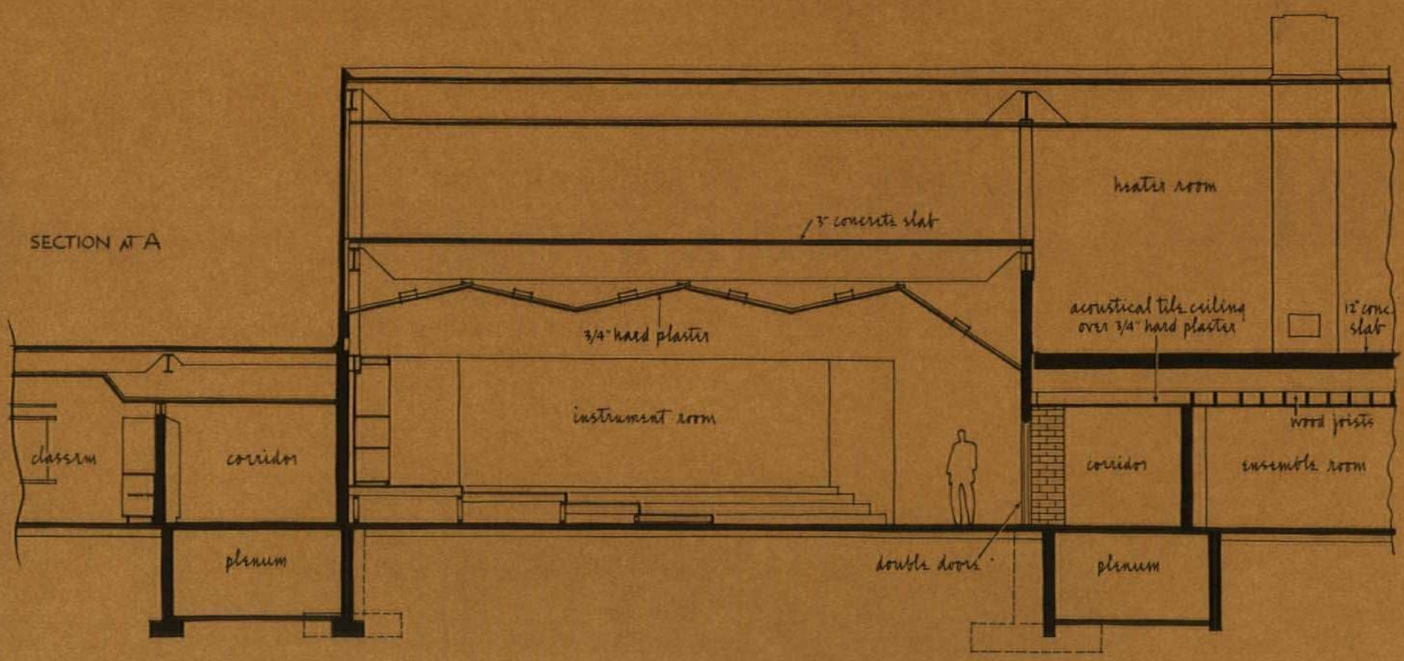
Photos: Louis Reens



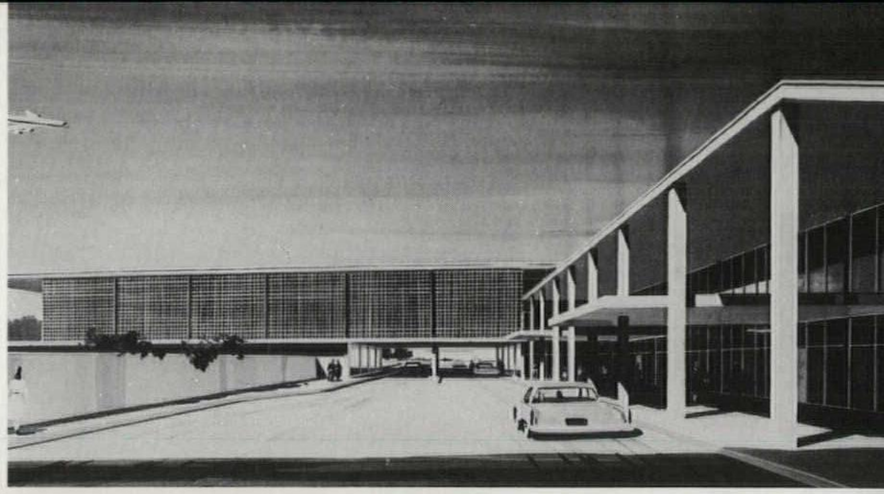
5

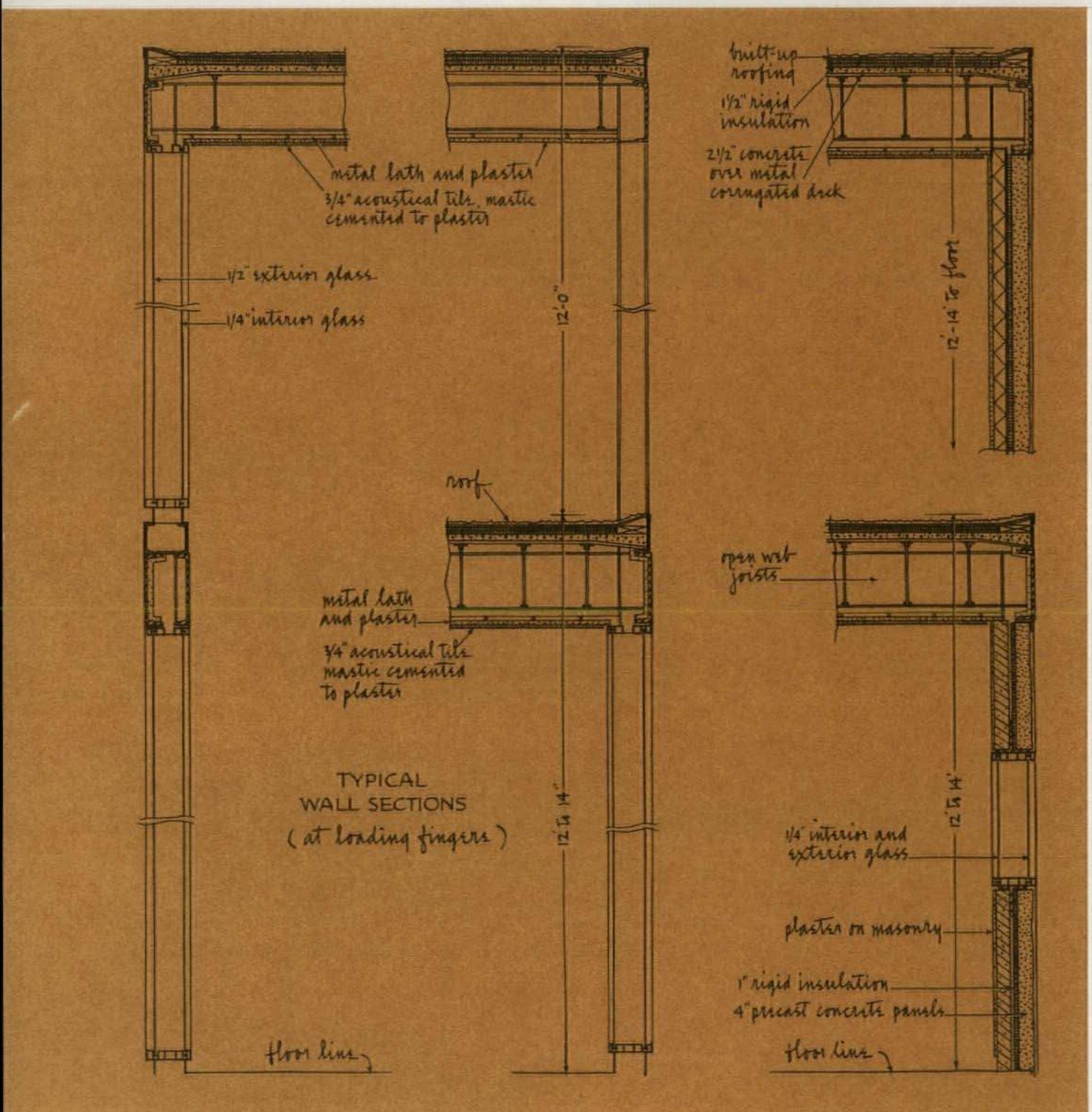
Primary acoustical consideration in the design of the music department at Conard High School, West Hartford, Connecticut, involved the control of sound transmission between spaces used simultaneously. A great deal can be accomplished acoustically by a carefully thought-out plan, as is evident in this design. Wide corridors—utilized as effective noise-control spaces—and two completely gasketed doors always occur between any two rooms. Storage rooms are also used to great advantage in isolating adjacent music rooms. Where space buffers could not be introduced in the Conard School, the common walls were constructed of 8-in. thick masonry, detailed to provide air-tight joints at all terminations. Acoustical "short circuiting" between rooms served by the same duct system is avoided by careful duct layout and the incorporation of a muffler and sound-absorptive lining in the branches between rooms. The second major consideration was the provision of an adequate acoustical environment within each of the spaces. To eliminate flutter echoes and exaggerated room resonance, hard, parallel surfaces were





avoided. Studied placement of sound-absorptive treatment on walls and ceilings provides reverberation control, yet at the same time allows sufficient reflection of sound between the musicians so that they may hear one another and improve their performance. Perforated storage-cabinet doors with sound-absorptive back-up are used in both the instrumental and choral rooms to aid reverberation control. Additional sound-absorptive treatment is provided by bands of acoustical tile cemented to plaster areas.
Nichols & Butterfield, Architects.





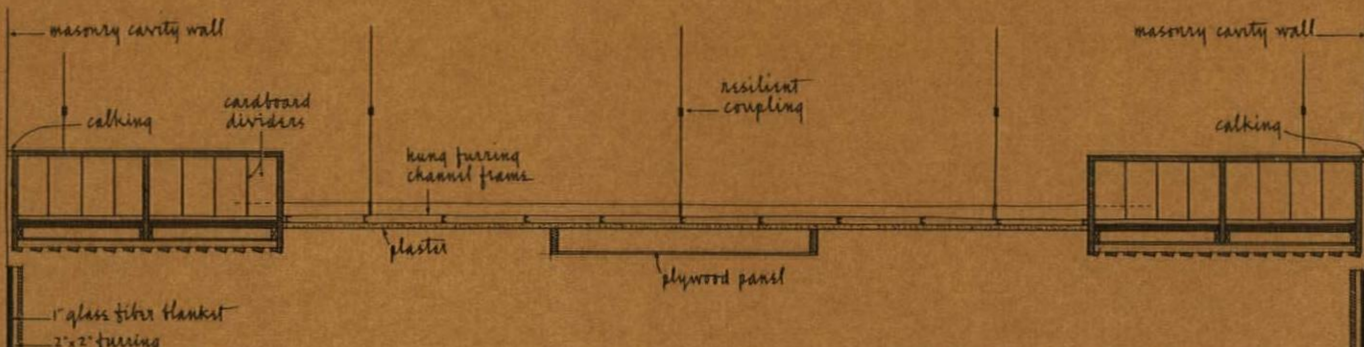
6

With the arrival of jet planes at civilian and municipal airports, noise control becomes even more imperative. In future air-terminal construction, exterior walls must be massive single walls or double walls having large air spaces or other suitable isolation—no cracks or "short circuiting" paths through these walls can be tolerated. In addition, careful arrangement of the internal functions of the terminal is implied. In the design of the new Municipal Air Terminal for Tulsa, Oklahoma, such provisions have been made *(details above)*. The interior functions of the terminal have been arranged according to the "noise-level criteria" assigned to each activity, and previously agreed upon by the airport manager and the architect. Thus offices and ticket-counters (NC factor 50) requiring the transmission of the spoken word through personal contact, telephone, or radio, have been placed in well protected areas, while such functions as baggage handling (NC factor 75) are in more exposed locations.

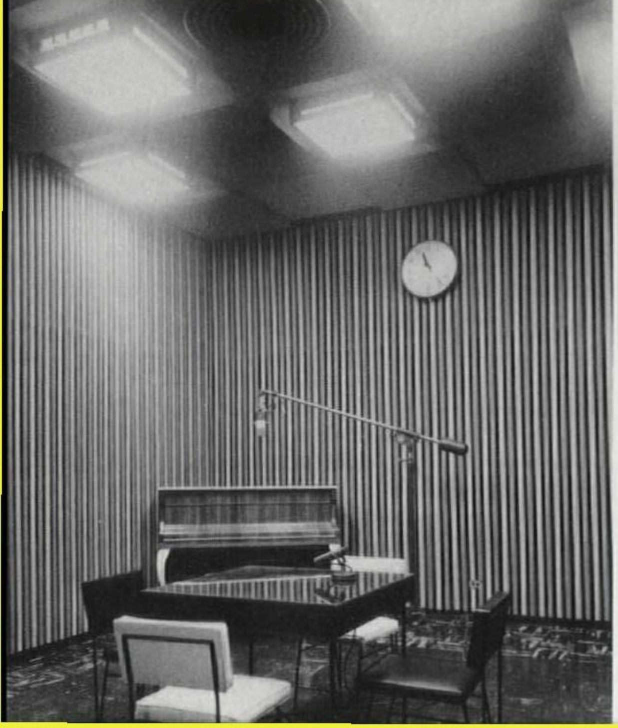
Murray-Jones-Murray
Architects-Site Planners.

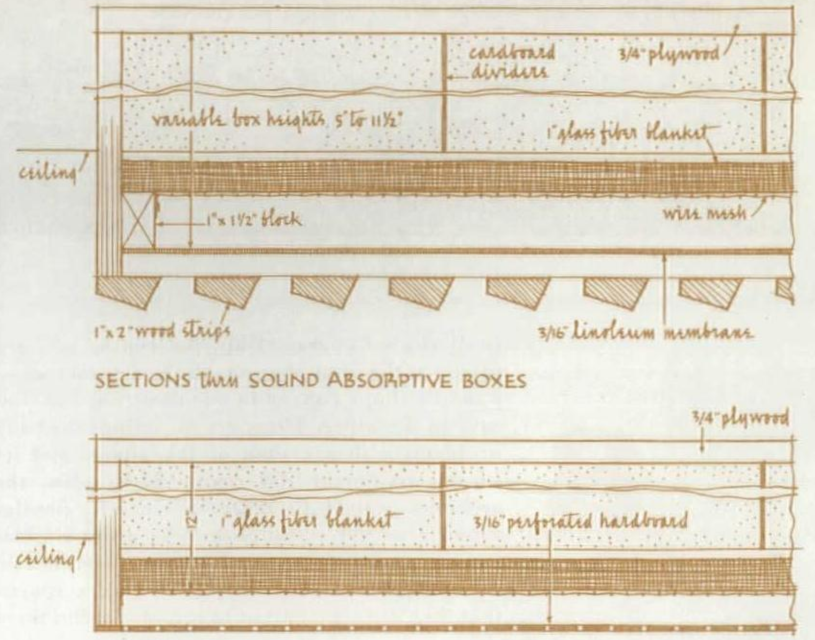
7

Broadcasting Station DZXL, Manila, contains two large audience-type studios, three drama studios, and several small studios. First consideration was adequate isolation of each of these spaces from one another. This required a significantly higher degree of isolation than required in most conventional buildings. All of the studios have 3-in. concrete floors floated on glass-fiber material which, in turn, rests on the structural slab. In addition, the ceilings of each of the studios consist of impervious plaster suspended on special resilient-rubber hangers. For the most part, wall constructions are dense masonry units and, in some instances, two such walls are required to isolate adjacent studios adequately. The provision of a satisfactory acoustical environment within each of the studios was the second major design goal. Some of the studios were proposed for both music and speech activities, and provisions for varying the reverberation characteristics were incorporated. Particular attention was paid to providing adequate reverberation control in the low-frequency range. At the same time, a higher order of sound diffusion had to be obtained so that microphones could be placed at almost any position within the studios.
C. D. Arguelles & Associates, Architects.



SECTION thru SUSPENDED CEILING



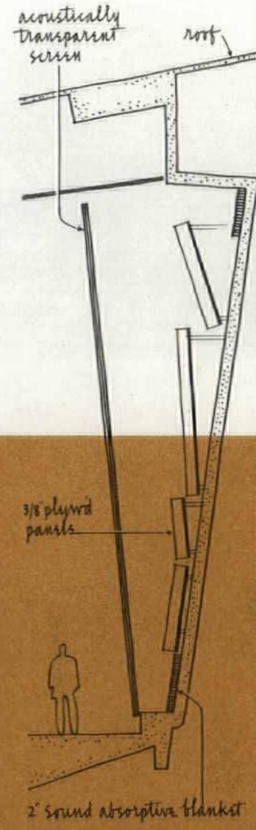


SECTIONS thru SOUND ABSORPTIVE BOXES

8

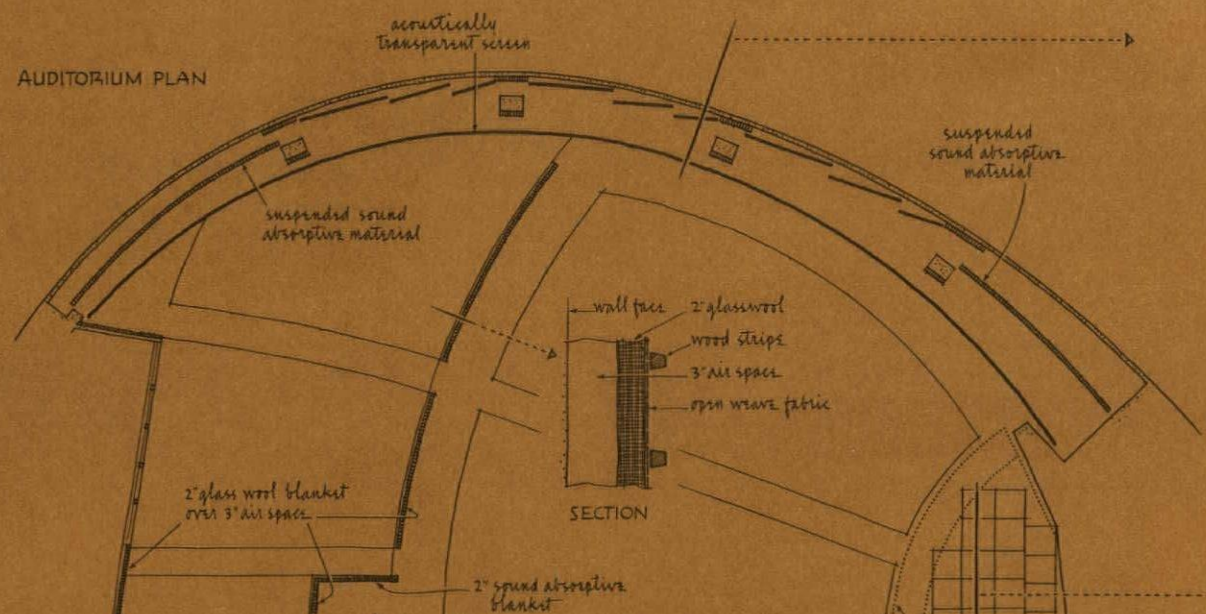
In Berlin's Congress Hall, the ceiling of hard plaster is the same shape as the structural roof—a saddle shape convex in one direction and concave in the other. There are no serious focusing problems with a ceiling of this shape, and no special treatment was required. In plan, the architect wished to create a smooth, circular room. This was accomplished by using a visual screen, made of strips of wood which formed the actual wall finish. These strips are so spaced that they are transparent to sound. Behind them were placed the various sound-reflective and absorptive surfaces needed to provide the desired degree of diffusion and reverberation. The room appears to be circular but, acoustically, is quite diffuse. Due to the high degree of diffusion provided by the doubly-curved ceiling, the space has proved satisfactory for musical performances, in addition to its primary use for speech activities.

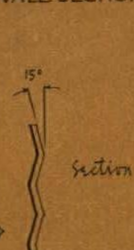
Hugh Stubbins, Architect; Werner Duettmann, Franz Mocken, Associated Architects.



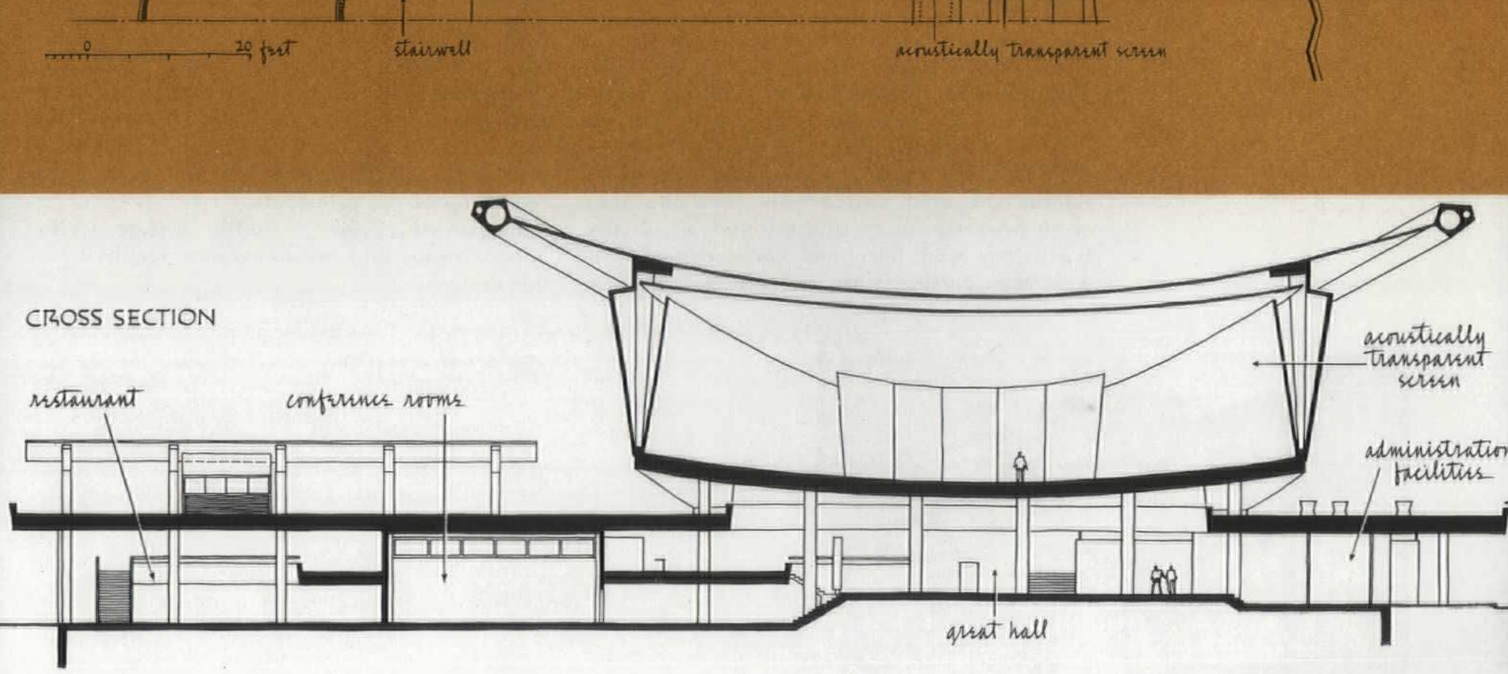
WALL SECTION

AUDITORIUM PLAN

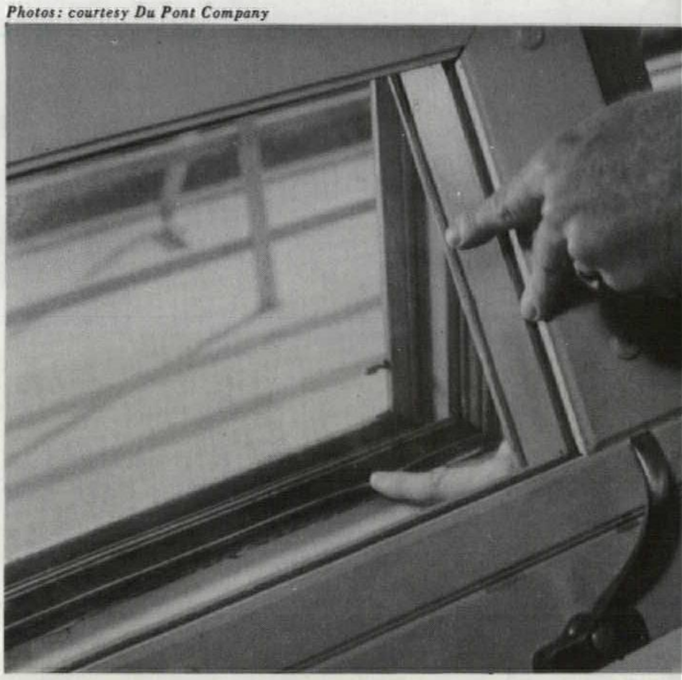




CROSS SECTION



Photos: courtesy Du Pont Company

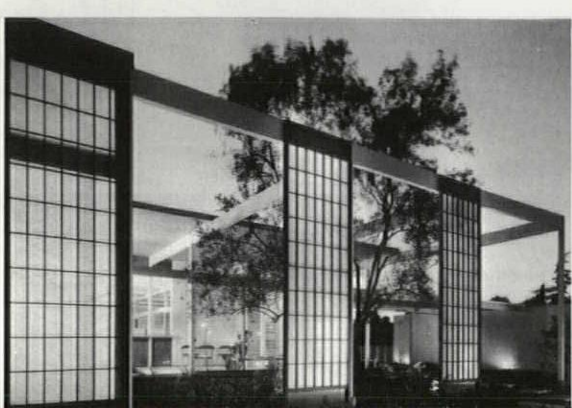


9

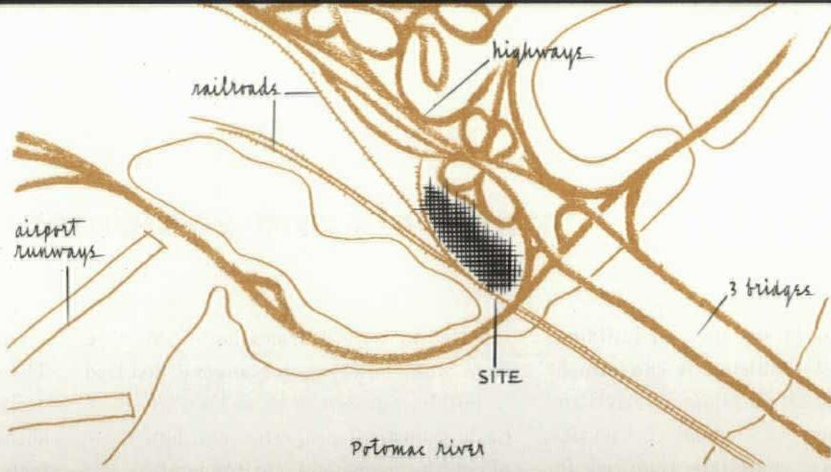
Site for the Marriott Motor Hotel, Arlington, Virginia, is triangular, bordered on one side by a busy arterial highway, on another by a main-line railroad track, and on the third by Washington International Airport. Noise control was uppermost in the minds of the designers from the outset. Consideration of the maximum sustained-noise levels, which would exist outside the typical bedroom unit, dictated the special double-window construction. Since each room was to be ventilated by an under-window room air conditioner, a labyrinth-type muffler had to be incorporated in the wall construction. This permitted outside air for the conditioner, but did not allow a path for exterior noise. Where bedroom units opened onto balconies, special sound-isolating doors were provided.
Joseph G. Morgan, Architect.

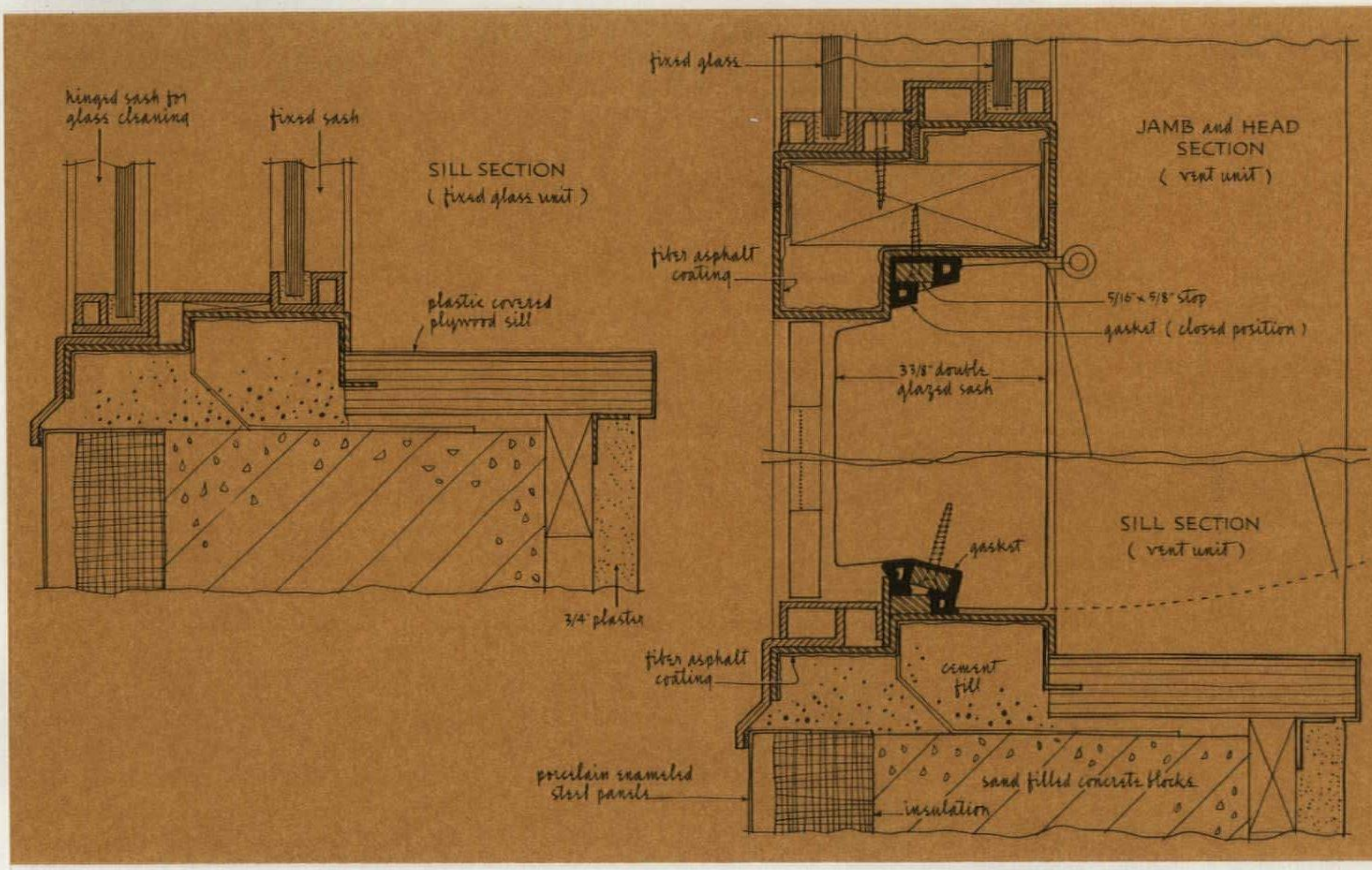
10

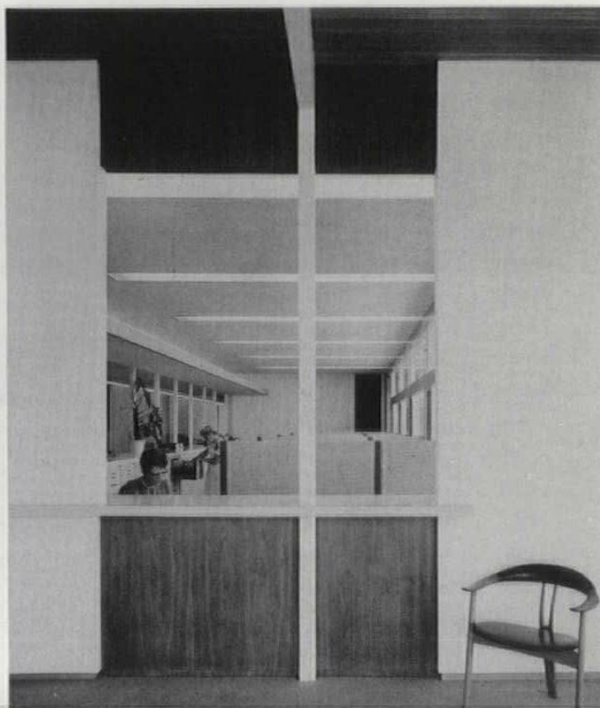
The acoustical problem of the secretarial pool has been particularly well resolved in this small office building for six attorneys in Long Beach, California. Not only do the partitions between individual desks provide a sense of privacy and recognition of the individual, while still maintaining the pool arrangement, but also they serve primarily to mute the sounds of electric typewriters and telephone conversations. The 4'-6" high partitions are surfaced on both sides with ¼" perforated/cement-asbestos-board, backed by 1½" rigid glass-fiber insulation. In addition to the acoustical treatment of these baffles, acoustical tile has been applied to the ceiling, and a glass screen introduced between the secretarial pool and the hall leading to the offices of the principals.
Killingsworth, Brady & Smith, Architects. No outside acoustical consultants were required for this design.



Photos: Marvin Rand


highways
railroads
airport runways
3 bridges
SITE
Potomac river


hinged sash for glass cleaning
fixed sash
SILL SECTION
(fixed glass unit)
plastic covered plywood sill
3/4" plaster
fixed glass
JAMB and HEAD SECTION
(vent unit)
fiber asphalt coating
5/16" x 5/8" stop
gasket (closed position)
3 3/8" double glazed sash
SILL SECTION
(vent unit)
gasket
fiber asphalt coating
cement fill
porcelain enameled steel panels
sand filled concrete blocks
insulation



PART THREE
materials and equipment

Just as one might say that all buildings have acoustical problems, it can also be said that almost all building materials and equipment have acoustical properties. Within a space, materials required for sound reflection are different from those required for sound absorption, and we have also seen that sound isolation between spaces is another matter altogether. Also, it is often required to isolate a piece of vibrating mechanical equipment from the building structure, so that just the piece of mechanical equipment itself becomes the radiating-noise source, rather than the entire surrounding structure. This introduces a whole range of materials for acoustical control in buildings and, generally, these include vibration-isolating mounts for rotating and reciprocating equipment (steel springs, rubber, cork, etc.), as well as resilient connections and couplings that must be provided for all of the many connecting ducts, pipes, and electrical conduits. Occasionally, double constructions are required to provide high degrees of sound isolation between spaces, and we need similar vibration-isolating materials to provide acoustical discontinuity between layers of construction—as with resilient materials for supporting "floated" floors, walls, or ceilings. Even the selection of individual pieces of mechanical and electrical equipment may require consideration of acoustical properties of the equipment itself. The designer may have to consider noise output of the air-conditioning fans, pumps, compressors, cooling towers, boilers, etc., and select the quietest available piece of equipment in any of these categories. In instances where we want a certain level of background noise as the "acoustical perfume" to make lightweight-partition assemblies adequate—from a sound-isolating viewpoint—the selection of equipment may not be in the direction of choosing the quietest available equipment but rather in choosing an air diffuser, for example, that will have the desired amount of noise of the proper characteristics. Detailed discussion of the acoustical properties of the many building materials and kinds of equipment cannot, of course, be handled in a short discussion of this sort. It is well, however, for anyone involved in building design to be at least aware of basic acoustical properties and how these affect the acoustical environment.

In considering materials and equipment from an acoustical standpoint, one very important factor must be borne in mind. We are inevitably interested in acoustical performance over a wide range of frequencies, and single-number descriptions are sometimes inadequate. Most manufacturers of sound-absorptive materials provide sound-absorption data at several representative frequencies, and a great many partition manufacturers do likewise with sound-transmission-loss data. Equipped with this kind of detailed information on performance of a particular product on a frequency basis, and with a basic understanding of the acoustical problem involved, an architect can rarely misuse the product or be surprised at the results. In comparing a certain product of a particular type, it is sometimes useful to average the results of measurements at several frequencies, but one must always remember that average numbers do not describe the performance of the whole frequency range of sound that we deal with in architectural acoustics.

sound-reflective materials

Most materials, unless they have been specifically designed to be sound absorptive, can be considered sound reflective over the entire frequency range. Wood, plaster, precast-masonry units, concrete, and other similar materials fall in this category. Some very thin, finish materials, such as thin plywoods and plastics, can be selectively reflective at certain ranges of frequency; that is, they may provide some sound absorption due to panel action, usually in the low-frequency range. Very few manufacturers advertise their products on the basis of ability to provide sound reflection, and the architect will usually have to select these materials relying on his own experience and his knowledge of the basic facts about sound reflection.

sound-absorptive materials

There is a wealth of available products designed specifically to provide sound absorption. A great many of these are factory-finished and the absorptive characteristics can be very carefully controlled during manufacture. In addition, there are some wet, applied-in-the-field products which can give appreciable absorption; their field performance, however, is somewhat influenced by the method of application. Among these are acoustical plastics, sprayed-asbestos-fiber materials, and the like.

Basically, the absorptive qualities of the porous-type absorptive materials are determined by thickness of the materials and nature of the finish surface. The absorptive characteristic of porous materials, with respect to frequency, is simply described (*Figure 8*). In **A** we see that a thin, porous material mounted directly on a hard-backup surface has relatively little absorption in the low-frequency range, and that the absorption increases with frequency. If we want to get more low-frequency absorption, it is necessary to increase the thickness, either by providing a thicker porous blanket or by providing an air space behind the material. This effect is shown in **B**. Now, in most architectural situations, we can rarely leave a porous layer exposed. We have to provide a more durable facing that will be maintainable over a long period of time. This requires some sort of protective facing with openings which can be either added as a separate element to the porous layer, or made an integral part of it. The effect of adding a facing material is essentially determined by size and spacing of openings that are left to allow sound to get into the fuzzy core of the material. Very thin plastic or paper can also be used as a facing material even though there are no perforations as such, since these thin materials transmit most of the impinging sound energy right on through to the porous core. Generally speaking, the effect of adding a facing material is to reduce the absorptive qualities in the upper-frequency range. For many acoustical problems, we do not need efficient sound

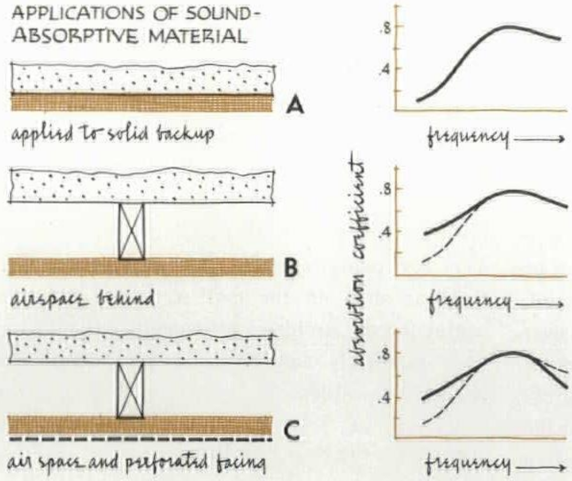
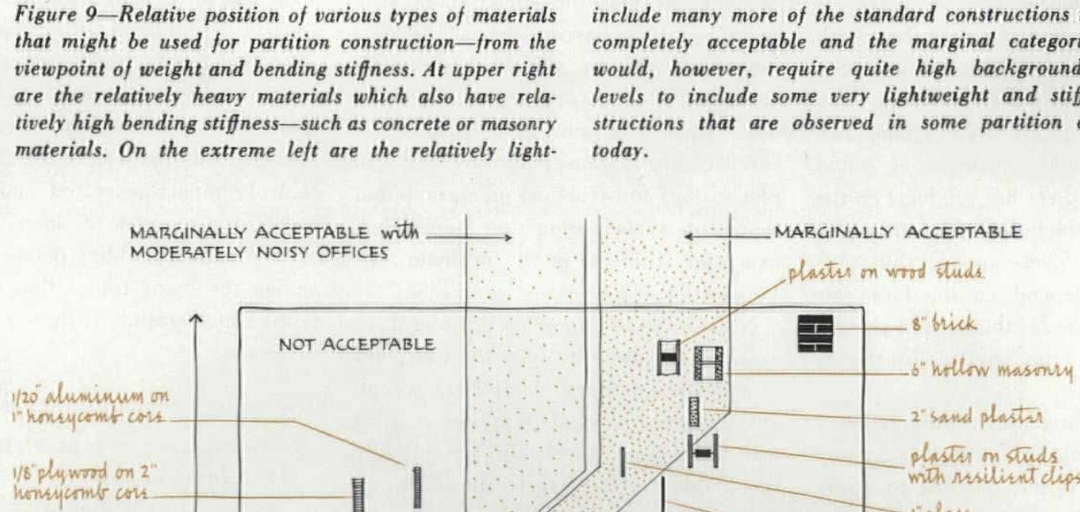


Figure 8—Effectiveness of sound-absorptive materials of various configurations. **A** *Porous material mounted directly on a hard, back-up surface will provide little absorption in the low-frequency range while providing efficient absorption in the mid or upper frequencies.* **B** *The effect of providing a thicker, sound-absorptive material by spacing porous material away from the hard, back-up surface. This "thicker" sound-absorptive material increases absorption in the low frequencies, as shown.* **C** *Effect of adding a perforated facing, usually required, to protect a porous material. The absorption in the upper frequencies will be reduced, depending on the hole size and spacing, but there will be virtually no effect on the low-frequency absorption.*

Figure 9—Relative position of various types of materials that might be used for partition construction—from the viewpoint of weight and bending stiffness. At upper right are the relatively heavy materials which also have relatively high bending stiffness—such as concrete or masonry materials. On the extreme left are the relatively lightweight, but also very stiff constructions—such as plywood or metal-honeycomb materials. Also on the far right are the relatively heavy but less stiff constructions—such as lead and steel sheets. For a particular background-noise environment—a relatively quiet office area, for example —the diagram shows where these various constructions would fall from the point of view of acceptability in providing acoustical isolation between the adjacent office spaces. In general, the heavy materials (even stiff ones) would provide satisfactory isolation, but extremely lightweight, stiff constructions are not acceptable. As can be seen, many common building materials fall in the marginally acceptable category. Increasing the background-noise level of the office area would shift the area of acceptability downward and to the left, and thereby include many more of the standard constructions in the completely acceptable and the marginal categories. It would, however, require quite high background-noise levels to include some very lightweight and stiff constructions that are observed in some partition design today.



CATEGORIES OF ACCEPTABILITY FOR SPEECH PRIVACY IN QUIET OFFICES absorption in the upper-frequency range and, therefore, this high-frequency cut-off does not affect the over-all performance of the material. The nature of the facing material may, however, affect the long-term absorptive characteristics of a given sound-absorptive material. If the perforations or fissures are very small and can be easily bridged by successive coats of paint, then the absorptive characteristics over the whole frequency range can be drastically impaired. Manufacturers of products that have very small openings to the porous core of the material, will very often caution against excessive painting and possibly suggest special painting procedures to avoid this problem.

Besides the relatively thick, porous type of sound-absorptive materials which can be used either with or without air space behind, we have another type of sound-absorptive material that has been developed to provide the absorption required in areas where continuous, light-diffusing ceilings are desired. Perforating the light-diffusing surface to allow sound to get through to a sound-absorptive layer at the level of the lights, would allow the light source to be visible through the perforations. It is possible, however, to perforate plastic materials and laminate them with thin, porous materials like cellulose-fiber paper. This carefully designed layer, combined with a large air space behind, can provide a reasonable amount of sound absorption, and there are products on the market today which can solve this particular problem. These special, thin, porous materials depend on the large air space behind them for their sound absorption—and cannot be applied directly to a hard surface.

Another way to get absorption below a light-diffusing, plastic ceiling, or in any space where it is not possible to apply porous materials continuously over the ceiling area, is by the use of suspended sound-absorptive units or baffles. These materials have wide usage in industrial areas where the ceiling must be kept completely free for access to ducting, pipes, etc., but basically these absorb sound in the same way as the horizontally applied porous materials; that is, they all essentially consist of porous materials either in the form of vertical baffles—or in other geometrical shapes—that absorb sound energy which is directed toward them.

We have already noted that sound absorption is also possible by the use of thin materials which absorb sound by panel action. In rooms where we want to get a good deal of low-frequency absorption—without providing too much additional mid- and high-frequency absorption, we use thin plywood or other such materials. Very few panel-type absorbers are advertised as such on the market, but it is useful for the architect to remember that such materials can be used for some acoustical problems.

sound-isolating barriers

Textbooks on acoustics, manufacturers' literature, and test-laboratory bulletins give the architect much detailed information on the sound-transmission-loss properties of various wall, floor, and ceiling constructions. Although the subject cannot be discussed fully in this brief report, it may be useful to examine one particular situation to discover how acoustical-isolation requirements are met by various construction types. Let us assume two private offices in a relatively quiet environment: the problem is to select a barrier that provides adequate speech privacy between these spaces. We have already pointed out that the effectiveness of a sound-isolating barrier depends on its weight, its stiffness, and its air tightness. Assuming that we can neglect air tightness, since this can be controlled by careful construction procedure, we can plot various constructions on a graph that represents surface weight on the abscissa axis and stiffness on the ordinate axis (*Figure 9*).

Next, we superimpose on this plot three areas of acceptability from the viewpoint of acoustical privacy: completely acceptable (almost everybody would be satisfied with this degree of isolation); marginally acceptable (seven or more out of 10 persons would consider this degree of isolation satisfactory); and not acceptable (less than seven out of 10 persons would be satisfied). All of the heavy constructions—whether stiff, like masonry-block walls, or not so stiff, like lead sheet—fall into the completely acceptable category. Many of the conventional constructions—plate glass, plaster on studs, solid plaster, etc.—are found in the marginally acceptable group. And finally, the very lightweight but also very stiff constructions—such as metal or wood-honeycomb panels—are not acceptable.

Now, if we were to change the background noise levels in these two offices separated by any one of these barriers, we would shift the areas of acceptability either upward—to the right—for a quieter level of background noise; or downward—to the left—for a noisier background. This effect is also illustrated (*Figure 9*). Since the trend in contemporary office building construction is toward lighter components, the downward-left shift is perhaps the more realistic. However, to those involved with acoustical isolation problems, it is obvious that objectionally high levels of "acoustical perfume" are required to include some of the lightweight barriers as acceptable. The future approach, from an acoustical viewpoint, must then include some rethinking in partition design to minimize stiffness as well, if we are to solve the perplexing problem of acoustical privacy with lightweight, movable barriers.

This brief consideration of sound reflective, sound absorptive, and sound isolating properties of materials constitutes a limited and general introduction to the problems involved. Not dealt with are the many special materials and items of equipment that the architect may use in solving acoustical problems. Other important subjects that would justify more discussion are the properties of noise- and vibration-control devices required in mechanical systems, the properties of materials to control impact-generated noise, sound-isolating properties of doors, as well as other practical building details. These are among the many topics that require detailed consideration, if there are to be no surprises.

combinations of materials, maximum control

We have seen that reflection, absorption, and isolation are quite different in their basic mechanisms. How, then, can we combine these control elements to achieve satisfactory acoustical environment? First of all, sound-absorptive materials, as we have already noted, reduce the reverberation time by reducing the reflected-sound energy. In a large office space the use of the sound-absorptive ceiling is highly beneficial in controlling the spread of sound. Actually, even the level of sound is somewhat reduced, but the chief benefit is that of giving direction to the sources

—making them stay "over there" rather than surrounding the listener with reverberant sound energy from all directions.

We know that in offices and other spaces where speech communication is important, sound-absorptive ceiling treatment is highly beneficial in creating a comfortable working environment. We also find sound-absorptive materials useful in schools and hospitals to control the spread of sound in corridors, and to make gymnasiums and industrial-art-shop spaces satisfactory places to teach. High noise levels and long reverberation time in swimming pools, too, may require sound-absorption to allow a satisfactory acoustical environment for teaching and also for safety control.

A sound-absorptive ceiling in a noisy factory may or may not be of help. Limitations in the use of sound-absorptive materials in a factory situation are shown (*Figure 10*). If workers are well separated and the ceiling is low, then good control of the spreading of sound may result. On the other hand, if the ceiling is 30 ft or 40 ft high and workers are engaged in noisy activities very close to each other, a sound-absorptive ceiling will do very little for the individual worker or even for those workers in his immediate neighborhood. In both cases, it can be seen that ceiling treatment doesn't reduce at all the direct sound from a given machine.

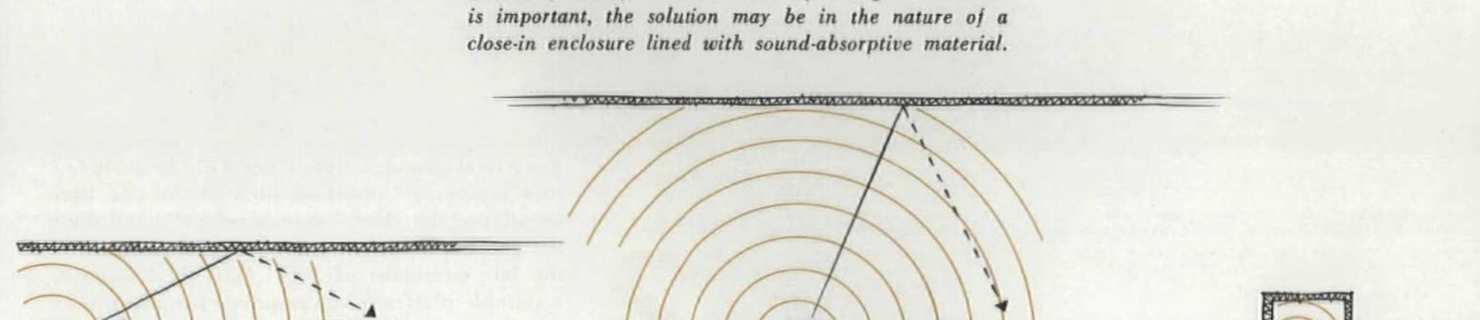
There have been disappointing results in the use of sound-absorptive materials for noise control, because people have not always remembered that sound-absorptive materials are merely non-reflective. The ideal situation for sound absorption is outdoors, where 100 percent of sound energy which goes out is absorbed by simply not coming back. Thus, we can understand why the operator of a noisy machine may not benefit much from the fact that the ceiling doesn't reflect. The answer may be in the form of some close-in absorption around the machine or possibly, in addition, an enclosure made of impervious, sound-isolating material, with small openings to minimize the amount of sound getting out into the space.

We must primarily think of sound-absorption, however, as a control device *within* a room—not by itself for control of the transmission of sound between spaces.

Really adequate control of transmission of sound from one space to another, in very quiet situations, can only be given by solid, impervious, heavy obstacles. As we have seen we may get away with light-weight—yet not too stiff—constructions; but only if we allow high enough levels of "acoustical perfume." Partial-height partitions, either with or without sound-absorptive finish, may be satisfactory in situations where there is no problem of privacy and where similar activities occur throughout the space. For private offices, or for any situation in which activities are quite dissimilar, a partial enclosure can never be satisfactory. In schools, for example, we hear a lot about open plan and partial enclosures. These work all right as long as children are being instructed in small groups, and are all doing the same sort of thing. Just let one class start singing, however, or have a movie or begin some other activity quite different from what the neighbors are doing, and we have real problems. Many teachers tell us that, in situations of this sort, they are not only bothered by the noise of neighboring class activities, but also feel constrained in the types of activities they can let their pupils have. They know what a nuisance it will be to other classes if they allow singing and other noisemaking activities.

We hear all sorts of rumors about "ultrasonic screens," plastic walls, carpets, etc., which will suddenly solve all the problems of flexibility in school planning. The behavior of sound in buildings is governed by the basic laws of physics—just as when one jumps out of a window, he always goes down! We aren't likely to discover any antigravitational fields in the near future, nor are we going to suddenly find ourselves with miracle partitions which don't weigh anything and which give us the privacy and lack of distraction which we all demand from our neighbors. Remember that there is no substitute for a *closed* door!

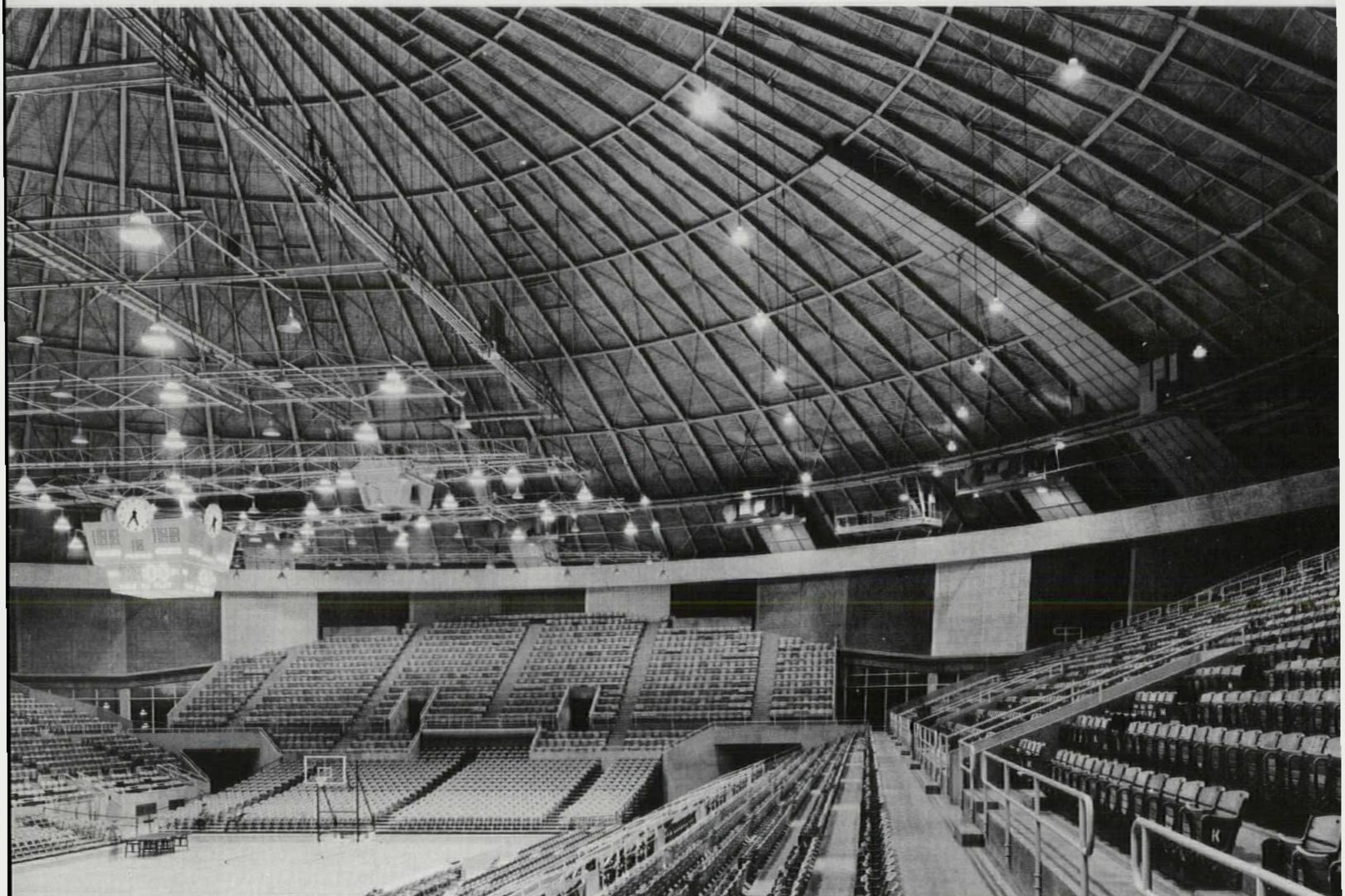
Figure 10—Sound-absorptive treatment in a factory with low ceiling and having machines widely separated, may be of considerable help in reducing the level of noise heard by adjacent operators. Note, however, that the direct sound remains unchanged and, therefore, sound-absorptive ceilings provide no help for the person operating a particular machine. In factories with high ceilings and having machines spaced very close together, ceiling sound-absorptive treatment may be completely uselss. If control of noise for the individual operating the machine is important, the solution may be in the nature of a close-in enclosure lined with sound-absorptive material.



case histories: *Use of Materials*

1

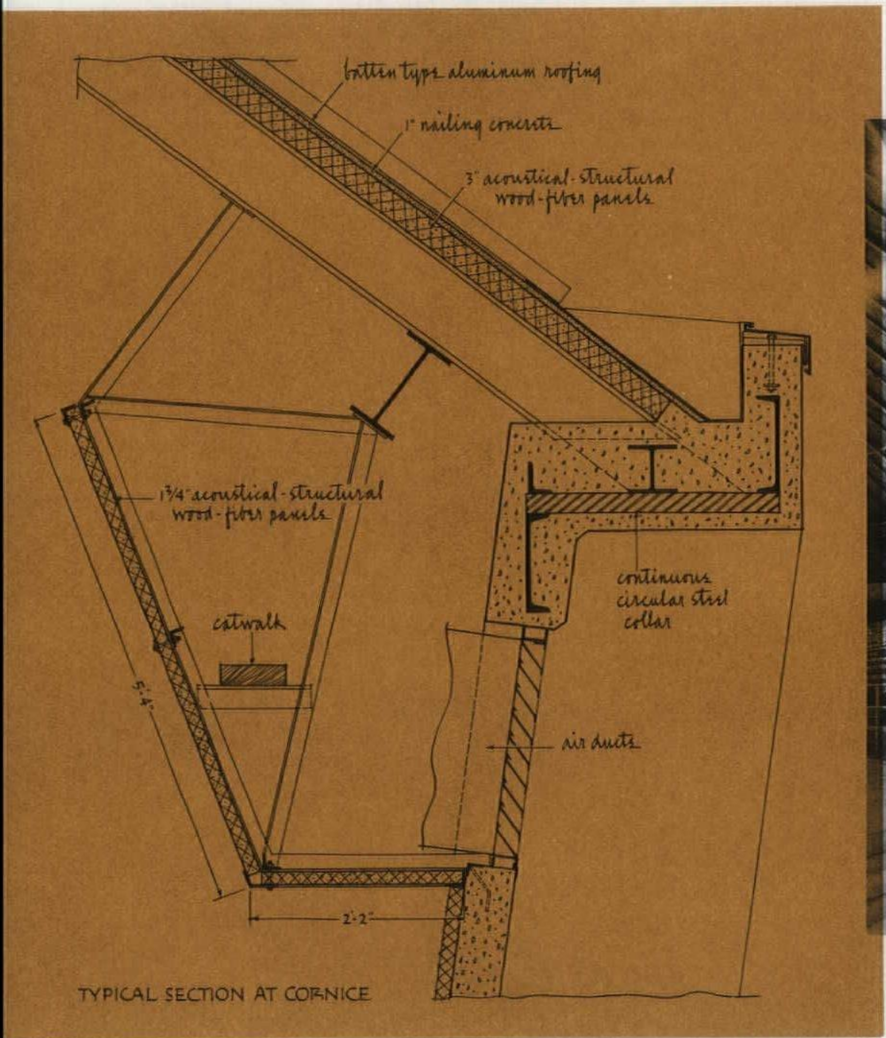
Sound-absorptive treatment, in the case of the Coliseum, Charlotte, North Carolina, serves as a structural- and thermal-insulation material as well. Wood-fiber roof planking, used over the structural steel members on the walls and ceiling, provides both echo and reverberation control in this space. Since all of the enclosing surfaces are too far away from the sound sources to provide useful sound reflection, the acoustical correction is almost entirely that of approximating "outdoor" conditions. The loudspeaker system is placed in a central cluster toward one end of the arena, over the position of a temporary stage used for certain functions. The loudspeakers are necessary for all activities, except band music, to provide adequate



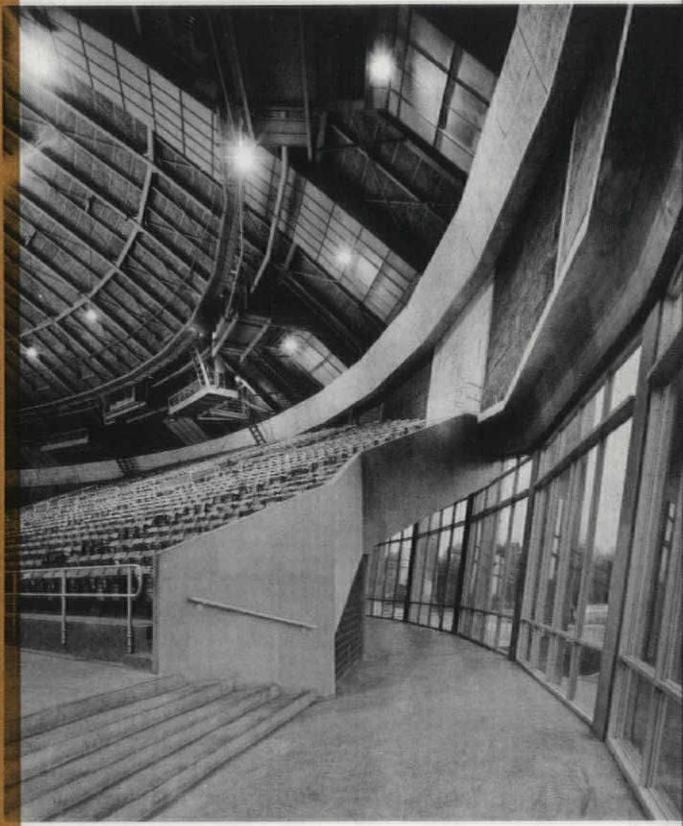
2

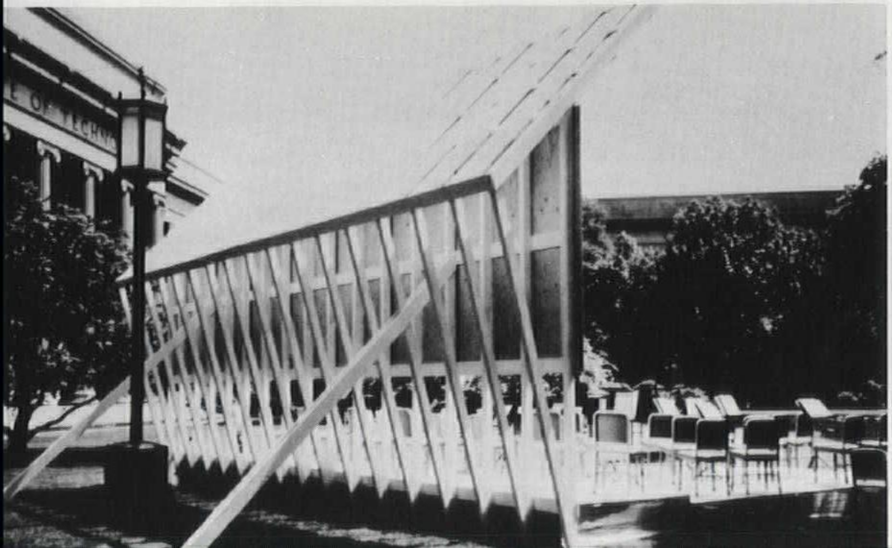
Acoustical considerations should not be excluded in a temporary situation such as the one that occasioned the "back-of-an-envelope" band shell design shown here. At a memorial service for the late president of MIT, Karl T. Compton, a suitable platform was required for a group of symphony musicians. The architect sensed the need for an enclosure and, using a few simple materials—two-by-fours and 4' x 8' plywood panels—an adequate acoustical enclosure resulted.

loudness throughout the seating areas. One interesting feature, from an acoustical point of view, is the use of rectangular seating in this basically curved building. Curved seating arrangements, in large auditoriums of this type, often give rise to difficult focused-echo problems when the audience area is partially occupied.
A. G. Odell, Jr. & Associates, Architects.



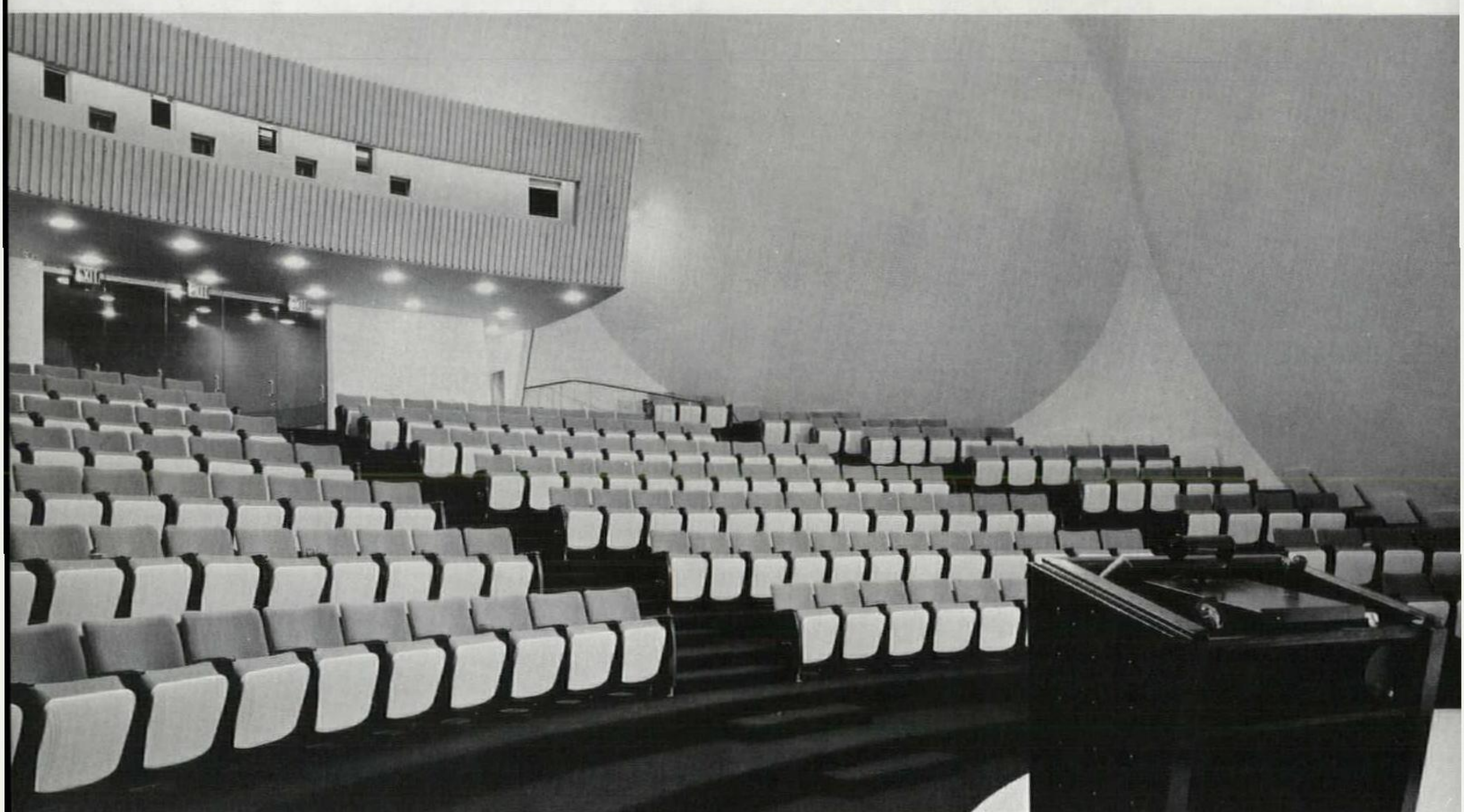
Photos: Alderman Studios, Inc.





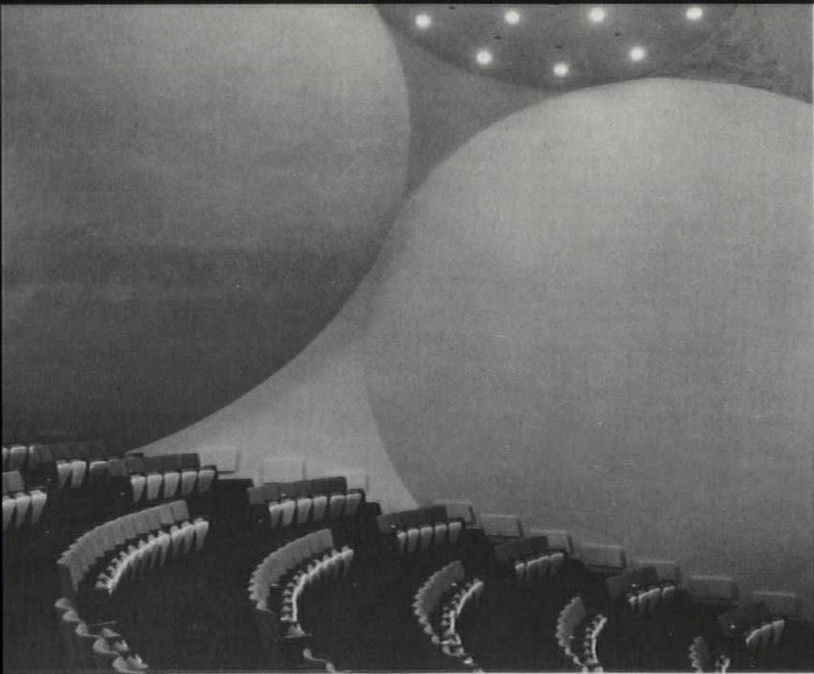
3

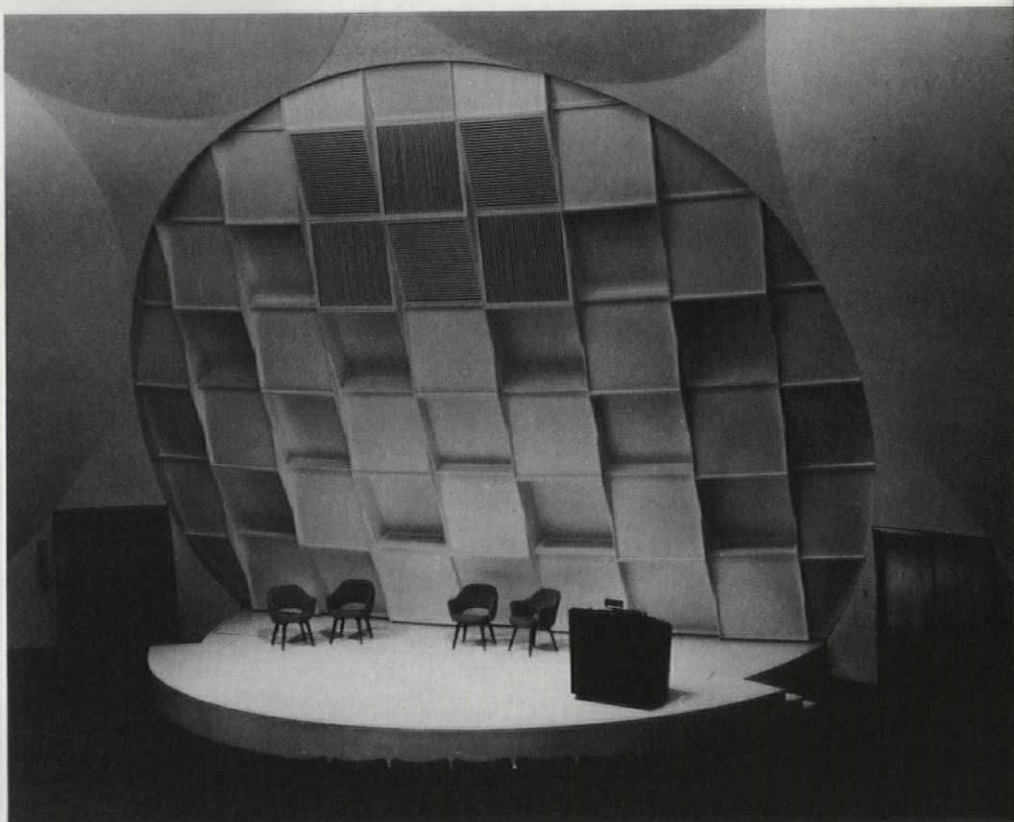
In planning the auditorium for Rockefeller Institute of Medical Research, New York, both architect and client felt strongly that the building should be a dome, to complement the rectilinear form of an adjacent building. After considering two acoustical alternatives—the suspension of a large number of isolated clouds within the dome, or the construction of an inner, acoustically transparent dome—a third proposal, using a series of large convex disks which bubble out toward the audience, was selected. To control echo, the rear wall was treated with wood slats, open fabric, and mineral wool. Sprayed asbestos was applied to portions of the ceiling between the uppermost disks. In addition, the entire floor has been heavily carpeted and seats fully upholstered. This has resulted in a large amount of high-frequency absorption and practically no low-frequency absorption. Though the room is primarily designed for lectures, scientific meetings, or motion-picture showings, occasional musical performances were also anticipated. To blend instrumental voices, some local reflective surfaces were introduced in the diffusing panel directly behind the stage. In addition, the stage floor has been left hard and reflective.
Harrison & Abramovitz, Architects.

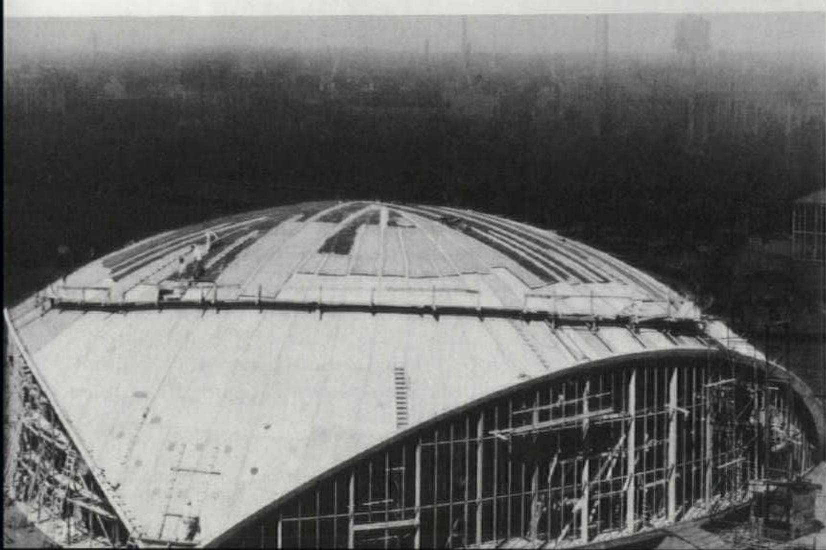


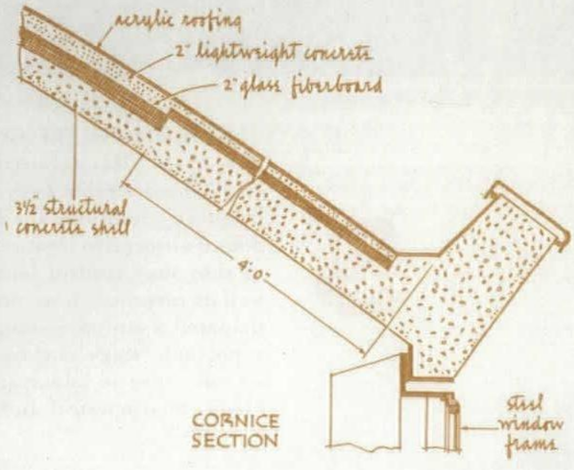
4

Where good listening conditions are of prime importance, adequate acoustical provisions for the interior are not enough without exterior sound-transmission controls. To exclude noises of aircraft, trucks, and nearby industry from MIT's Kresge Auditorium, a second layer of 2-in. lightweight concrete over a 2-in. glass-fiber blanket was added to the structural shell. This second shell is of no structural value, but serves merely to minimize sound transmission. Interior partitions come within 4 in. of the shell's surface. Rubber gaskets, filling this intermediate space, are designed not only to absorb movement due to expansion and contraction, but also to prevent sound leakage. *(See also Case History, PART FOUR, and technical article, page 120, June 1954 P/A.)*
Eero Saarinen & Associates, Architects.









CORNICE SECTION

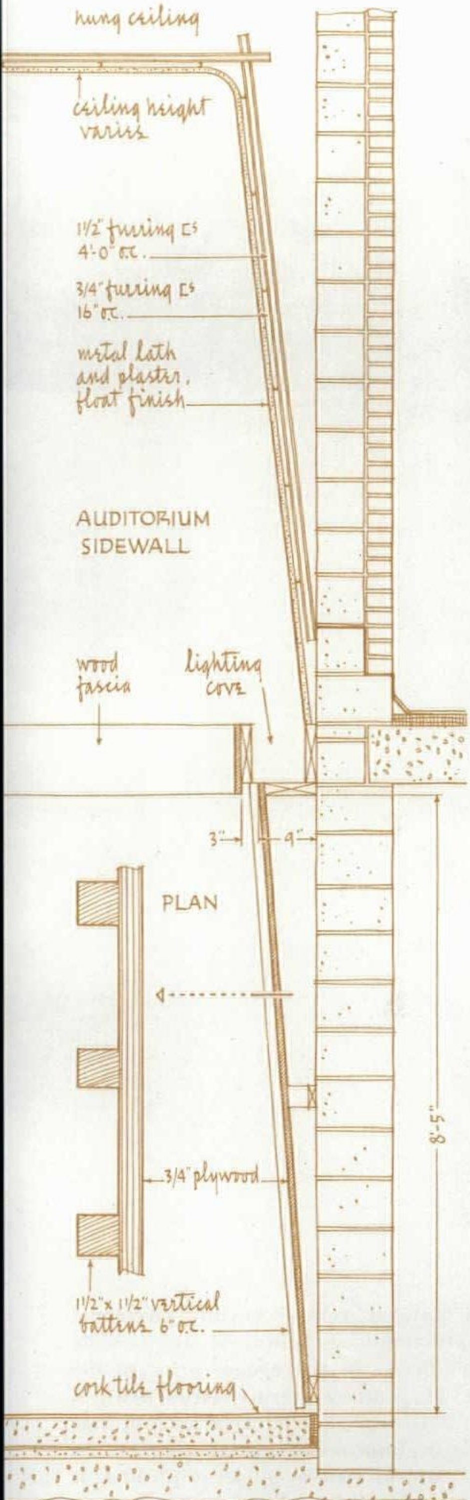
Photos: Joseph W. Molitor

5

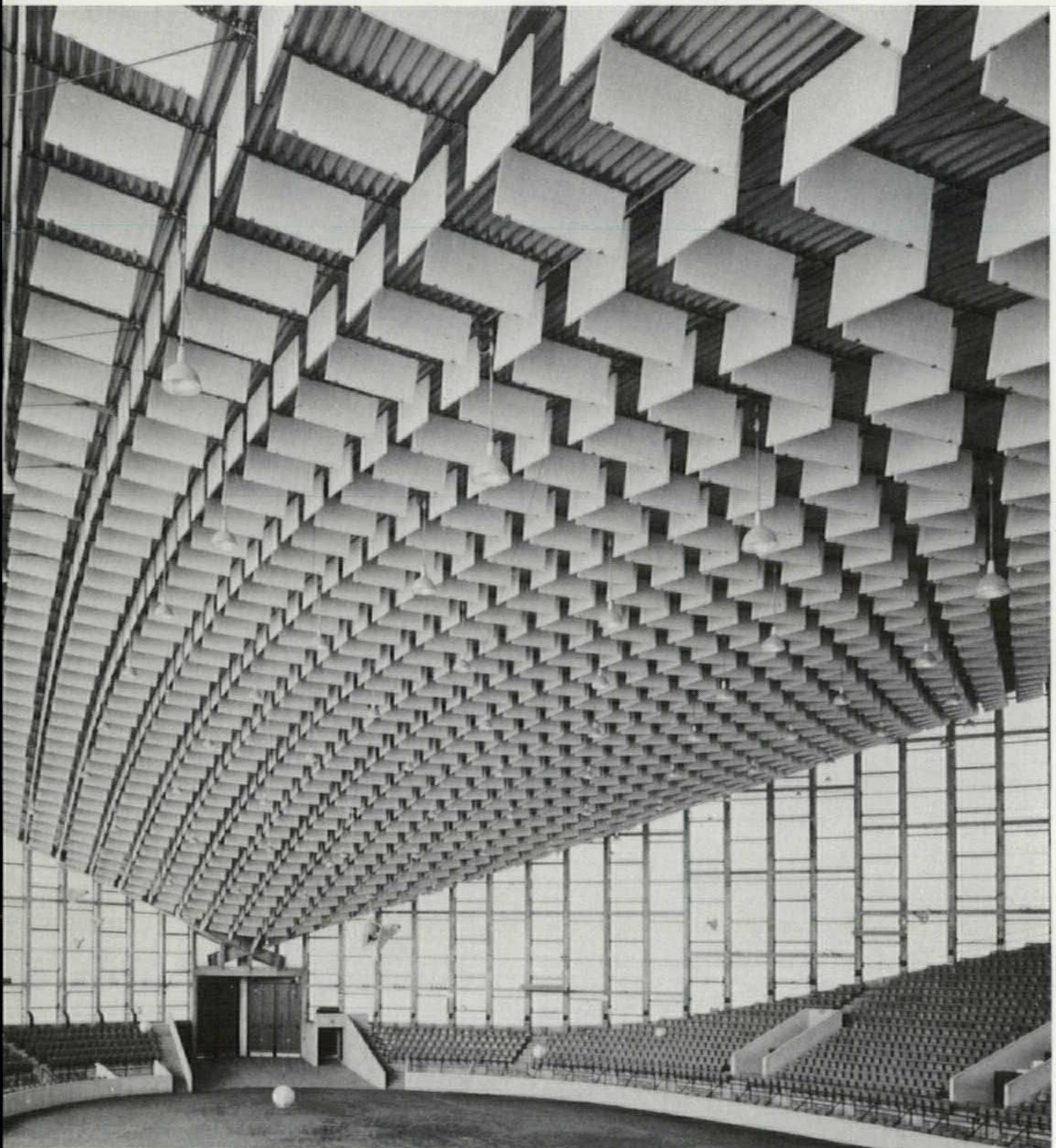
This auditorium in Greenfield High School, Greenfield, Massachusetts, incorporates almost all of the desirable features to achieve adequate listening conditions for both music and speech. Sound-absorptive treatments are carefully placed so that they control long-delayed reflections as well as reverberation. Since the school board anticipated a strong community musical program, a portable stage enclosure was provided. Such an enclosure is important not only to mix and blend the orchestral and choral music, but also to provide sound reflections between the performers so that they can hear one another and perform together better.

The band room has a high degree of sound diffusion due to its splayed-plaster ceiling and wall shaping. Sound-absorptive treatment is distributed over a portion of the ceiling and wall areas.

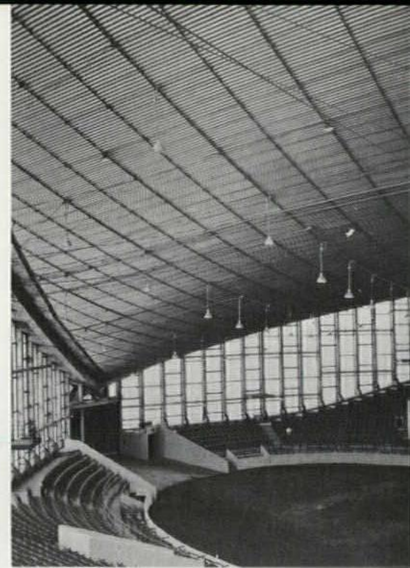
Corridors have sound-absorptive, mineral acoustical-tile panels suspended from the ceiling. James Albert Britton, Architect.



DETAIL OF ACOUSTICAL BAFFLES 1½" scale



Lewis P. Watson



Joseph W. Molitor

6

Enclosing approximately three million cu ft of volume, North Carolina State Fair Pavilion, Raleigh, presented an unusually difficult problem of integrating the required sound-absorptive treatment for echo and reverberation control. Many conventional types of sound-absorptive treatment could not be adapted to the cable-supported, saddle-shaped metal-roof deck due to structural movement of this element. Vertically suspended 2'x4' glass-fiber baffles, 6 ft o.c. in an egg-crate arrangement, proved to be a sensible solution to this problem and resulted in the transformation of this area into a highly satisfactory space for livestock shows, sporting events, and other large gatherings. For the installation of these baffles, a high-lift platform crane was utilized, eliminating the need for expensive scaffolding.

As in all large arenas of this type, with interior surfaces too far away from the sound source to provide natural reinforcement, electronic sound amplification is required to provide adequate loudness. In the arena, prior to the installation of sound-absorptive treatment, a distributed horn-type loudspeaker system was required for announcements. Once adequate reverberation control had been accomplished, it was possible to install a high-quality central loudspeaker system to handle speech amplification as well as music reproduction.

The large area of curved window-wall still presents some difficulty in focused, long delayed reflections. Treatment with sound-absorptive material was ruled out. However, the problem is minimized by careful placement of the loudspeakers, so that little sound energy is directed at these surfaces, but rather is concentrated on the seating area.

William Henley Deitrick, Architect; Matthew Nowicki, Consultant.

PART FOUR

planning for good hearing

In order to have good hearing conditions, we must satisfy a number of sensible, basic requirements. First of all, the acoustical environment for hearing is one of quiet. We know how ridiculous it would be to try to listen to a string quartet on a busy street corner in a modern city, and recall that we sometimes can't hear the sermon in a church when the air conditioning is too noisy. The background noise, which can be so useful as "acoustical perfume" in providing privacy and freedom from distraction in the office or apartment house, has absolutely no place in the room where we want to listen to speech or music.

loudness and distribution

It is almost axiomatic that it would be highly desirable to have the sounds we want to hear loud enough, and also to have them uniformly distributed. People sitting in the front of the room should not get great quantities of sound while those in the back barely hear. Hot spots and dead spots (locations receiving too much or too little sound due to focusing or reflected sound) can be just as unsatisfactory as a seat in which we hear everything twice, due to long delayed reflections. Adequate loudness and good distribution of sound are determined almost entirely by the shape and surface finishes of the room. Here, the architect can determine good-hearing conditions by careful design.

We see how sound is distributed when an audience is seated on level ground outdoors (*Figure 11*). A sound wave, as we have seen earlier, decreases in its intensity inversely as the square of the distance. However, as it grazes over the heads and clothing of the sound-absorptive audience, we have additional losses, which can amount to as much as one or two db per row. This means that people seated near the back of an audience not only receive less sound energy by virtue of the fact that they are far away from the sound source, but they are also deprived of sound energy by the people in front of them. Thus, in outdoor, flat auditoriums the loudness and distribution requirements are very poorly met.

The ancient Greeks and Romans apparently understood this problem quite well and built their theaters on steep hillsides in quiet locations (*Figure 12*), with the audience placed at a very steep angle. They found that there was significantly less loss of energy in the freely advancing sound waves, than when seating areas were flat. Perhaps we are giving our Greek and Roman forebears too much credit for acoustical sense in planning, since they may well have been attempting to solve only the line-of-sight problem, and just obtained good hearing conditions as sort of a bonus. In any case, this points up a useful truism in many room-acoustics situations; good sight lines usually mean good hearing lines. The same result can be achieved by placing the source of sound very high with respect to the audience, but this causes an uncomfortable visual relationship, and we most often resort to the very simple expedient of providing a sound mirror—the hard, sound-reflective ceiling of the auditorium. The action of the ceiling as a reflector brings sound energy down to the audience, to reinforce the direct sound (*Figure 13*). The use of the ceiling as a sound mirror is basic in the design of a room for good

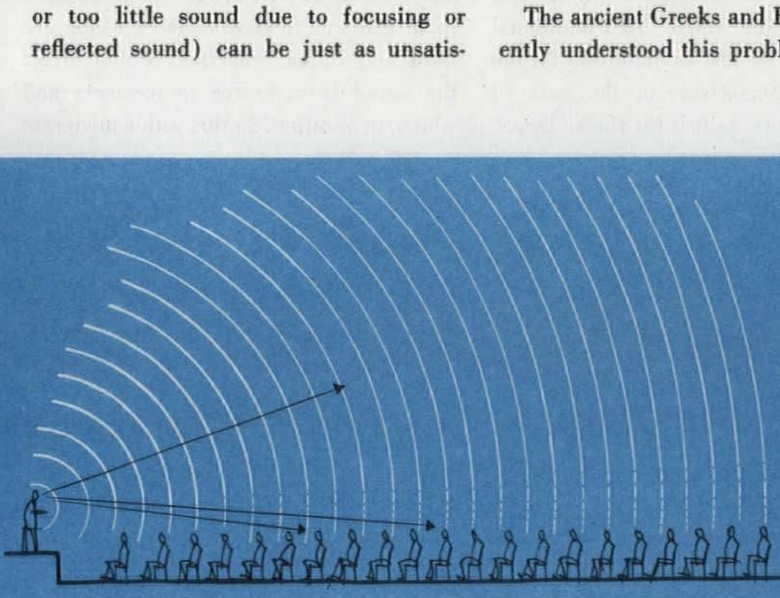


Figure 11—Illustration of sound distribution when the audience is seated on level ground outdoors. The sound energy heard by the rearmost listener is reduced not only by normal decay due to distance from the sound source, but also by absorption provided by the person seated in front.

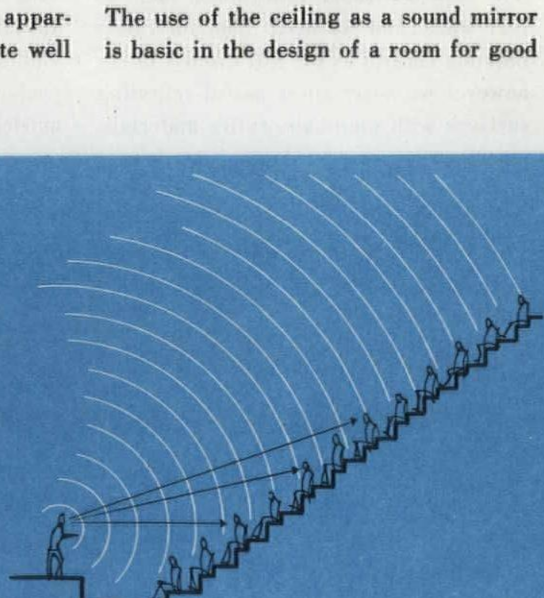


Figure 12—Distribution of sound in a steeply sloped outdoor auditorium. The absorption, provided by the audience in front of a given listener, is minimized, and the level of sound heard by the rearmost listeners is almost directly dependent on the distance from the source.

hearing conditions. It can be shaped and refined in many ways, but basically it should be hard and sound reflective. It must never be sound absorptive without explicit reasons. The ceiling is the most important surface in the room for assuring adequate loudness and good distribution. It is obvious that, if a listener is going to receive sound energy from the ceiling, he must be able to "see" the ceiling. Seats in a deep under-balcony area are usually the worst seats in the house, for just this reason. If balconies are part of a particular room design, the under surface of the balcony should always slope upward toward the main ceiling, with sufficient opening of under-balcony space so that the rearmost seats "see" a large part of the ceiling (*Figure 14*).

Since the invention of sound-absorptive materials, many churches and auditoriums have been constructed using these materials to cover the ceiling surface and, indeed, too many people still think that all they need for good acoustics in an auditorium is such treatment all over the ceiling. This use of absorptive material almost inevitably produces bad hearing conditions, since the room has been deprived of its most useful reflector. This is not to say that sound-absorptive materials do not have their very important place in the design of rooms for good-listening conditions. There are many surfaces in rooms where we need them for the control of undesirable reflections, such as rear walls, and we need them for reverberation control as we will discuss later; however we *never* cover useful reflecting surfaces with sound-absorptive materials.

sound-mixing and diffusion

An equally important function of the sound-reflective ceiling is to mix sounds coming from various parts of a large performing group—e.g., the congregation in a church or an orchestra or chorus on a stage. Whenever people attempt to perform together, it is essential that all members of the group hear each other. Without a good sound-reflective ceiling overhead, a listener just doesn't hear the other performers well, and it is most difficult to get a sense of the total performance. Few persons in a church, for example, like to participate in the congregational singing or prayers if they feel that all of the others are not doing the same thing. One does not like to be conspicuous! How often one sees an orchestra trying to give a concert in a conventional stagehouse, surrounded by velour draperies. Surrounding the performers with sound-absorptive materials is like painting a headlight reflector black, in the lighting analogy. It is virtually impossible for the performers to hear each other or to give any sort of co-ordinated performance; also, a great deal of useful projection of sound out to the audience is lost.

There are many refinements in the design of auditorium ceilings and the design of reflective enclosures for orchestras and smaller musical groups. The essential factor, however, is one of reflection, which adds loudness to the sound transmitted directly from the source. This additional loudness may be just as important for the performers themselves—in the case of musical groups—as it is for the audience.

We recall from an earlier part of this discussion that the reflectors, in order to be significant as directors of sound energy, must be large, compared with the wave lengths of the sounds they are reflecting. For this reason, reflective planes must be at least 3 ft or 4 ft in minimum dimensions, and usually are 10 ft to 20 ft in size. We also find it desirable to provide a certain amount of sound diffusion in the reflection. This is analogous to the reflection of light from a mat-finish surface as opposed to a glossy surface. Just as most people prefer diffuse light reflection, so, too, do most of us prefer diffuse acoustical reflection. Sound diffusion is desirable because sources may vary in their physical position in the room, and receivers are seated in all parts of the space. We want to produce a condition in which as much sound energy as possible is directed from all source positions to all listening positions, and we do this by diffusion or by introducing large-scale irregularities in our reflective surfaces. These irregularities, to be effective, must be 3 ft or 4 ft across and 6 in. or more deep and must occur over a good part of the useful reflecting area. We must always remember that the wave lengths of sounds we are dealing with are relatively large. Small-scale breakup will only affect the very high frequencies and will not provide the kind of sound diffusion we need.

Essentially then, the design for good distribution and adequate loudness in a room leads us toward surfaces which are hard and sound reflective; which direct the sound from source to receiver; and which, in addition, do this with a moderate

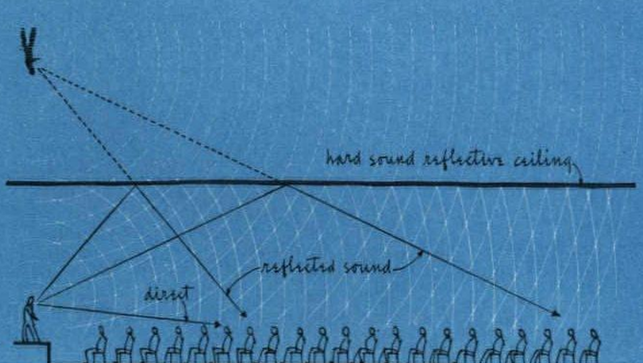


Figure 13—Distribution of sound in an auditorium with a hard, reflective ceiling. The reduced level of direct sound heard by rearmost listeners is compensated for by sound reflected from the ceiling area.

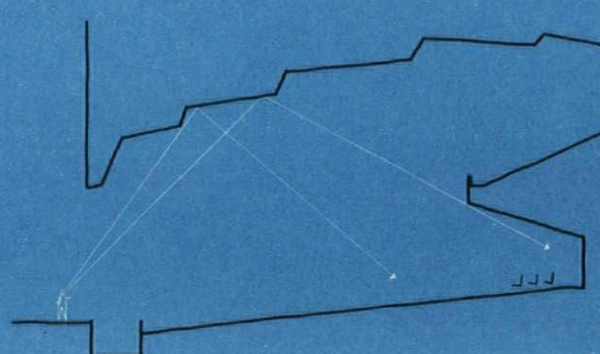


Figure 14—Listeners in an under-balcony area of any auditorium should be able to "see" a large part of the main auditorium ceiling, if they are to hear sound as well as other listeners in the auditorium. Deep, re-entrant under-balcony spaces never *allow good listening conditions.*

degree of diffusion, to increase the uniformity of the energy distribution over the entire audience. Diffusion represents a refinement in the design which is often not essential but always highly desirable. It is especially important in the overhead reflector for an orchestra. Diffusion can often be achieved with the basic structural means at hand; e.g., coffers, beams, folded plates, and the like. The First Presbyterian Church of Stamford and the Air Force Academy Chapel (*see Case Histories*, **PART ONE** *and* **PART TWO**) are excellent examples of effective sound diffusion.

undesirable reflections

Some kinds of sound reflection are undesirable in listening spaces. Generally speaking, distinctly audible echoes will occur when a listener hears reflected sound energy at sufficient intensity, 1/17th of a second or more after he hears the direct sound (or a difference in the length of path between the direct and reflected sound of greater than 65 ft.) We usually get these delayed reflections from rear walls. They are controlled by tilting the rear-wall surface downward to ground the reflection nearby, by treatment with sound-absorptive materials, or sometimes by both surface breakup and absorption. Most often in churches we want to minimize the use of sound-absorptive materials to preserve the proper environment for music, and a great deal of large-scale breakup is in the direction of the solution.

Another basic kind of undesirable reflection is focused reflection that we get from large, curved, interior surfaces such as domes, barrel vaults, conical shapes, and the like. Focusing surfaces do not, of course, satisfy our requirements for uniform distribution. Curved rear walls in auditoriums are particularly troublesome because the focused sound energy is a delayed sound reflection as well—therefore, a more potent echo. The only real solution is to avoid these shapes, but, since domes and vaults are such useful structural and esthetic forms, they will no doubt continue to be chosen by architects to enclose auditoriums and churches. However, the designer must be aware of the sound-distribution problems involved when he selects these forms, and the truly satisfactory acoustical solution can only be found in the design stage. The Aula Magna in Caracas and the Kresge Auditorium at MIT (*see Case Histories*, **PART FOUR**) show one approach to solving the curved-geometry problem, by hanging in useful reflecting surfaces. The MIT Chapel (*also Case History*, **PART FOUR**) is another approach, where large-scale modulation of the cylindrical form itself eliminated the focusing problem. Still another approach is to provide a visually curved, but acoustically transparent, surface behind which the desired acoustical shaping can be accomplished. An example of the latter is the side-wall treatment of the Berlin Congress Hall (*see Case History*, **PART TWO**).

sound amplification

When all the measures for assuring loudness of the desired sounds by natural reinforcement from the enclosing surfaces of a space prove inadequate, electronic sound amplification must be utilized. Churches and auditoriums seating fewer than about 600 persons should never require a loudspeaker system—assuming the speakers and the singers use their natural vocal power, and that the other interrelated aspects of the acoustical design have been properly handled. On the other hand, a sound-amplification system is perhaps always required in spaces seating more than 1000 persons, since many of the speakers who will use the space will not be trained orators. Large arenas and coliseums, where the enclosing surfaces are too distant to provide useful reinforcement of live sound, are perhaps the extreme cases and require complete amplification for all activities.

In any case, a good sound-amplification system is always a supplement to acoustics of the space; not a substitute. The over-all system, including the loudspeakers, the microphones, and all the intermediate-control components, must be carefully chosen and integrated with the acoustical design. A satisfactorily integrated sound system involves not only high-quality components, but also proper placement of the components within the space, proper tailoring or adjustment of the system to fit the particular acoustical environment, and proper adjustment by the person who controls the system during its operation.

A single source of amplified sound from loudspeakers located above and slightly forward of the source of the live sound, gives the most realistic results (i.e., the amplified and natural sound apparently coming from the same source). Ideally, the listener should not be aware that the sound system is in operation. In extremely long, low-ceilinged spaces, or those having seating arrangement in which it would be impossible to get adequate coverage from a single loudspeaker source, we often have to resort to a so-called "distributed" loudspeaker system. This type of system employs many loudspeakers throughout the ceiling area, with each loudspeaker projecting amplified sound at very low levels and over limited distances. The latter approach is often required, too, in highly reverberant churches that have been designed primarily for the performance of liturgical music. Whatever the type of sound-amplification system required for the particular room design, the selection and placement of components must be completely integrated with the particular acoustical environment, and this can be done really well only in the design stage. Many architects have returned to an auditorium or church a year or so after it has been in use to find "juke-box"-like loudspeaker enclosures projecting from surfaces all around the room, and with far from satisfactory results in solving the sound-amplification requirements. Proper integration of these elements is definitely a part of the acoustical design.

reverberation control

Of equal importance to having the listening area quiet, plus having sounds uniformly distributed and loud enough, is the blending of one sound with the next to give a full quality without excessive muddling. Over the years, experienced listeners have observed a large number of auditoriums and have correlated their likes and dislikes with physical measurements of reverberation time. The reverberation time in a room is arbitrarily defined as the time required for the sound to decrease to one millionth of its original intensity (or by 60 db) after the source has stopped. In general, we need a relatively long reverberation time for sufficient blending of musical sounds, but a shorter one for the proper understanding of speech.

The reverberation or persistence of sound is determined almost entirely by the volume, nature of the surface finishes, and the occupancy. If the room is finished entirely in hard, sound-reflective materials, the sound will persist for a long time, whereas if it is finished (or furnished) with great quantities of porous materials, the sounds will very quickly be absorbed and energy will be dissipated. The equations, enabling the designer to predict the reverberation time of a space, as well as suggested optimum values for speech and music uses, are available in textbooks and will not be discussed here in detail. The optimum reverberation time for an auditorium designed primarily for speech might be perhaps 1.2 to 1.5 sec at mid-frequencies, while, if the room is intended principally as a concert hall, its reverberation time might be 1.8 to 2.0 sec. A church where liturgical music is extremely important might be designed to have a mid-frequency reverberation time of as much as 2.0 to 2.5 sec. The choice of a specific reverberation time is not a matter to be taken lightly, and careful consideration must be given to exactly how the space will be used. If, as is so often the case, a multipurpose room is to be provided, some sensible compromise must be reached.

While the actual calculation of reverberation time is a more or less routine matter in acoustical engineering today, even here new things are constantly being discovered. We find, for example, that in many of the older concert halls a relatively high reverberation time was often achieved by packing the audience quite close together. In our modern halls we seem to like more luxurious seating with wider spaces between rows and between seats, and the result is that we cannot achieve as high reverberation time simply because the audience becomes a more efficient sound absorber when it is spread out over a greater area. If we increase the reverberation time by increasing the volume too much, the sound loses its "punch" by being required to fill too much space. The important thing for the designer to realize is that good-hearing conditions do not necessarily mean an elaborate or complicated scheme of interior treatment for reverberation control; but rather the application of the basic idea of control of reflection by ceiling surfaces and control of reverberation by the sensible use of sound-absorptive and sound-reflective materials. The achievement of good-hearing conditions in the average high-school auditorium, or in any listening space today, should not be the exception—it should be the rule!

planning for optimum acoustical environment

We have already pointed out that architectural acoustics is not just concerned with the provision of good-hearing conditions. The other basic objective, and perhaps the one that interests us most in the greatest number of spaces we design in buildings, is the provision of a satisfactory acoustical environment. A knowledge of the basic facts of life about acoustics will tell us how to go about achieving it, but, first of all, we must understand just what is satisfactory acoustical environment.

Simply stated, a satisfactory acoustical environment is one in which the character and magnitude of all the sound are compatible with the satisfactory use of the space for its intended purpose. Unfortunately, this statement of objective is not so easily put into simple concrete numbers that the architect can work toward. Just as the architect cannot say that 70 F is the ideal temperature for all of the spaces in the building, or that 100 ft-c is the ideal light intensity, so one cannot simply say that the maximum noise level shall be 30 db. Because we are dealing with human beings whose adaptability to measurable quantities of the basic physical phenomena of heat, light, and sound vary over wide limits, the selection of optimum numbers is a rather involved business. The human ear, for example, can detect the gentle rustle of leaves (less than 10 db intensity) and yet survive without permanent hearing damage a powerful jet-engine roar (120 db—a million, million times as intense). In addition to the magnitude or intensity of sound, we are concerned with frequency characteristics (pitch) as well as its dynamic characteristics (variance with respect to time), when we set out to determine the optimum noise environment.

Much groundwork has been laid by acoustical researchers and psychologists which enables us to understand how much and what kind of noise will affect speech communication, annoyance, and fatigue. A great deal has been done, too, in the problem of hearing damage due to high-noise levels, although, fortunately, in most of our buildings we don't have to worry about this problem. The researcher's investigations are far from complete, particularly in terms of annoyance and fatigue effects of noise, but we do have a good basis for specifying acceptable noise environments in many of the kinds of spaces we must design in our buildings.

beware of single numbers

Single numbers, as read on a simple temperature thermometer, would be useful if we were interested only in the total quantity of sound energy in an acoustical environment. But single numbers give us no idea of the frequency makeup of the sound. Our ears are more tolerant to low-frequency sound energy than to high-frequencies, both from the point of view of annoyance and our ability to understand speech sounds. Therefore, a thermometer of acoustical energy that reads 50 db without also telling us the frequency characteristics of the sound, may mean an intolerable acoustical environment or a completely acceptable and pleasant one.

Simple sound-measuring devices are available whose frequency response characteristics are adjusted to look at certain ranges of frequency as, for example, A-scale readings on a standard sound-level meter. Many textbooks on architectural acoustics give lists of acceptable levels of sound for various spaces in terms of A-scale ratings, and these simply mean that the low-frequency end of the spectrum has been ignored. While single number A-scale readings may, perhaps, more closely approximate how our ears respond to various sound levels, they still do not give the detailed information about the mid- and upper-frequency characteristics of the sound that we often need in specifying an acoustical environment.

noise-criteria curves

One very useful method of specifying continuous-background-noise levels, which gets away from the limitations of single numbers, consists of the so-called "noise-criterion curves." This method simply provides a method of rank-ordering various levels of noise in terms of specified sound-pressure levels in eight-octave bands of frequency. Octave bands are a convenient method of dividing the audible frequency range into eight sections for measurement purposes as shown (*Figure 15*). The NC numbers are the arithmetic average of the sound pressure levels in the 600-1200 cps, 1200-2400 cps, and 2400-

4800 cps bands. So actually we could have NC's other than those shown on the figure. For example, NC 22 or NC 48, etc.

Also shown (*Figure 15*) is the subjective evaluation that a listener might give to an acoustical environment that has octave-band sound levels which approximate these curves. Below NC 25, for example, most people would judge a space as "very quiet," above NC 55 "very noisy," and with ranges of "quiet," "moderately noisy," and "noisy" in between. In terms of speech communication, NC 30 would permit understanding of speech at normal voice levels at distances up to about 20 ft; NC 40 levels would require a raised voice to be understood at 20 ft, but would only permit normal voice communication at distances up to about six ft. NC 50 would require a raised voice to be understood at less than six ft between speaker and listener. Even higher NC's than 50 would be permissible in factory environment where speech communication and annoyance are not too important; however, if the continuous-noise levels exceed NC 80, we begin to get into the range where we have to worry about hearing damage.

Some recommended noise-criteria curves for various types of occupancy are indicated (*Table I*). Just as we might expect, most listening spaces require low NC's; the noisier kinds of spaces, like business offices and factories where speech communication is restricted to short distances, permit higher NC curves. For comparative purposes equivalent single-number, A-scale sound-level meter readings are shown. These numbers are not nearly as meaningful, in terms of specifying a noise environment, since they do not accurately define the shape of the noise spectrum with respect to frequency, which is required in many instances.

It should be emphasized that often we are interested in more than just the maximum permissible levels. If we need a certain amount of "acoustical perfume" to assure adequate acoustical privacy between spaces, our NC curve may well specify the bottom limit of the background noise spectrum as well. For example, in a small private office the occupants may not object to the noise, if the levels do not exceed NC 40. So, we design quieting measures for our ventilation system on that basis. But, in order to meet the design goal at some frequencies, we may find that we provide levels which are well below NC 40 in a large part of the frequency range. In such an instance, there would not be sufficient noise to mask the sound coming through the lightweight movable wall construction from the adjacent office. In other words, while we very often do not want too much noise, we may at the same time not want too little noise. In an auditorium, on the other hand, where we don't need any "acoustical perfume," we would not mind getting things quieter than our design goal—except that it doesn't make much sense in trying too hard to exceed the design goal, since more noise control usually costs more money.

The most recent editions of *Guide of the American Society of Heating and Air-Conditioning Engineers* describe methods for calculating noise levels due to air-moving equipment to meet NC criteria as discussed above. Many manufacturers of fans, air diffusers, and related equipment now rate the noise-producing output of their products in terms of octave-band data. Most acoustical-materials manufacturers, as well, have available acoustical-performance data on their products, in terms of frequency. Today, the architect is in an excellent position to specify an acoustical environment and then select the proper materials and equipment to meet that environment in meaningful terms. As the field of acoustical-engineering advances, and we learn more about the influence of noise on workers' efficiency, on sleep, on speech communication, and on just plain annoyance, the form of criterion curves may change somewhat. But it is clear that single-number descriptions of an acoustical environment, that ignore frequency characteristics of the sound, are woefully inadequate.

TABLE I: Recommended Noise Criteria for Rooms

Type of Space	Recommended Noise Criterion Curve	Computed Equivalent Sound-Level Meter Readings (A scale readings in db)
Broadcast Studios	NC 15-25	25-35
Concert Halls	NC 20	30
Legitimate Theaters (no amplification)	NC 20-25	30-35
Music Rooms	NC 25	35
School Rooms	NC 25	35
Large Conference + Board Rooms (for about 50 or more people)	NC 25	35
Apartments and Hotels	NC 25-35	35-45
Assembly Halls (with amplification)	NC 25-30	35-40
Homes (sleeping areas)	NC 25-35	35-45
Conference Room (for 20 or less)	NC 30	40
Motion Picture Theaters	NC 30	40
Churches	NC 30	40
Courtrooms	NC 30	40
Libraries	NC 30-40	40-50
Hospitals	NC 30-40	40-50
Small Private Offices	NC 30-40	40-50
Restaurants, Stores	NC 40-50	50-60
Sports Coliseums (amplification)	NC 50	60
General Offices (typing and business machines)	NC 40-50	50-60
Factories	NC 40-65	50-75

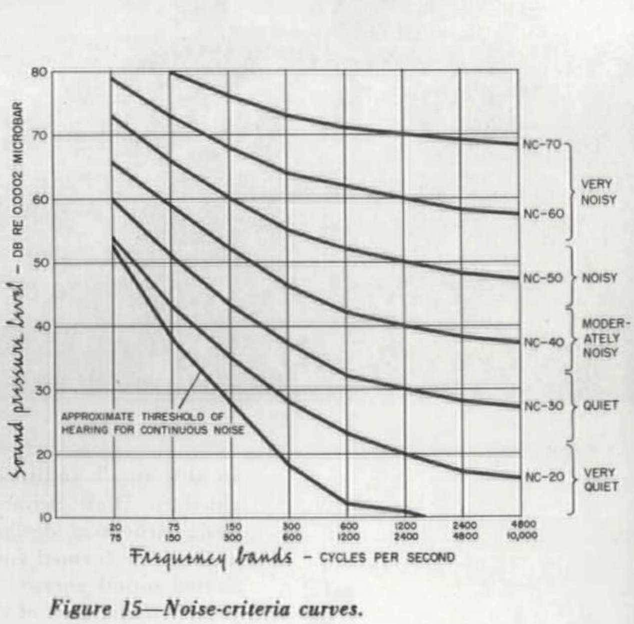
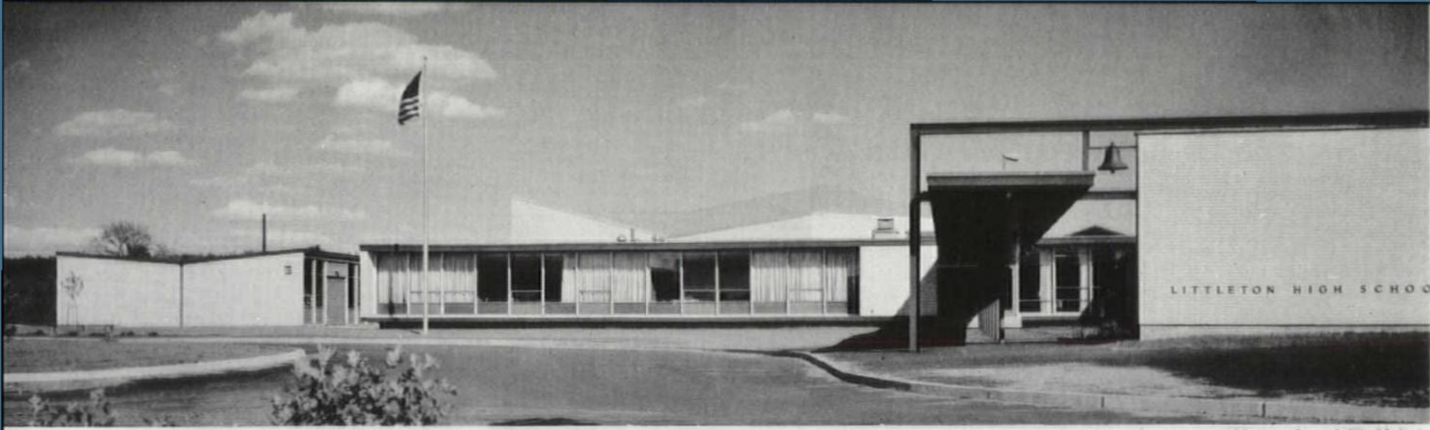


Figure 15—Noise-criteria curves.

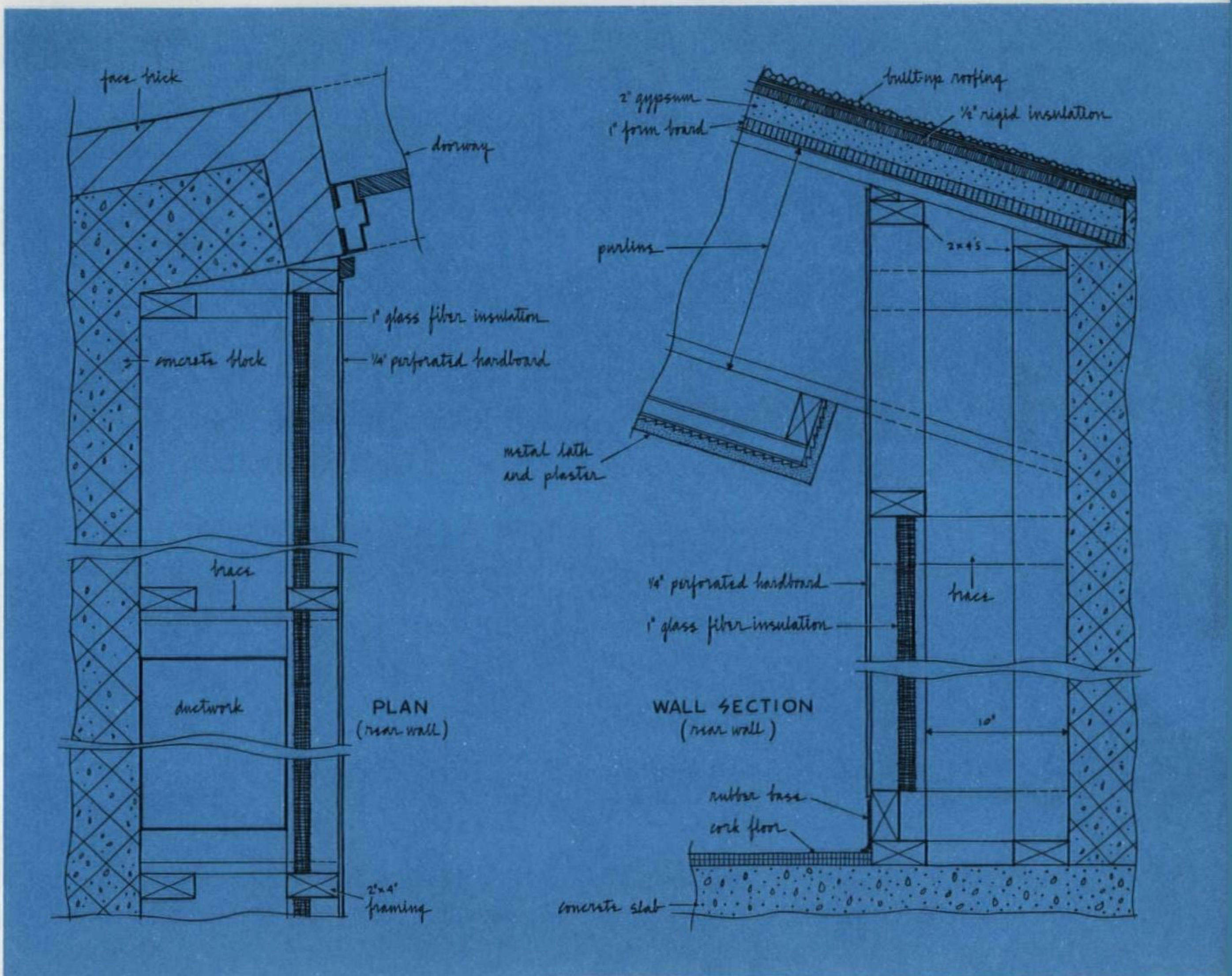
case histories: *Design for Optimum Hearing*

1

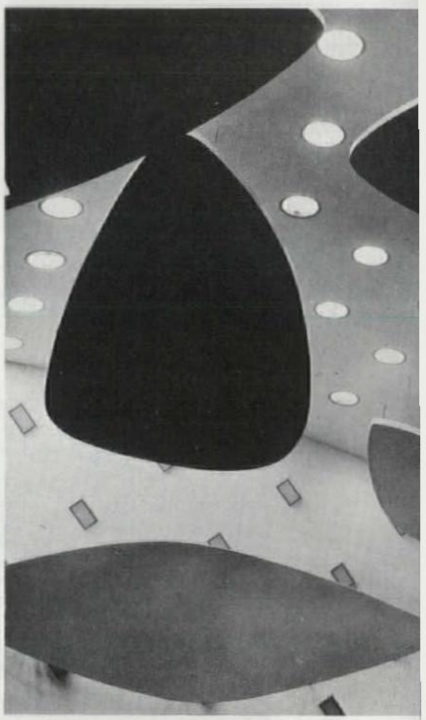
In this small auditorium for Littleton, Massachusetts, High School, the architect chose a basic structural design which would result in an interior formed for good distribution of reflected sound energy. Four large plaster panels cover a major part of the auditorium ceiling and are suspended directly below the 1-in. sound-absorptive formboard-and-gypsum roof construction. At both sides of the room, the suspended plaster panels stop short of the side walls to expose a limited area of sound-absorptive roof deck for reverberation control. The entire rear wall area exposed to the room is finished with a sound-absorptive blanket between wood-framing members faced with perforated hardboard. This treatment serves both to control rear wall echo and to provide the balance of the sound absorption required to control reverberation. Speech amplification is rarely required in a small room of this sort in which the interior surfaces are designed to provide maximum natural reinforcement of the speaker's voice, and where sufficient sound-absorptive materials to control echo and rever-

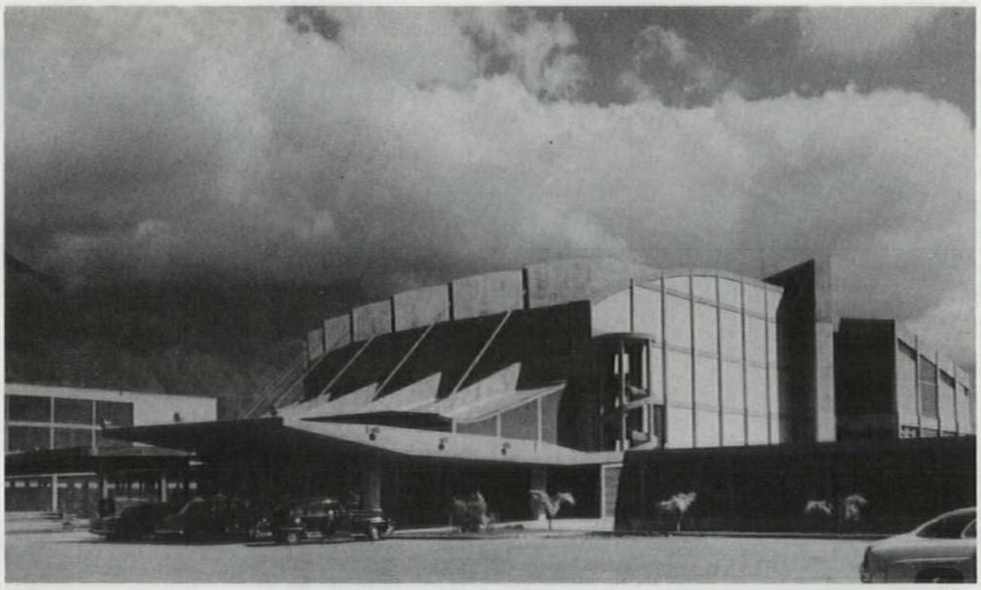


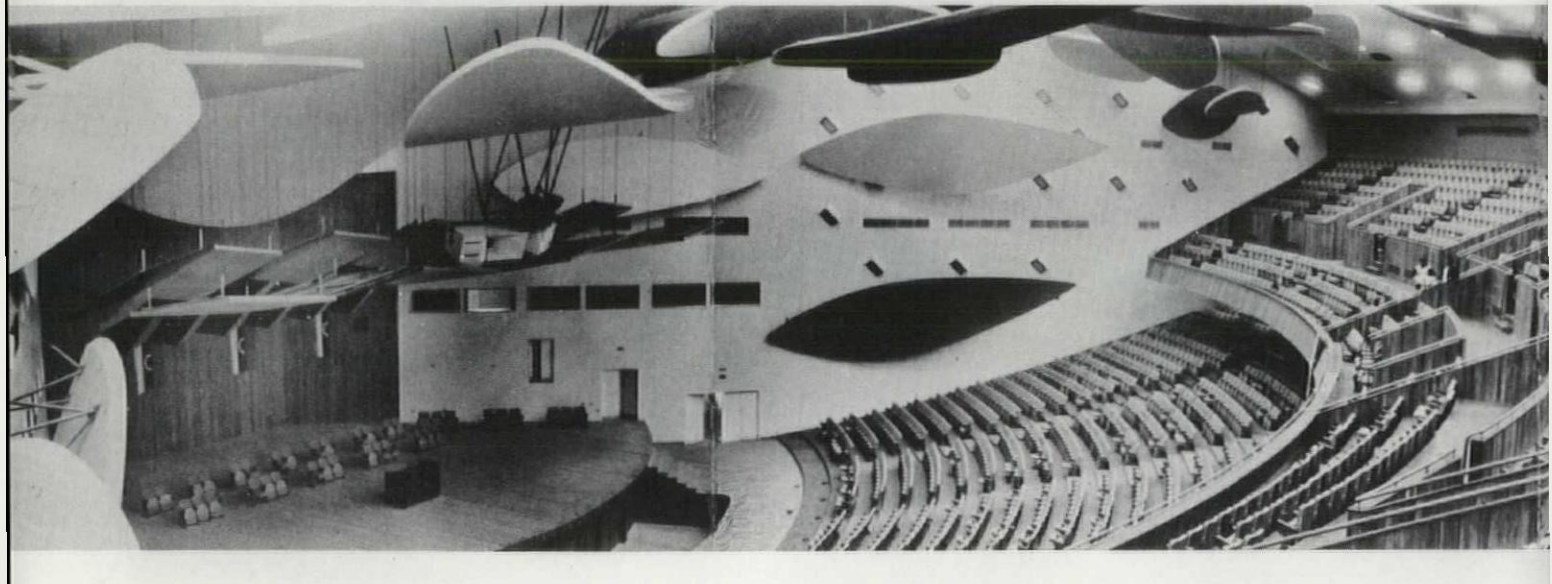
Photos: Joseph W. Molitor



beration have been incorporated. Even in a small auditorium the first requirement for good listening conditions is a reduced background-noise level. The architect gave special consideration to the control of noise from the ventilation system as well as from adjacent simultaneously used music spaces. A remote location for the mechanical equipment permitted relatively long duct runs which are adequately lined with sound-absorptive material. A special sound-isolating door was provided at the stage egress.
The Architects Collaborative, Architects.

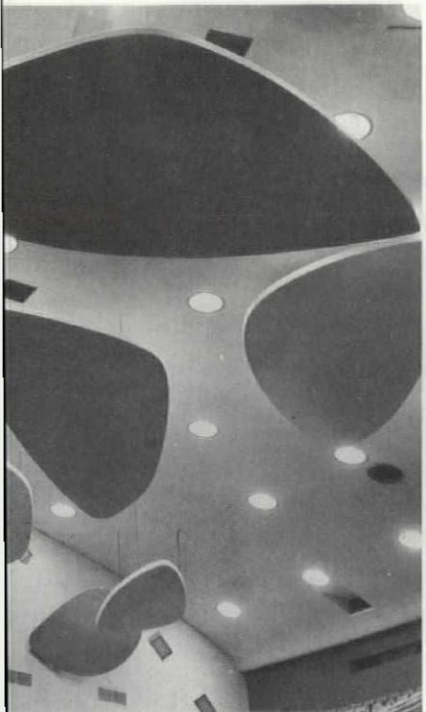


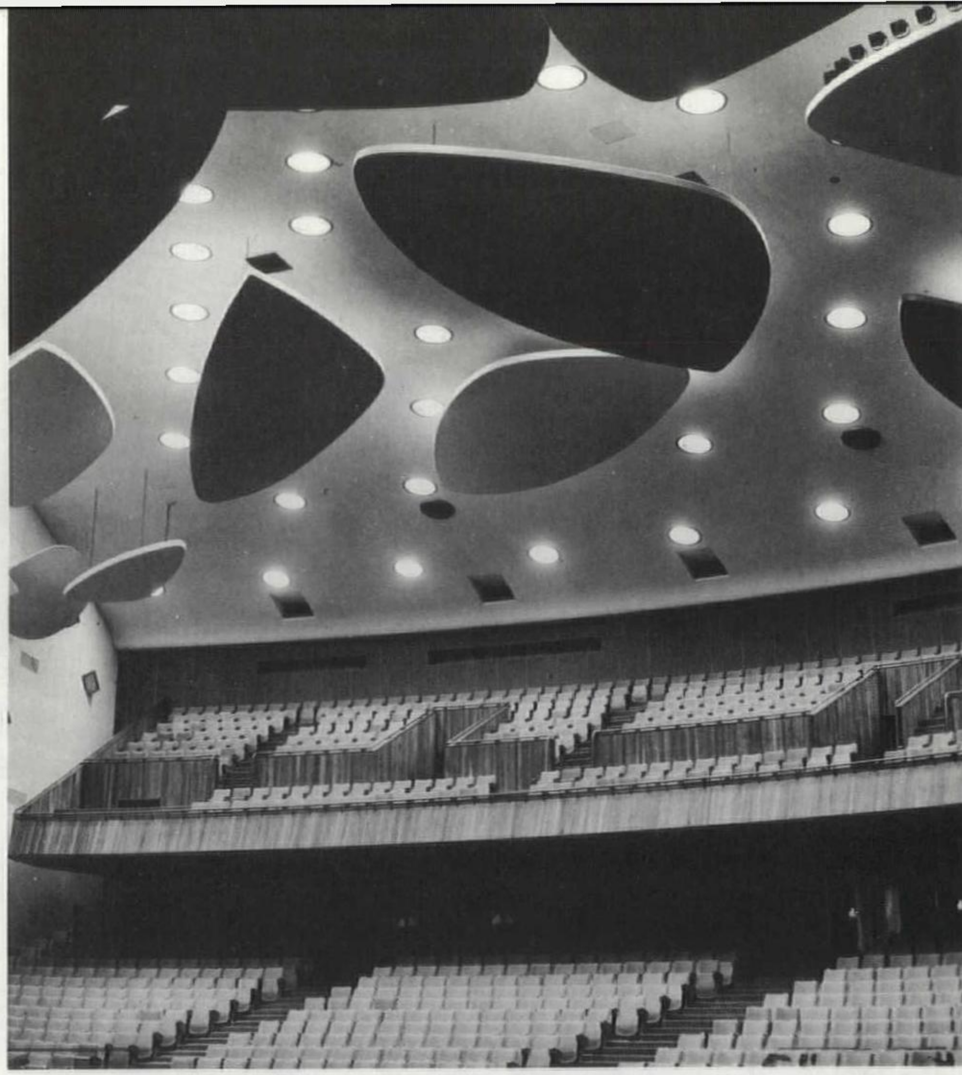


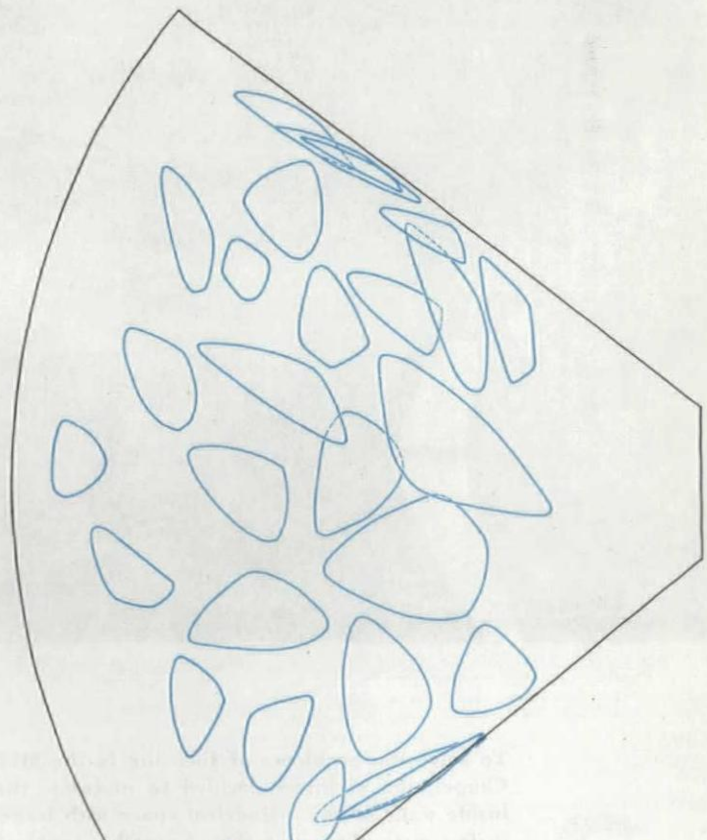


2

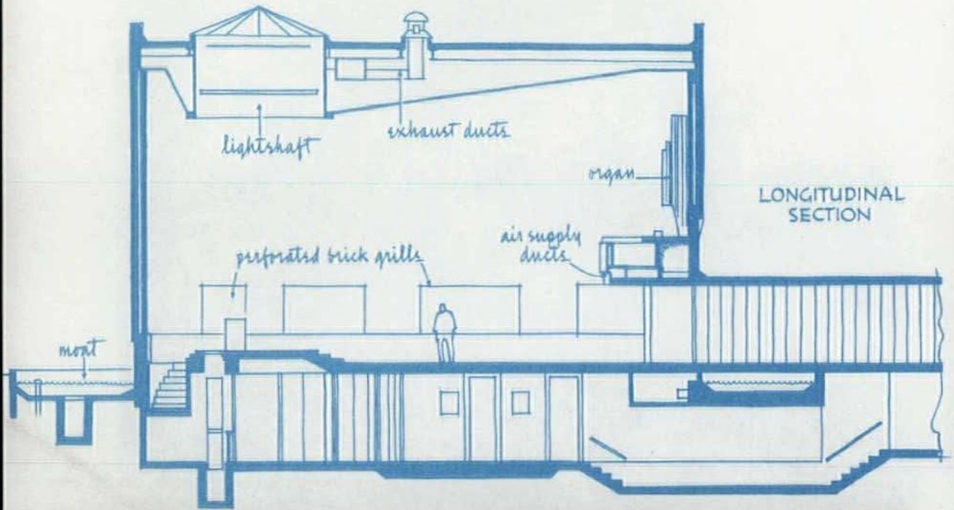
The vaulted-ceiling construction and the large area of curved rear wall of the Aula Magna at University City, Caracas, Venezuela, presented some particularly difficult sound-distribution problems. Large-scale reflecting surfaces were introduced to obscure a large part of the vaulted ceiling and to provide uniform distribution of reflected sound throughout the seating area. These were developed in close collaboration between the architect, the acoustical consultant, and Alexander Calder, the sculptor. Of particular interest is the scale of reflecting objects required to perform this function of proper sound distribution. The upper-rear wall required extremely deep and carefully detailed sound-absorptive treatment to eliminate the problem of focused echoes. Since a large portion of the wall area consisted of doors, double doors were provided; the interior doors were perforated on both sides and filled with sound-absorptive material. The balcony rail was also finished with efficient sound-absorptive material for echo

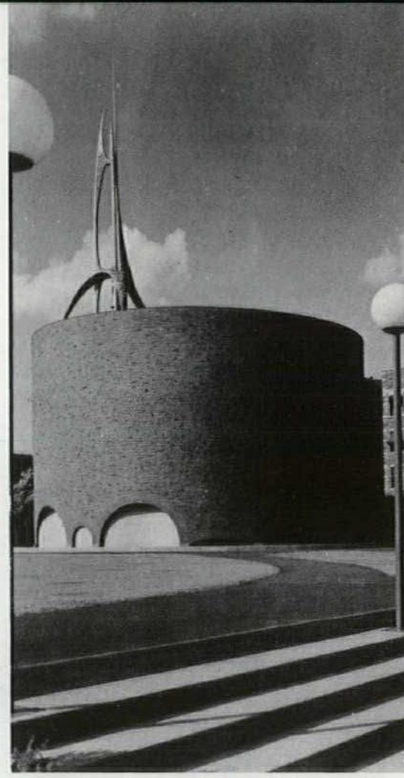


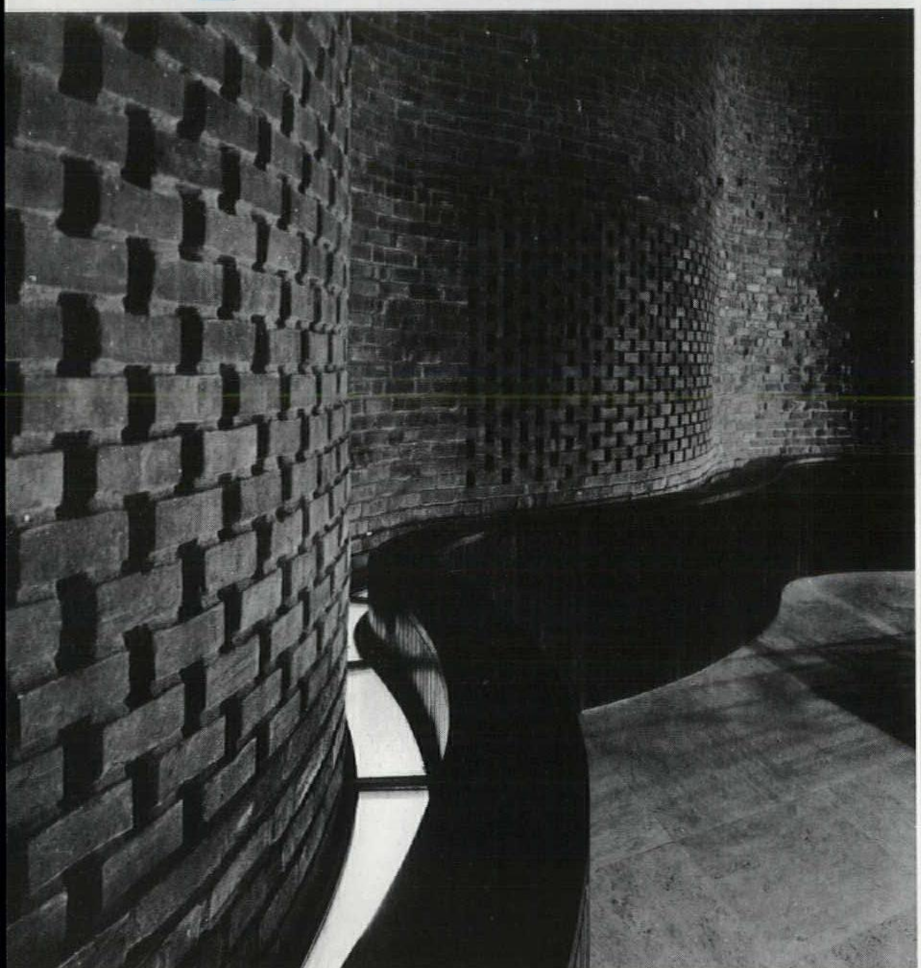


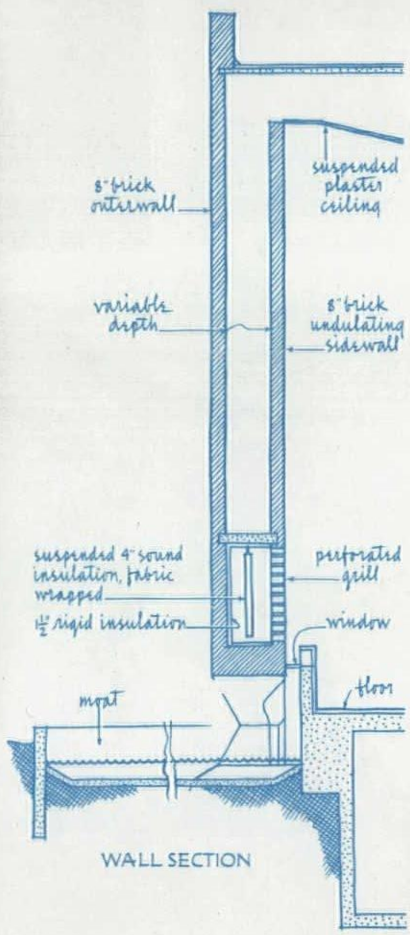


control. This large auditorium is widely used for both speaking and music. Live speech requires amplification which is provided by a central cluster of low- and high-frequency units in the ceiling just forward of the stage enclosure. The highly diffuse stage canopy not only projects stage-emanated sound to the audience, but also performs an important function of mixing and blending of musical sound when the hall is used by orchestras and choruses. Dr. Carlos R. Villanueva, Architect.









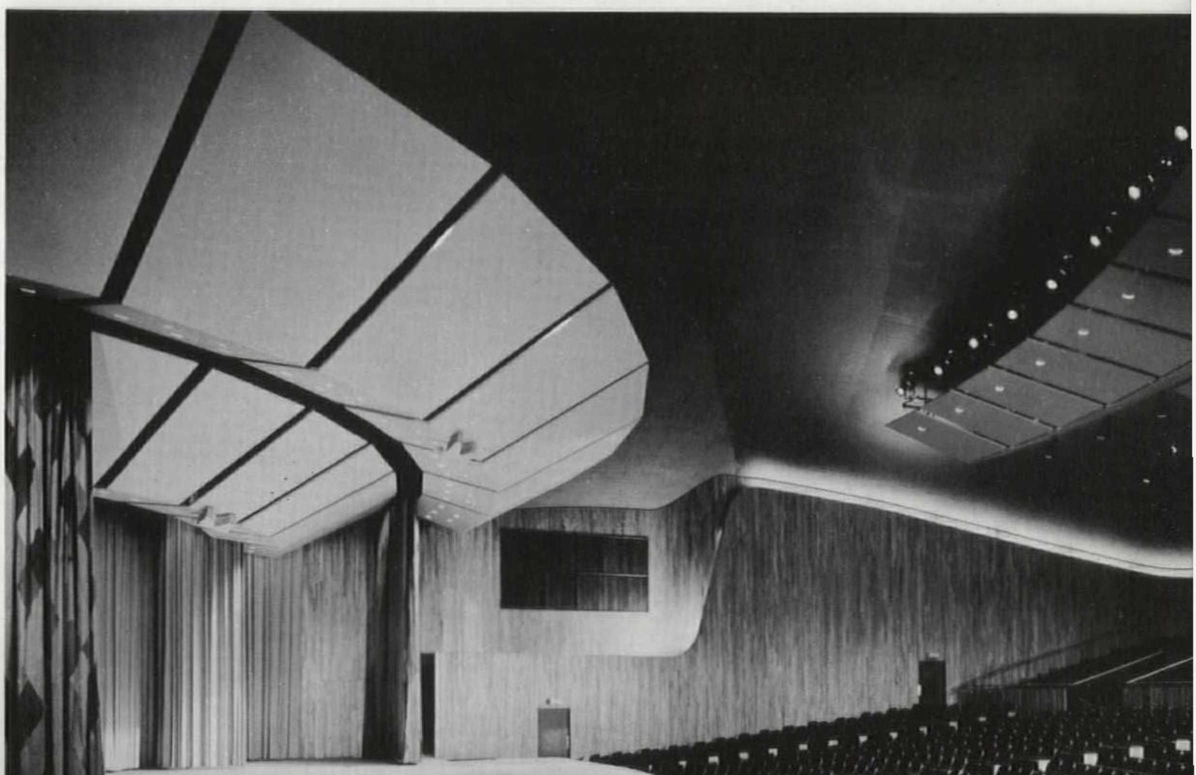
3

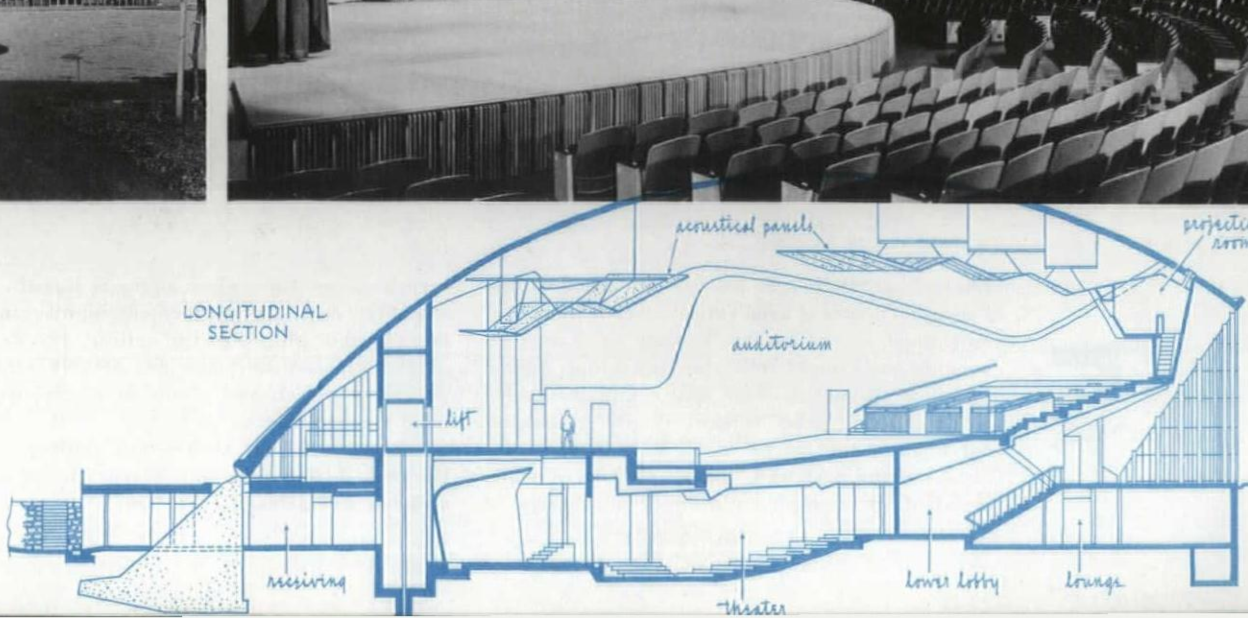
To solve the problems of focusing in the MIT Chapel, the architect decided to undulate the inside walls of the cylindrical space with large-scale curves of varying size. A small amount of sound-absorptive material for reverberation control is introduced behind brick grills in the side walls, and the hard-plaster ceiling is an eccentric conical surface descending from the sides of the room to the skylight opening. Although the reverberation time for such a small space is reasonably high (approximately 1.75 seconds at 500 cps), hearing is excellent for both speech and music. A small 12-stop exposed pipe organ in this chapel has won an excellent reputation among performers of liturgical music.
Eero Saarinen & Associates, Architects.

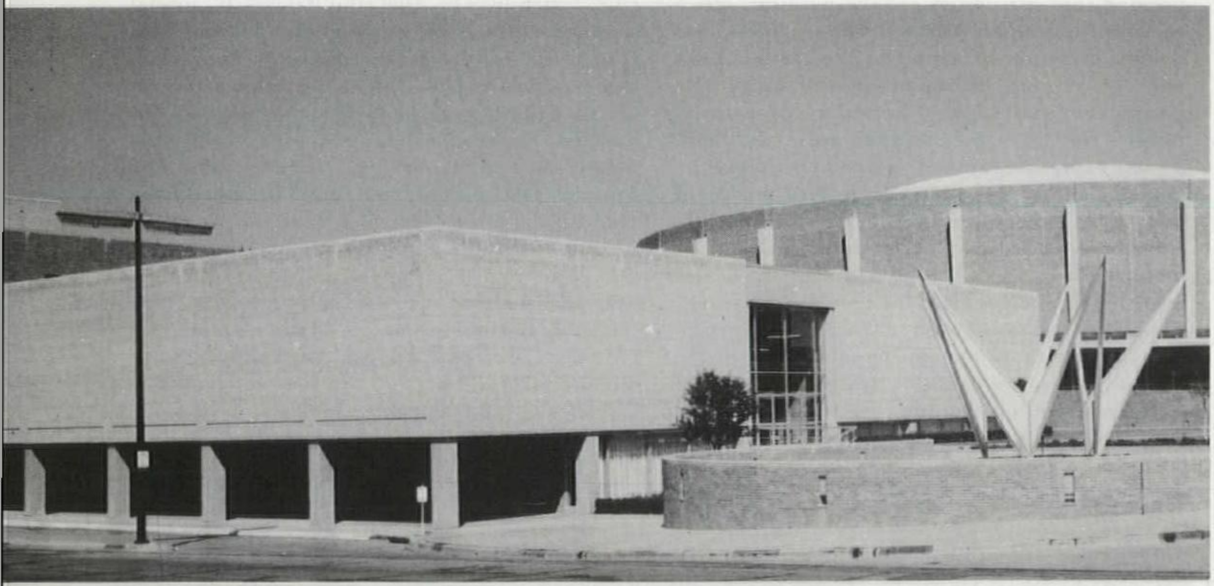
4

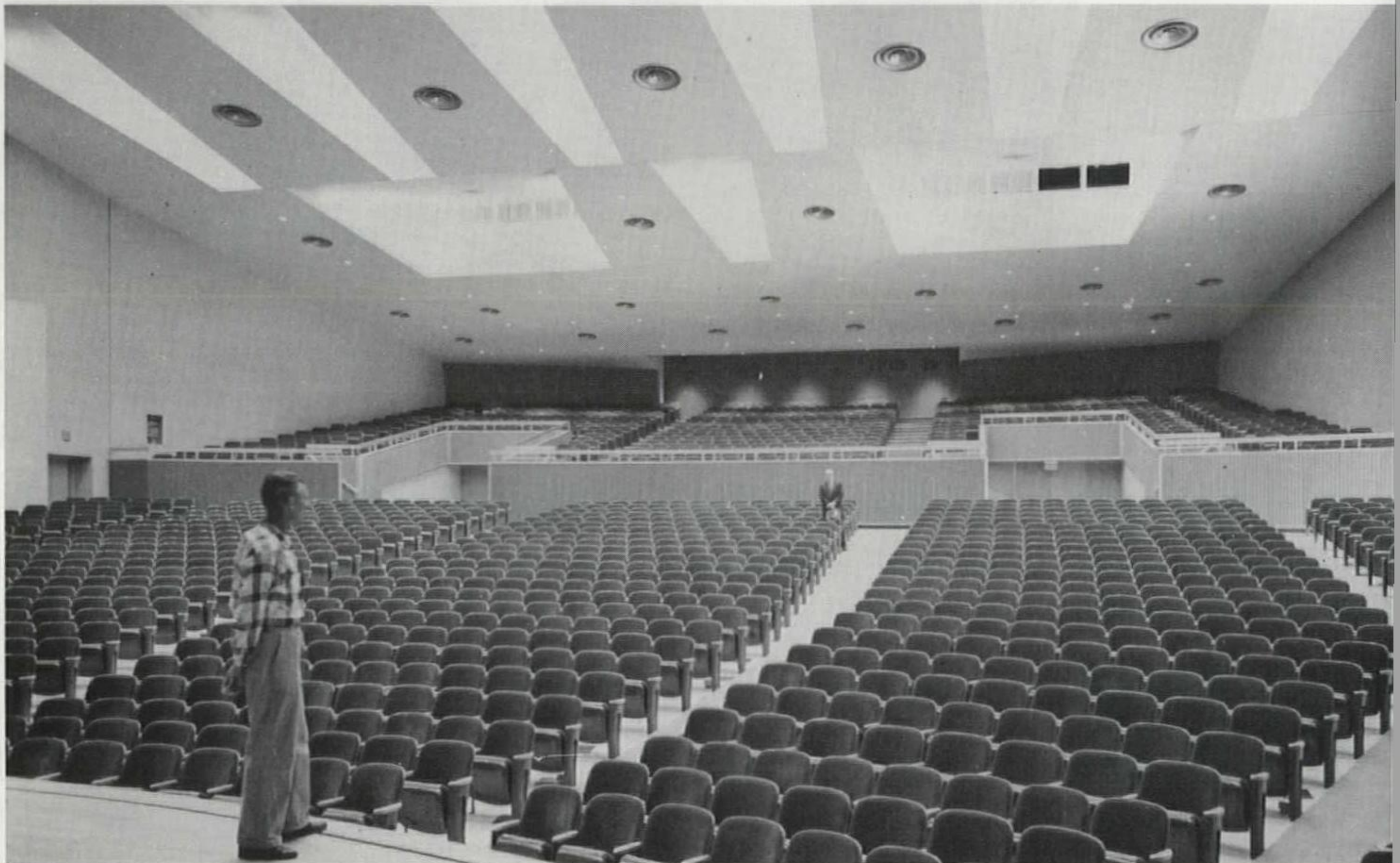
For the structure of the MIT Kresge Auditorium, the architect chose a segment of a dome. Incorporated into his design are the necessary "correctives," hung-plaster reflecting panels, for proper direction of sound to the seating areas and for mixing of sound on the stage. The panels are located only where they are actually needed for the reflective control of sound. Visually they obscure only a small portion of the domed surface. Since the rear wall of this room is curved, it required treatment with a highly efficient sound-absorptive material. Glass-fiber blankets were used, behind a wood-strip screen over plastic cloth. This is the only special sound-absorptive treatment used in the room. The audience and the fabric-upholstered chairs provide the remaining sound-absorptive surfaces needed for reverberation control. Suitable measures were incorporated in the air-handling system to control noise from that source. In addition, since there is a small theater below the auditorium which may be used simultaneously, special sound-isolating floor construction was employed. It consists of the basic structural floor slab, below which a 1-in. thick, continuous, dense-plastic ceiling is suspended on resilient-rubber hangers. The actual finished ceiling in the little theater is hung below this construction. The finished ceiling could not provide appreciable sound isolation because of perforation required for lighting and air-conditioning ducts. Though the large 1238-seat auditorium was designed primarily for voice projection, it is also used for such musical events as organ recitals and symphony concerts. The smaller space beneath the auditorium seats 200 and was intended for theatrical performances.
Eero Saarinen & Associates, Architects.

Photos: Joseph W. Molitor





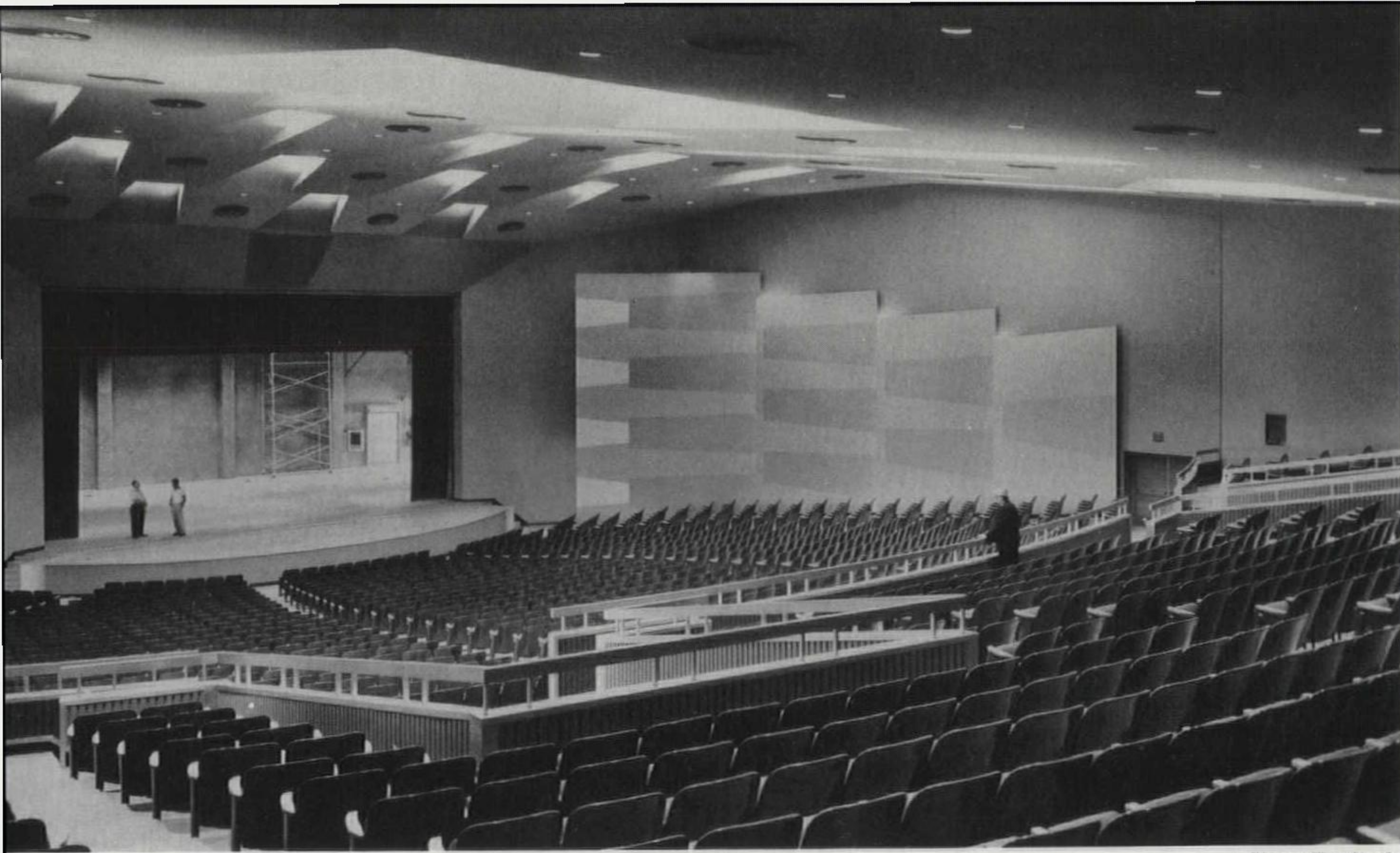




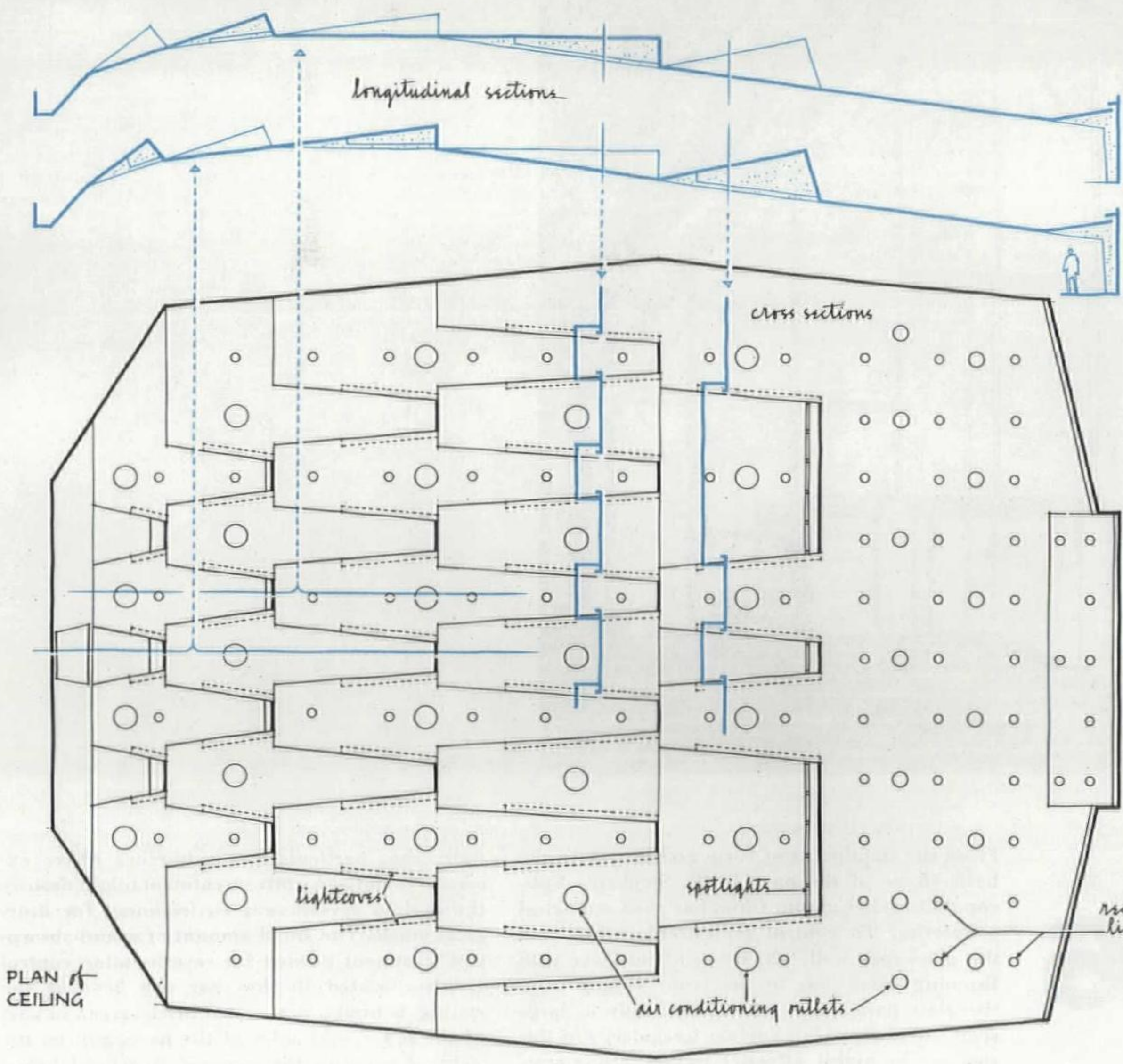
5

Located at Dallas Memorial Auditorium, the Lyceum Theater is used for all sorts of theatrical and musical events. Its ceiling is shaped to provide good sound reflection and a high degree of sound diffusion. Rear wall sound-absorptive treatment for echo control is placed behind corrugated, perforated metal at both the cross aisle and the rear wall. Fully upholstered seats, installed throughout, minimize the change in reverberation time when there is less than full capacity. A centrally located sound-reinforcement system placed in the ceiling, just forward of the proscenium, provides amplification for both live speech and recorded material that is used for programs.

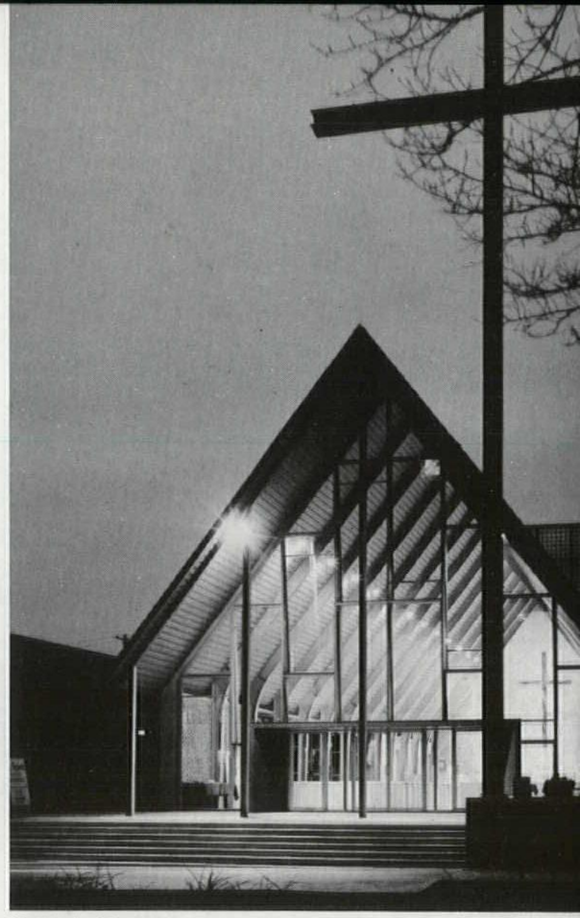
George L. Dahl, Architects-Engineers; Bolt, Beranek & Newman and Wayne Rudmose, Associated Acoustical Consultants.



Photos: Wm. Langley



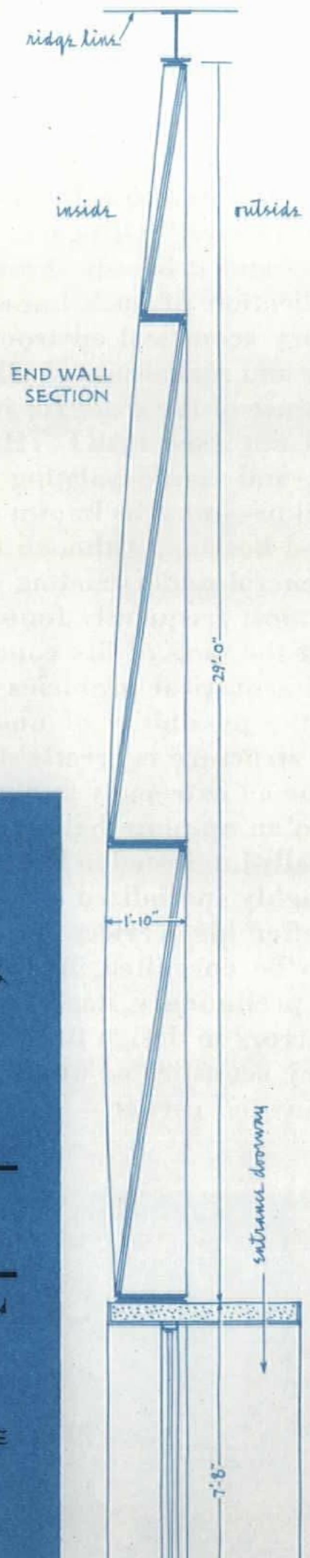
case histories: design for optimum hearing

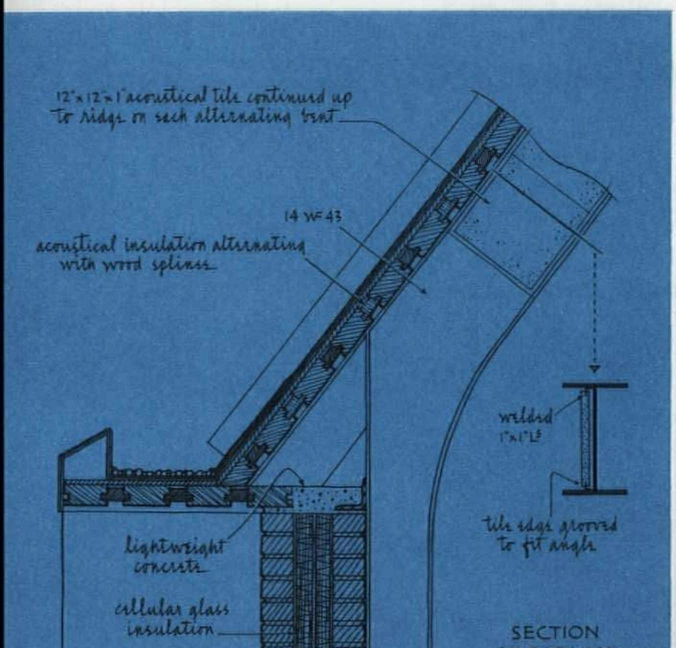


Photos: Joe Munroe

6

From the standpoint of form and materials, the basic shape of the nave in St. Stephen's Episcopal Church, Canton, Ohio, has good acoustical properties. To control undesirable echo from the glass rear wall, which would interfere with listening conditions in the front seating area, the glass panels are splayed vertically in large segments. Large-scale surface irregularity of this sort can be highly effective in controlling rear-wall echo, particularly in churches where excessive sound-absorptive treatment might destroy the desired reverberant environment for liturgical music. The small amount of sound-absorptive treatment needed for reverberation control is incorporated in the rear two bays of the ceiling, behind a perforated brick screen in part of the lower west sides of the nave, and on the webs of some of the exposed structural bents.





The sanctuary surfaces are as acoustically reflective as possible, since all of the speaking positions and the choir and organ are located there. Likewise, the main ceiling of the nave, with the exception of the rear two bays, is hard and sound reflective to achieve optimum distribution of reflected sound and good natural reinforcement of speech and music.
Brooks & Coddington, Architects.

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CONCLUSION

One trite remark sure to disturb an acoustical consultant is: "...this material has acoustical properties." Of course it has! All materials have acoustical properties and it is only through knowledge of these and intelligent application of such knowledge that designers can produce a satisfactory acoustical environment—defined as one in which the character and magnitude of all the sound are compatible with the satisfactory use of the space for its intended purpose. As Newman has pointed out (*see* PART THREE), the sound-absorptive, sound-reflective, and sound-isolating properties of materials—alone or in combination—must be known and understood to accomplish design for good hearing. Although the science of acoustics is a complex one, a general understanding of the subject—as it is related to problems most frequently found in architecture—is not difficult to reach. If the facts of life concerning the nature of sound and the types of acoustical problems illustrated in this issue are borne in mind, the possibility of unsatisfactory acoustics resulting in a completed structure is greatly diminished. Today's acoustical consultant can be an extremely important member of the design team. Contrary to an opinion that may be widely held, such a consultant is not generally interested in being consulted only on large design projects or highly specialized structures. The acoustical consultant will gladly offer his services for both large and small projects. He prefers to be consulted, however, at the beginning of a design during its preliminary stages, rather than being brought in later to remedy errors in design that, in any case, would *never* provide as satisfactory acoustics as would have been possible had the consultant been invited earlier.

THE EDITORS

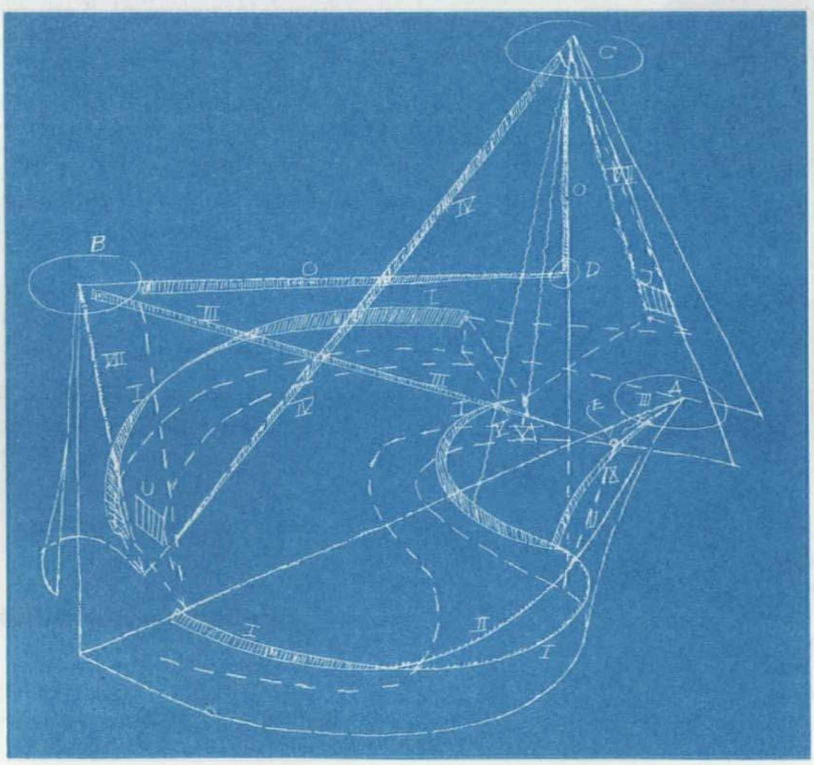
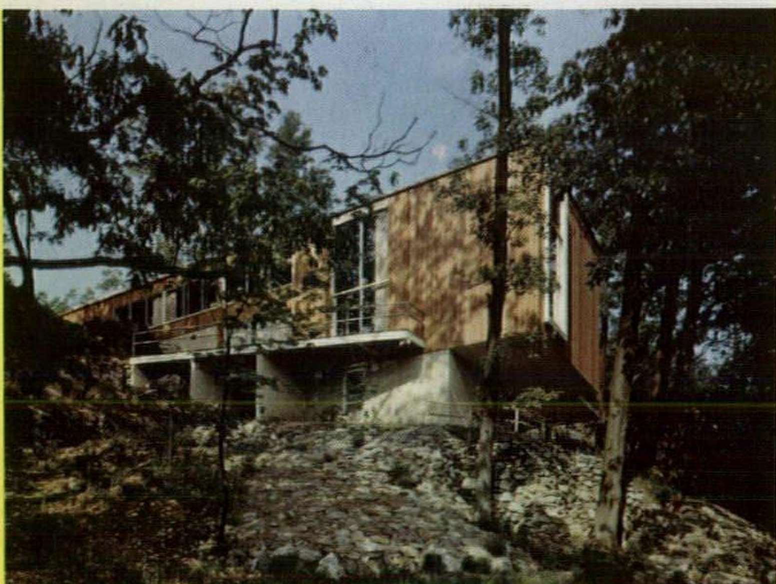


Diagram of sound routes in the Philips Pavilion—Le Corbusier's "poème électronique"—at Brussels Fair:
Route I horizontal
II goes from I → A
III B → E → A
IV U → C
O B → D → C
V and VI in the conical plane
VII B → U
VIII C → J
IX A ↓

In living, dining and bedrooms

more new homes



ARCHITECTS: Sherwood, Mills & Smith BUILDERS: Borglum & Meek

DESIGNERS AND BUILDERS: Purtell-Ba

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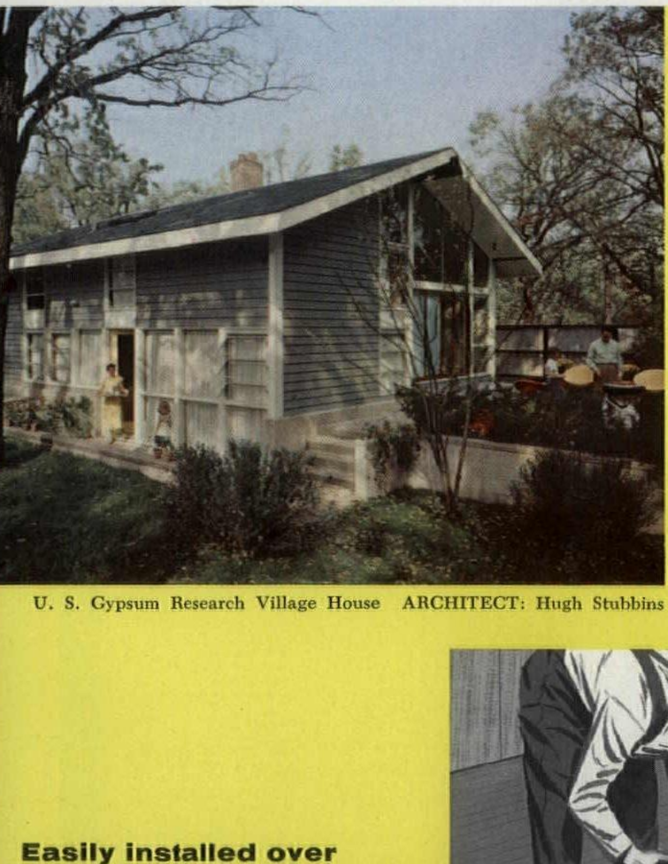
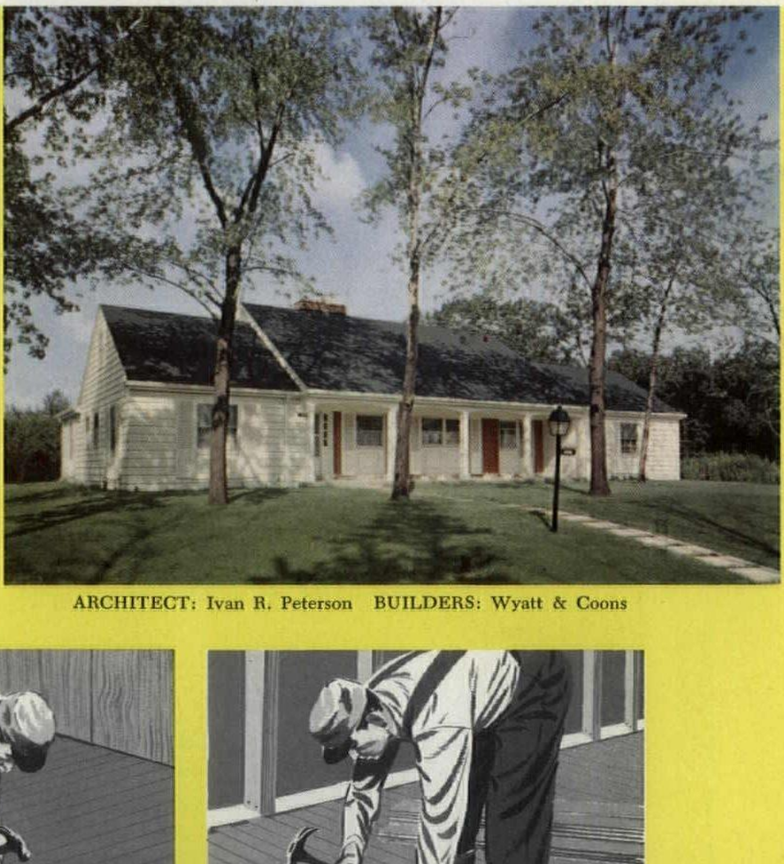
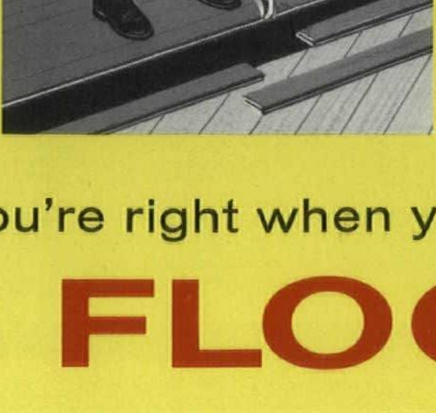
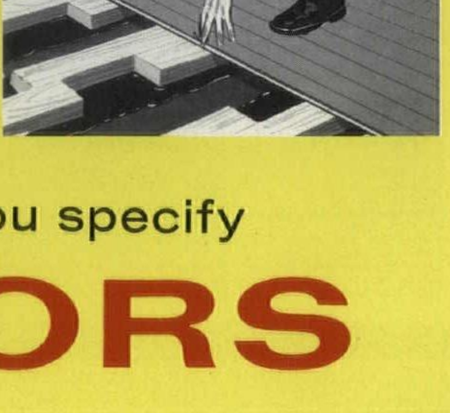


U. S. Gypsum Research Village House ARCHITECT: Hugh Stubbins



ARCHITECT: Ivan R. Peterson BUILDERS: Wyatt & Coons





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OAK FLOORS

Barbara J. Melnick

high school

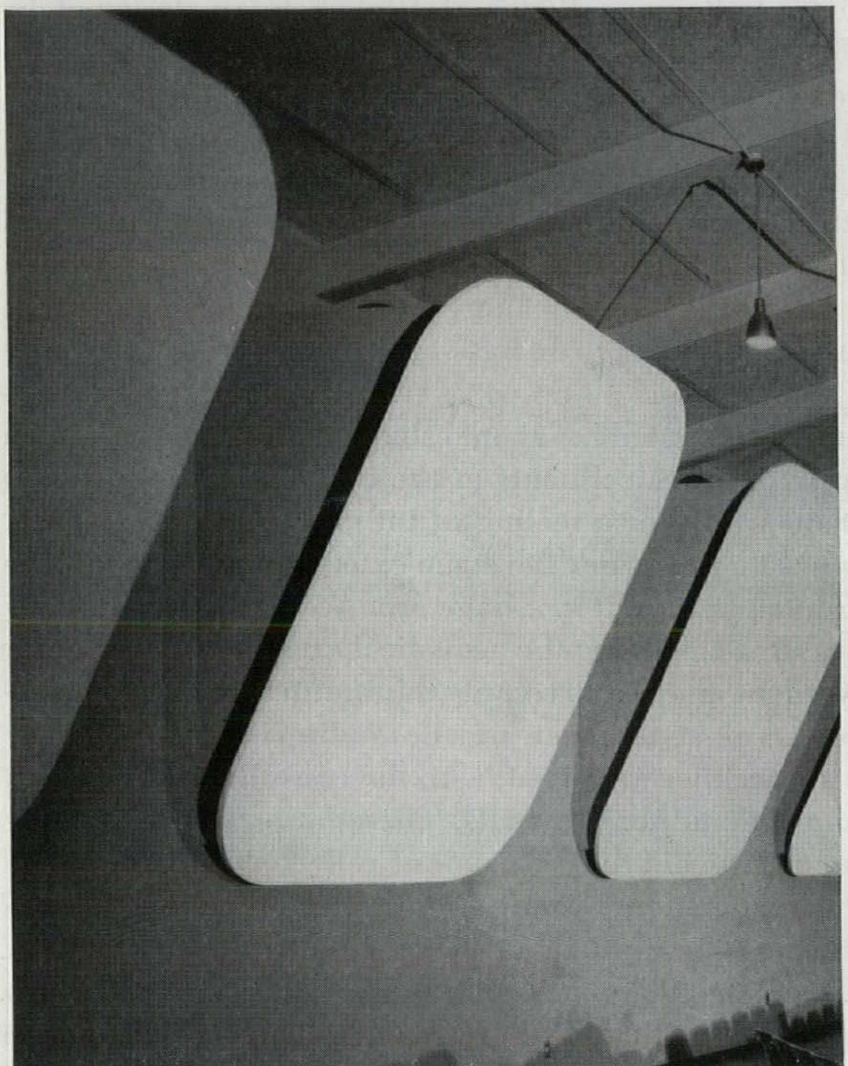
A special set of acoustical-design requirements is presented in each of the interiors—auditorium, band-practice room, shops, classroom, and library—selected for analysis here from Ramapo Regional High School, designed by Architects Sherwood, Mills & Smith, of Stamford, Connecticut.

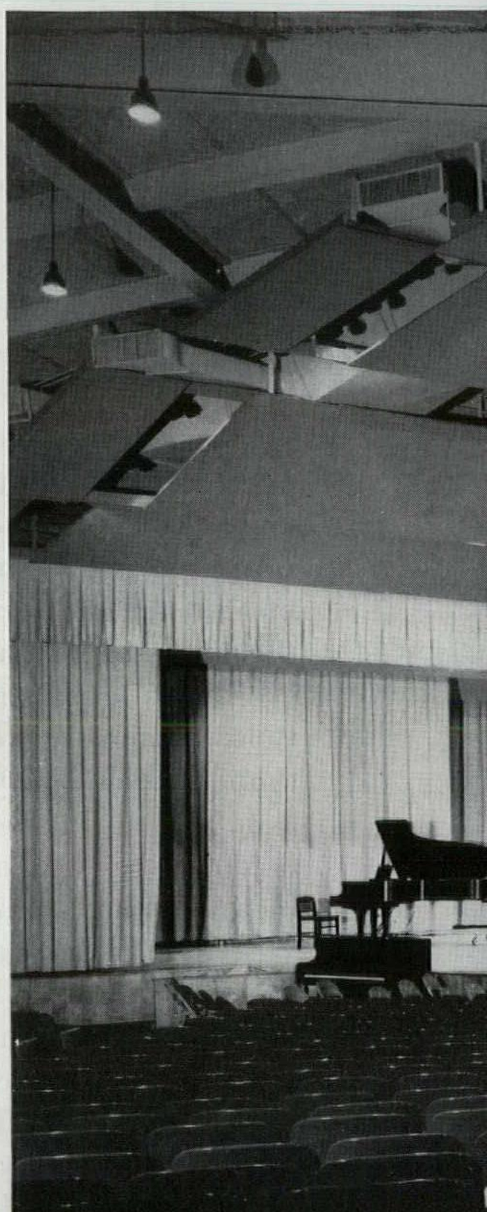
The environments created, the total impression of each of the interiors, their shapes and spatial effects, offer an interesting diversity and certainly a pleasant experience for students; and yet they are all unified by the architects' choices of surfacing materials and colors. Though both the auditorium and the band-practice room are windowless and employ acoustical devices which have become dominant interior-design elements, the restful tones of neutral, pale gray, the wood-fiber roof deck, and concrete-block walls are consistently effective throughout.

The spacious auditorium's elongated hexagonal shape was evolved as a form simple to frame structurally: large steel bents at the corners of the hexagon meet at the high point of the roof. For a feeling of intimacy within the space, the audience is brought close to the stage; the stage extends into the audience area and the seats are grouped around it in a huge arc. Acoustical Consultants Bolt, Beranek & Newman, Inc., reviewing the acoustical qualities of the room, thought the shape was excellent and required only minimum acoustical correction. Since flat reflective areas at the rear of the auditorium would have created echo difficulties, the architects evolved, with the consultants' approval, inclined panels hung from the auditorium walls. These large, approximately 10-ft square, plywood panels also aid the diffusion of reflected sound, distributing it uniformly. A permanent and important sound-reflective device, ceiling-hung plywood panels, directs sound out from the stage into the auditorium. Sound is again redistributed by the exposed beams, a structural means to achieve diffusion. The rest of the ceiling is exposed wood-fiber roof deck, made sound-reflective by heavy paint, except for a 10-ft-wide perimeter border which is left sound-absorptive to control reverberation. Additional absorptive material was provided in the fabric-covered seating to aid in reverberation control when the room is partially occupied.

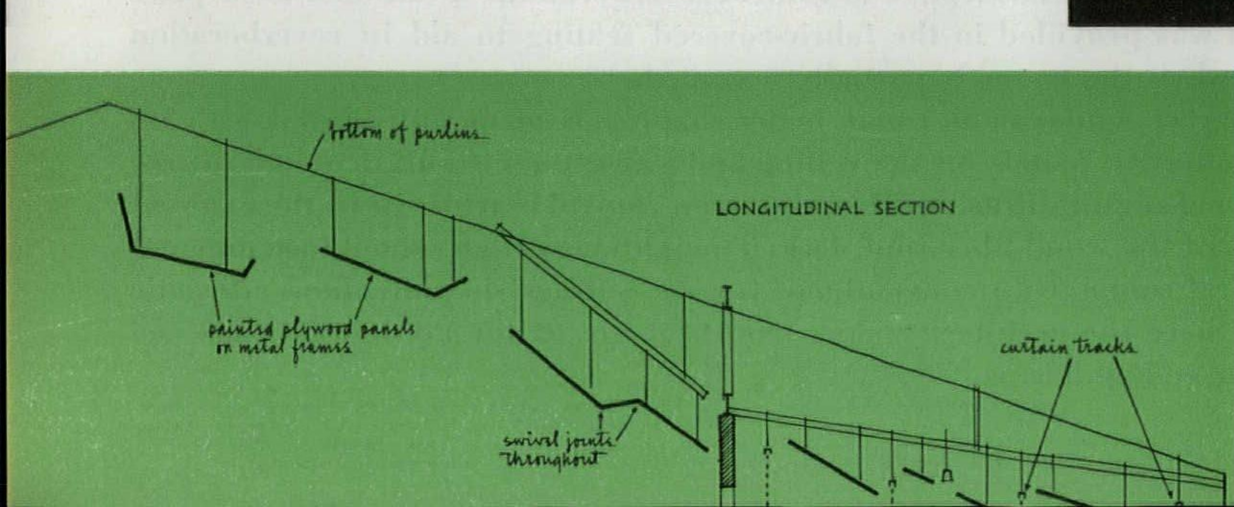
In the rectangular band room, better shaping is again introduced with inclined reflective panels on the ceiling and walls; these result in a high degree of reflected-sound diffusion. Reverberation control is achieved by the exposed portions of the wood-fiber roof deck. Though many high school instrumental and choral rooms with conventional furred ceilings do not allow adequate volume, here the architect makes acoustical use of the additional space between the ceiling beams.

high school





Photos: Joseph W. Molitor



client	Ramapo Regional High School
location	Franklin Lakes, New Jersey
architects	Sherwood, Mills & Smith

Design Theory: The hexagonal auditorium seats 823 persons around a stage which extends forward into the audience area. Acoustical consultants deemed the shape excellent. At the front of the room, panels hung from the ceiling are reflective planes (section acrosspage) for good sound distribution. Exposed wood-fiber roof deck is made sound-reflective by heavy paint except for a 10-ft-wide perimeter border left sound-absorptive to control reverberation. Inclined panels (acrosspage) on rear walls reflect sound downward to the audience to avoid echo. Fabric-covered, padded seating absorbs sound and controls reverberation, especially when auditorium is partially full.
Color Plan: Gray unites varied ceiling surfaces and walls. Upholstery is blue; textured-satin curtain, gold. Reflective wall panels, painted soft yellow, gray, green, are decorative accents.

data

doors

All: natural-finish birch/United States Plywood Corp., 55 W. 44 St., New York 36, N.Y.

furniture, fabrics

Seating: blue upholstery/American Seating Co., 901 Broadway, Grand Rapids 2, Mich. **Stage Curtain:** textured satin/gold/F. Schumacher & Co., 60 W. 40 St., New York, N.Y.

lighting

Pendant: incandescent/white-opal diffusing glass/satin-chrome finish/ The Edwin F. Guth Co., 2601 Washington Blvd., St. Louis 3, Mo. **Stage-Lighting Board, Spotlights:** Metropolitan Lighting Fixture Co., Inc., 16 E. 39 St., New York, N.Y.

walls, ceiling, flooring

Walls: concrete block, painted gray. **Reflective Wall Panels:** gum plywood/ 10'-0"x9'-6"x0'-5/8" hardwood edges/ painted yellow, gray, green/custom-made. **Ceiling:** steel bents painted gray/exposed, structural, insulating, acoustical panels of wood fiber/ Porex/Porete Manufacturing Co., North Arlington, N.J. **Reflective Ceiling Panels:** painted plywood. **Flooring:** concrete slab unpainted.

high school

Robert Stahman

Design Theory: In designing the band-practice room, architects and acoustical consultants determined that the basic rectangular space could be shaped with splayed reflective panels on the ceiling and walls to achieve a high degree of reflected-sound diffusion. The exposed portions of the wood-fiber roof deck are sound absorptive for reverberation control. The additional space between the ceiling beams allows adequate volume, a quality often lost in music rooms with conventional furred ceilings.

Color Plan: Simplicity of color was desired in the room which has its important wall and ceiling surfaces broken into a multiplicity of small areas. Ceiling and beams are white to reflect light; walls are gray, flooring tan.

data

doors

All: natural-finish birch/United States Plywood Corp.

lighting

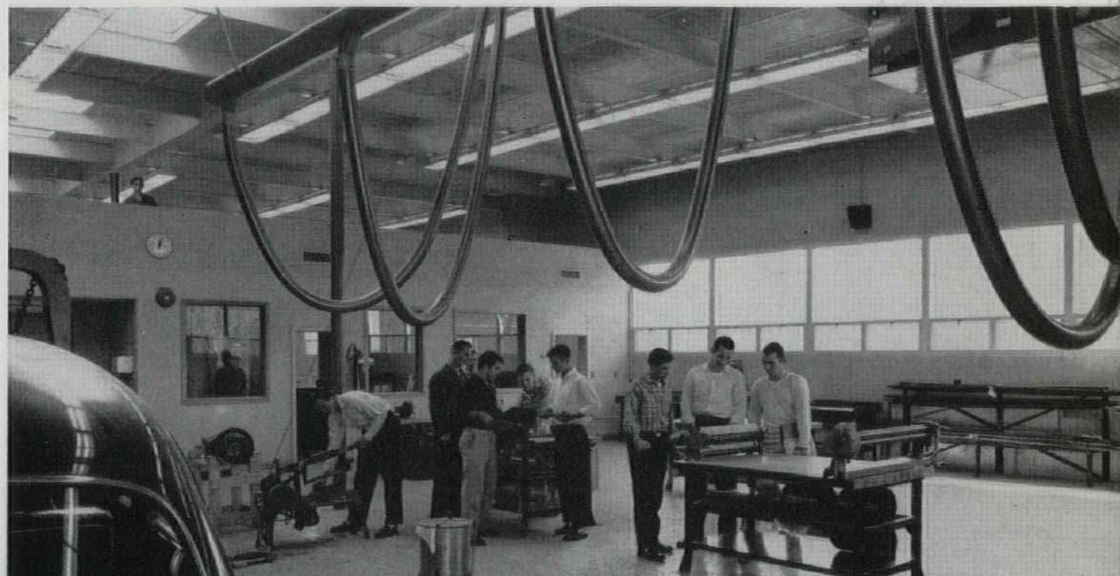
Skylights: Marcolite/The Marco Co., 45 Greenwood Ave., East Orange, N.J. **Fluorescent:** surface mounted/ baked white-enamel finish/Lightolier, Inc., 346 Claremont Ave., Jersey City, N.J.

walls, ceiling, flooring

Walls: cement block painted pale gray. **Reflective Wall, Ceiling Panels:** gum plywood/hardwood edges/painted white/custom-made for high degree of reflected-sound diffusion. **Ceiling:** steel beams/wood-fiber roof deck/painted white/Porex/Porete Manufacturing Co. **Flooring:** asphalt tile/ tan

Joseph W. Molitor

Robert Stahman



Design Theory: The industrial arts rooms, adjacent to the band practice room, are located at the end of a wing—with the auditorium, band-practice room, arts room, industrial arts room—which separates these noise-makers from quiet classrooms. Band-practice room is isolated from shop noises by a heavy, double wall with bagasse-fiber filler. The sound absorptive wood-fiber roof deck controls reverberation. The high ceiling in the woodworking shop (top) and the metalworking and machine shop (right) allows a central core for planning and balcony storage space.

Color Plan: White ceiling and beams give high light reflectance. Block walls painted gray are restful. Maple flooring rather than concrete was desired by the Board of Education, for the students' comfort and to minimize painting.

data

doors, windows

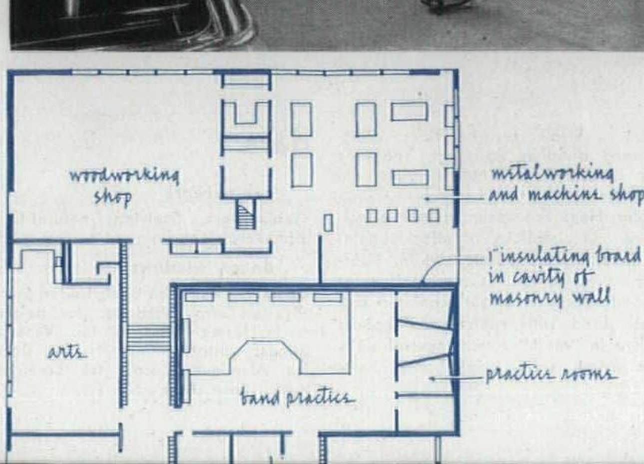
Doors: natural-finish birch/United States Plywood Corp. **Windows:** steel painted white/Hope's Windows, Inc., Jamestown, N. Y.

lighting

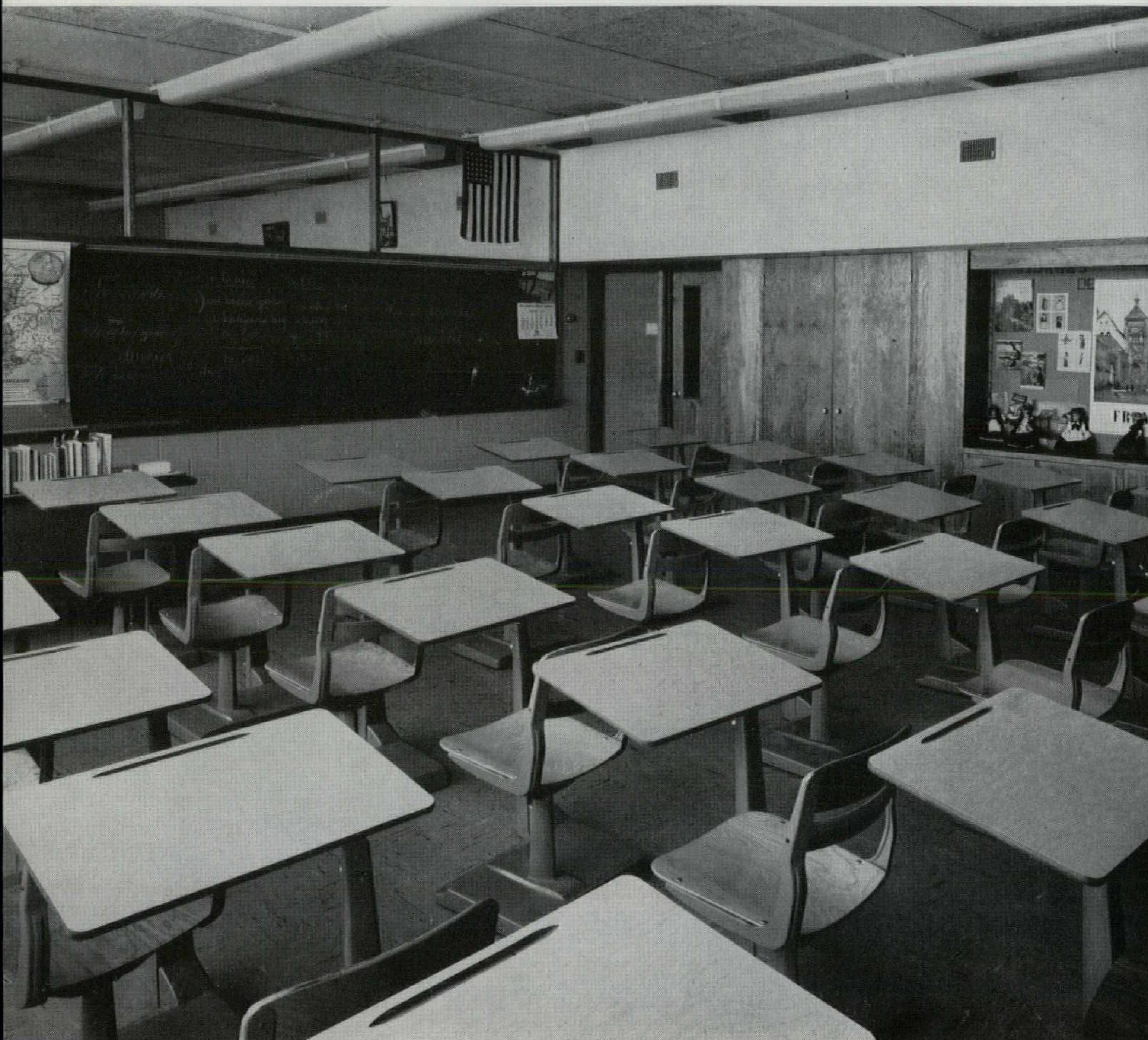
Skylights: Marcolite/The Marco Co. **Fluorescent:** surface mounted/baked white-enamel finish/Lightolier, Inc.

walls, ceiling, flooring

Walls: concrete block painted gray. **Ceiling:** steel beams/wood-fiber roof deck/painted white/Porex/Porete Manufacturing Co. **Flooring:** maple/natural finish/Haywood Floor Co., 414 W. Broadway, New York 12, N. Y.



high school



Design Theory: The typical classroom, almost square, to provide flexibility, has a window wall from a low sill (2'-6") to the ceiling (11'-4"). Built-in cabinetwork along the corridor wall offers storage space for teacher and class; tackboard area above low center cabinets may be used for visual-aid projection. The two end walls with tackboard and chalkboard space are painted concrete block; the glass top gives a feeling of space and openness to each room. Wood-fiber roof deck controls reverberation; glass-topped dividing walls are adequate for isolating most normal classroom sounds.

Color Plan: For maximum light reflectance and simplicity of effect, beams and ceiling are painted white, flooring is pale tan. Occasional color accents occur in brightly painted end walls used with neutral chalkboards or, as in "math" rooms, neutral walls contrasted with bright-blue chalkboards.

data

cabinetwork

Cabinetwork, Shelving: natural-finish birch/architect-designed/custom-made.

doors, windows

Doors: natural-finish birch/United States Plywood Corp. **Windows:** steel painted white/Hope's Windows, Inc. **Venetian Blinds:** white/aluminum/Hunter Douglas Aluminum Corp., 405 Lexington Ave., New York, N. Y.

lighting

Fluorescent: surface-mounted / baked white-enamel finish/Lightolier, Inc.

walls, ceiling, flooring

Walls: concrete block painted pale gray or bright color. **Corkboard, Chalkboard:** Nucite chalkboard/New York Silicate Book Slate Co., 541 Lexington Ave., New York, N. Y. **Ceiling:** steel beams/wood-fiber roof deck/painted white/Porex/Porete Manufacturing Co. **Flooring:** asphalt tile/tan.

Design Theory: The library, central to classrooms, has a feeling of airiness and spaciousness. The roof was pitched with a ridge in the center to achieve a feeling of height. The large window at the south end opens to a view of the distant mountains. On the east, a door leads out to a reading terrace. The west wall has clerestory windows over the bookcases while the north end of the room—which drops to normal ceiling height to give variety to the space—has skylights. Exposed wood-fiber roof deck absorbs sound. **Color Plan:** The openness, height, and spacious effect of the library is aided by the neutral color scheme. Simplicity and quiet of white-painted ceiling and beams; pale tan flooring; birch furniture, shelving, and doors are accented by brown-painted columns.

data

cabinetwork

Book Shelving: natural-finish birch/ architect-designed/custom-made.

doors, windows

Doors: natural-finish birch/United States Plywood Corp. **Windows:** Hope's Windows, Inc.

furniture

Tables, Chairs: birch/Driftwood finish/ John E. Sjostrom Co., Inc., Cabinetwork, 1717 N. 10 St., Philadelphia, Pa.

lighting

Incandescent: pendant-mounted fixtures/Rambusch Decorating Co., 40 W. 13 St., New York, N. Y.

walls, ceiling, flooring

Walls: concrete block painted gray. **Ceiling:** steel beams/wood-fiber roof deck painted white / Porex / Porete Manufacturing Co. **Flooring:** asphalt tile/tan.

Photos: Robert Stahman

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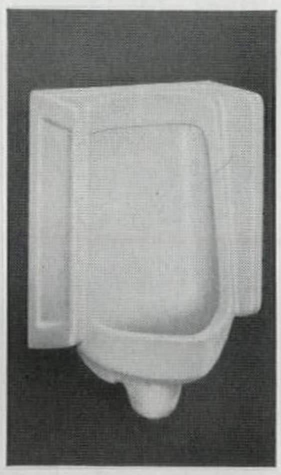

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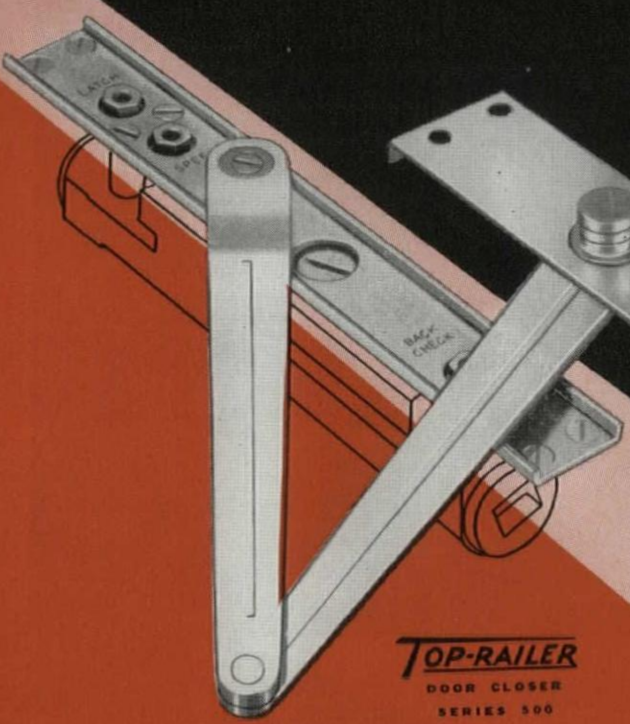

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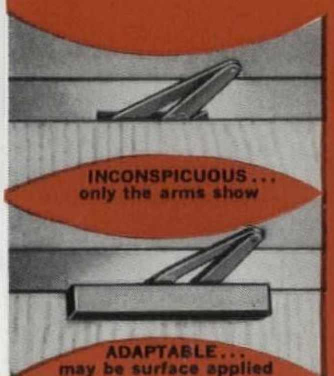

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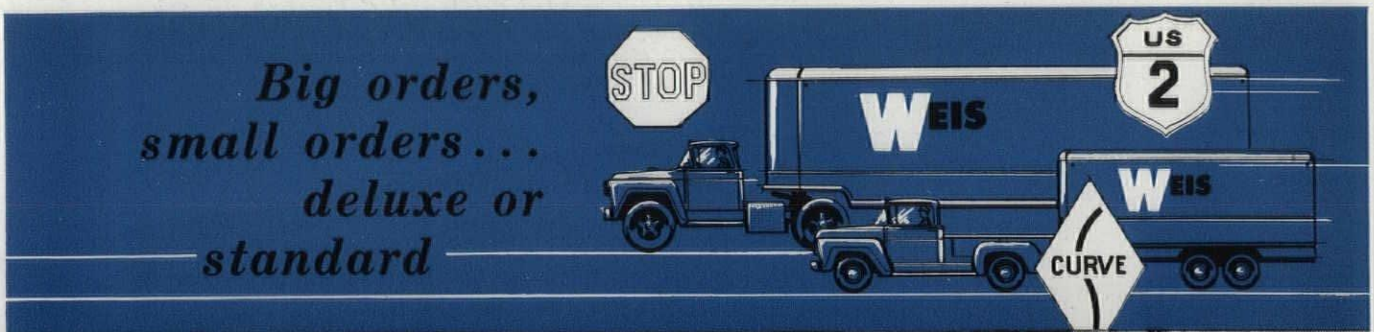

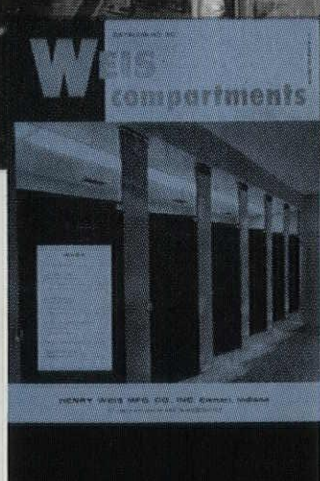

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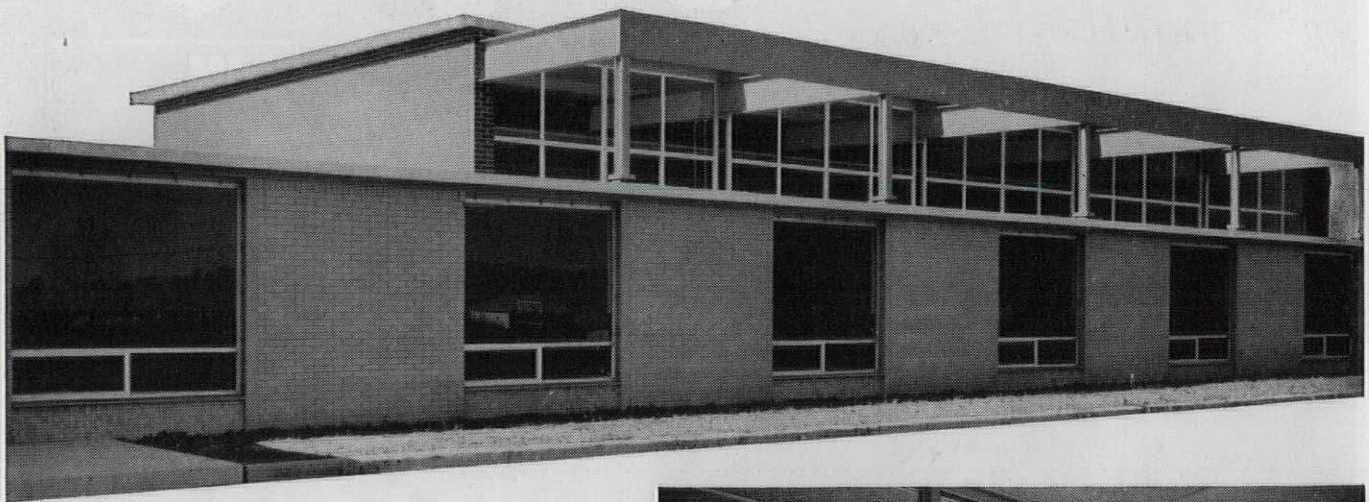

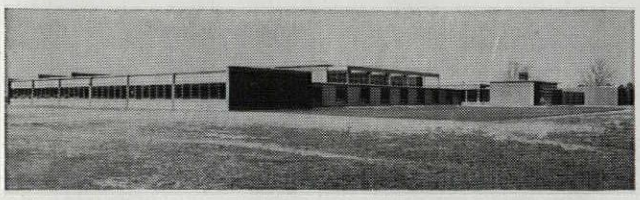

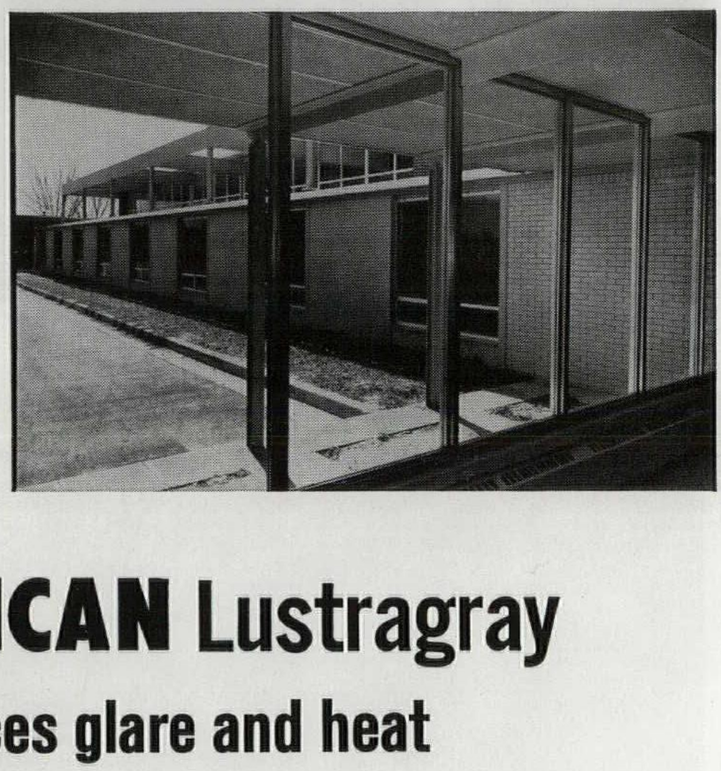

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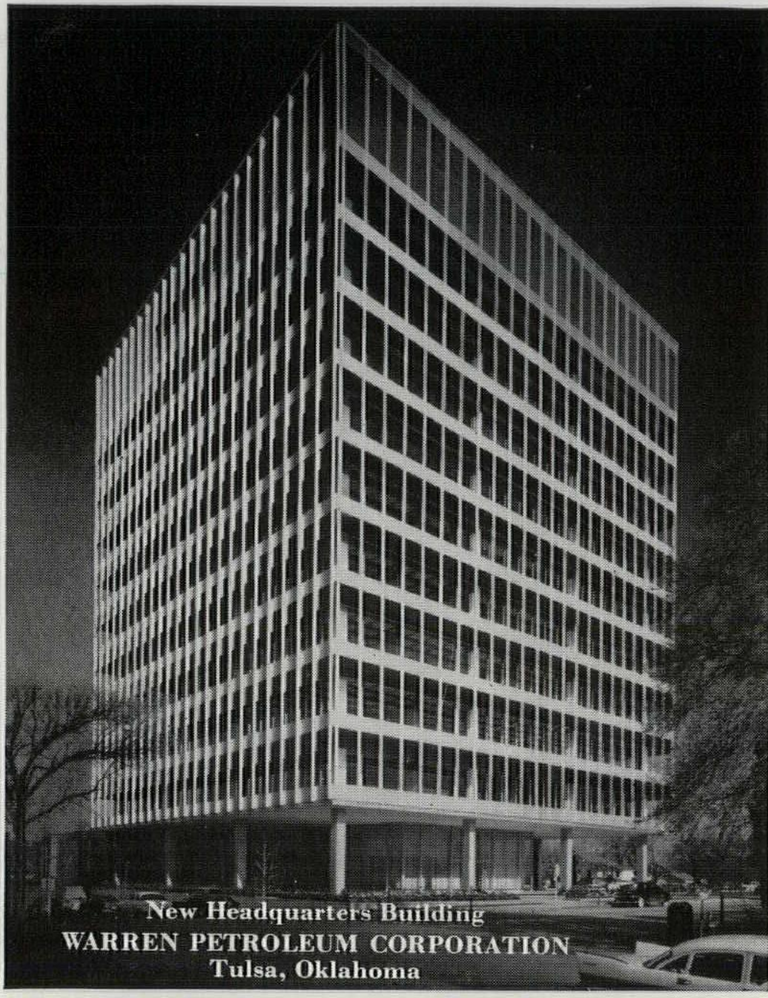

New Headquarters Building
WARREN PETROLEUM CORPORATION
Tulsa, Oklahoma

PHOTOS © EZRA STOLLER

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general contractor
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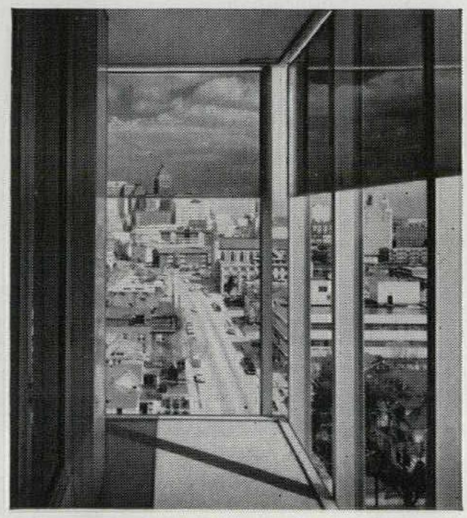

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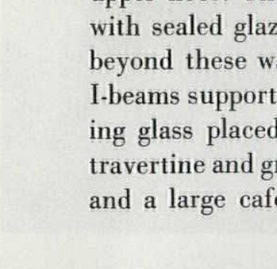

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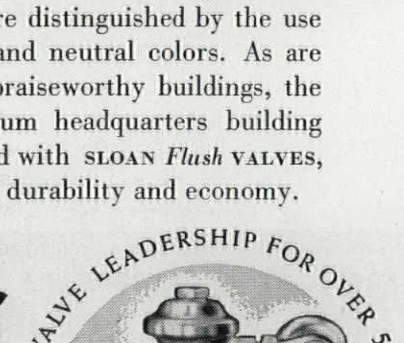

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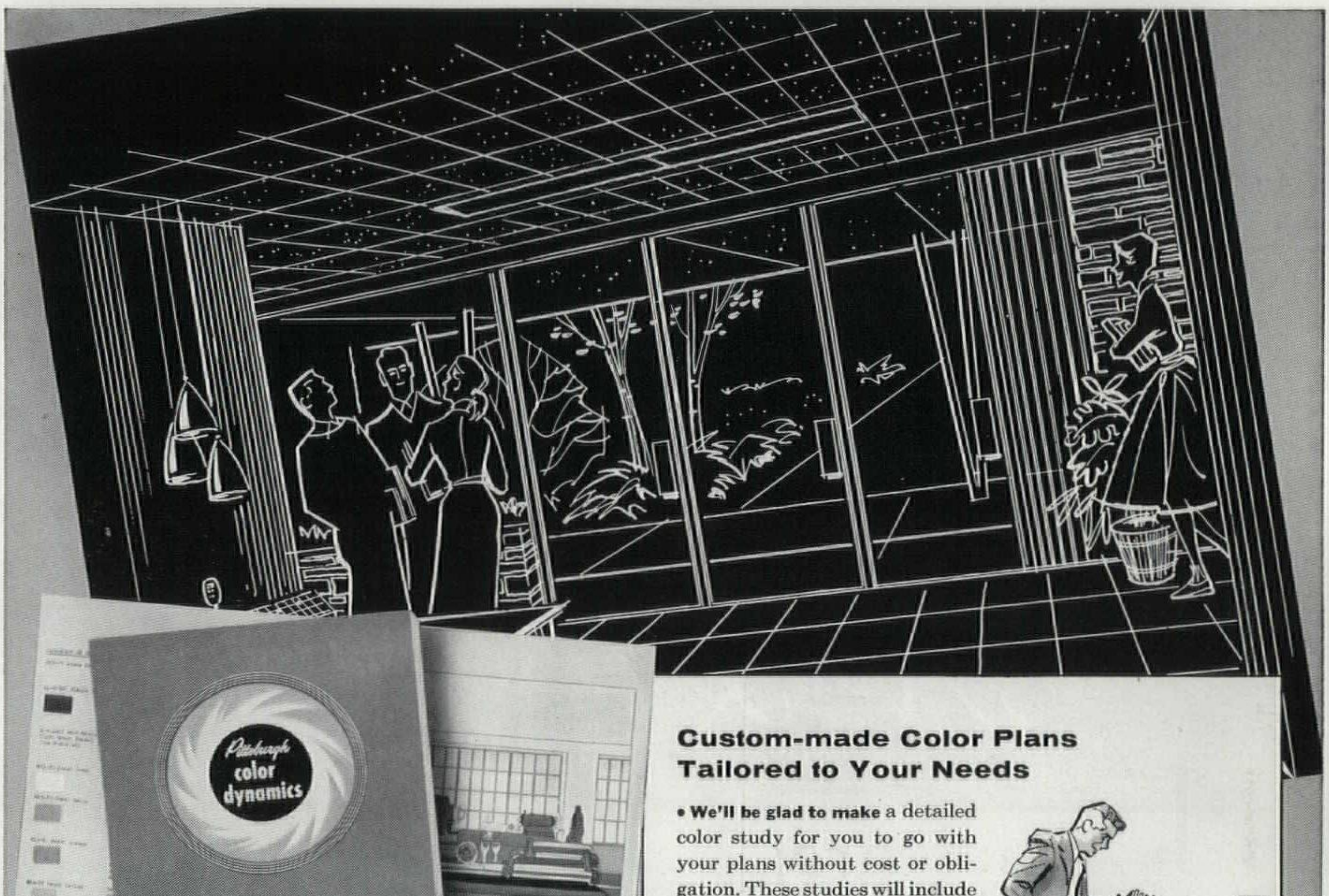

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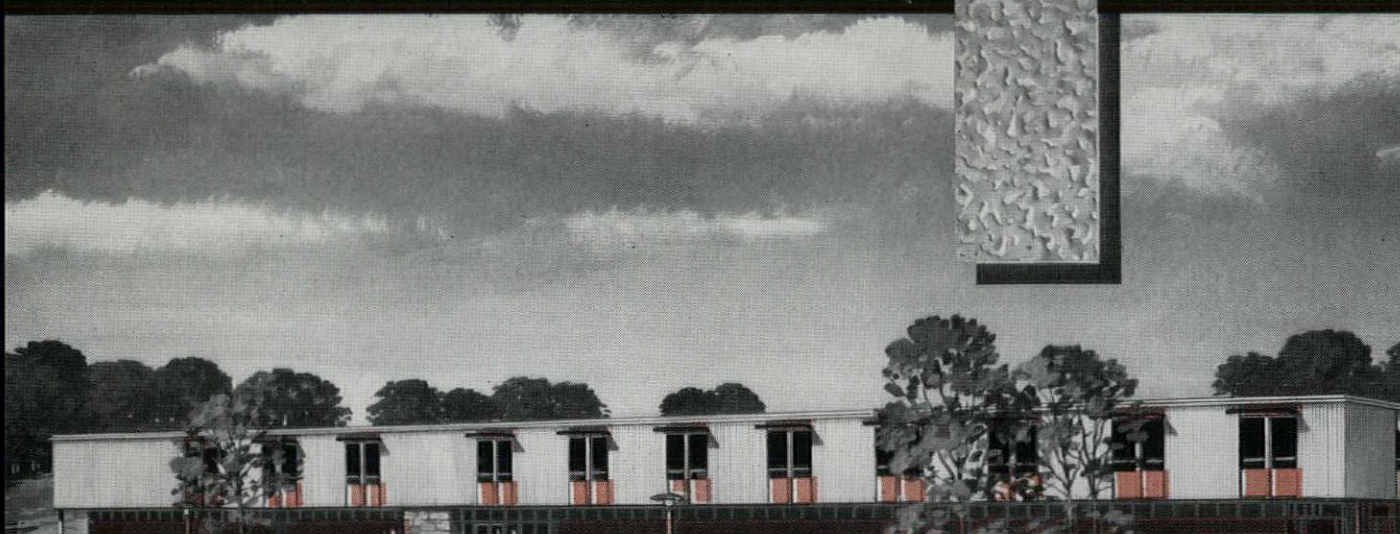

Sharon Steel Corporation makes only the Sharonart.* Curtainwall is formed of it by many metal fabricating concerns.

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A Non-Hegelian Prometheus

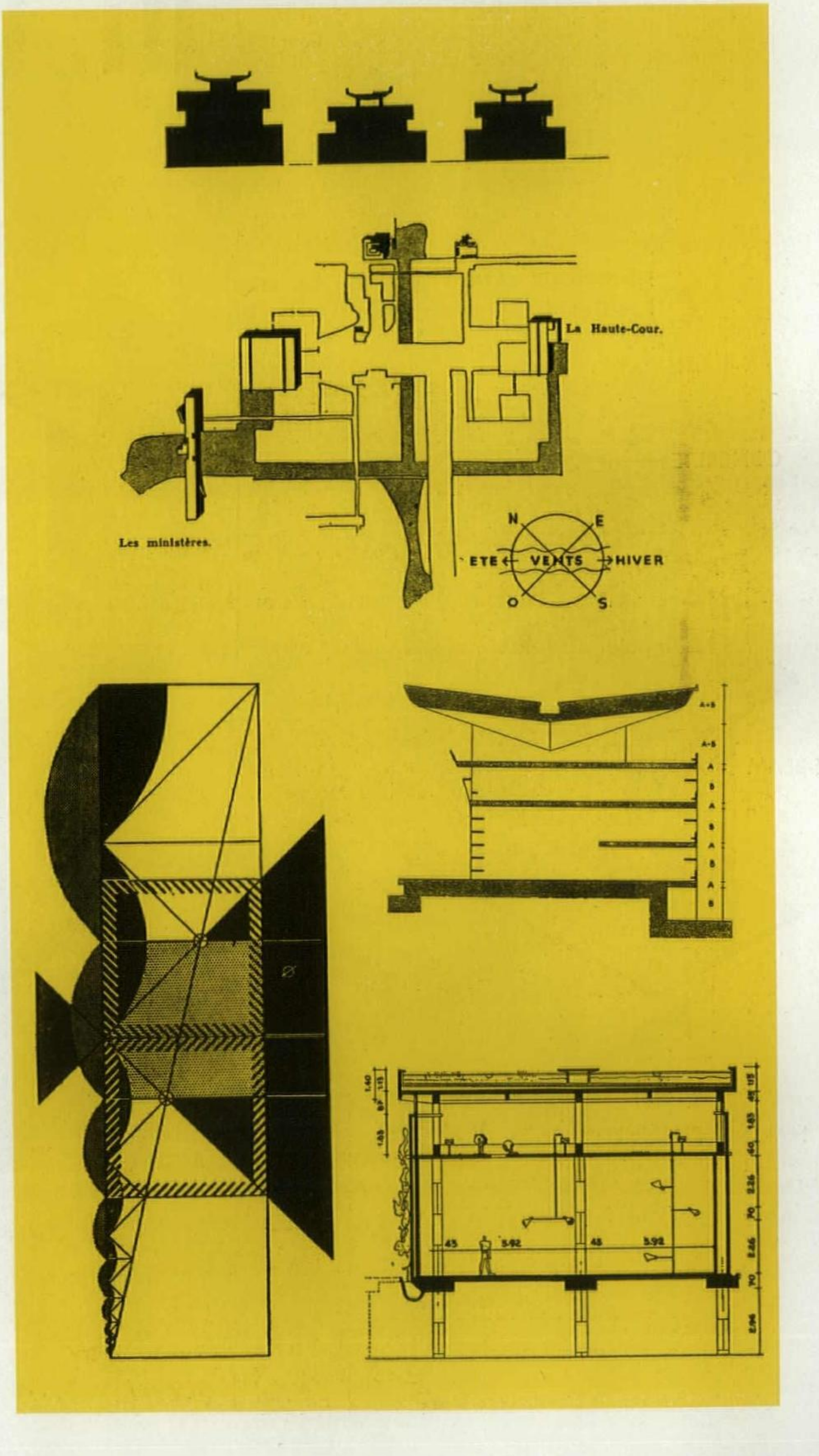
by Stamo Papadaki

Modulor 2. *Le Corbusier. Translated by Peter De Francia and Anna Bostock. Harvard University Press, Cambridge, Mass., 1958. 336 pp., illus. $8*

The middle of the 20th Century witnessed the rise of a quantum architecture, of forms resulting from statistical activities—that is to say from data abstracted from topical realities and relative conditions—and of design through corporate actions reflecting the minutes of complex executive councils. At the same time, the *homo absurdus* celebrated by the Dada Movement at the end of World War I became, after World War II, the *man without hope* of Jackson Pollack and Jack Kerouac. The fact that only two gates remain open for the man without hope: suicide, or an equally abrupt neo-vitalism—the Colin Wilson kind which would have embarrassed Bergson—should be of no particular importance and could be dealt with by graphs. But the rapid process of depersonalization no longer affects the individual alone, the man in his intimacy; it now demands the complete abstraction from any manifestation of creative activity of man as a subject or as a witness; it insists that all human metaphors must be excluded—even those which are remotely connected with man-made things or conditions. "Things are things and man is nothing but a man," says the novelist Robbe-Grillet.

The new painting is now writing on the wall, but without the convulsive quality of the prophets. This writing is more a part of the wall than of the author, who seems most eager to establish a distance between himself and the wall. Distance becomes eventually the image of a double absence, the one of the artist and the other of the writing. There is a wish for a separation—the author from the writing

(Continued on page 232)



A selection (right) *of drawings from the book showing application of the modulor scale.*

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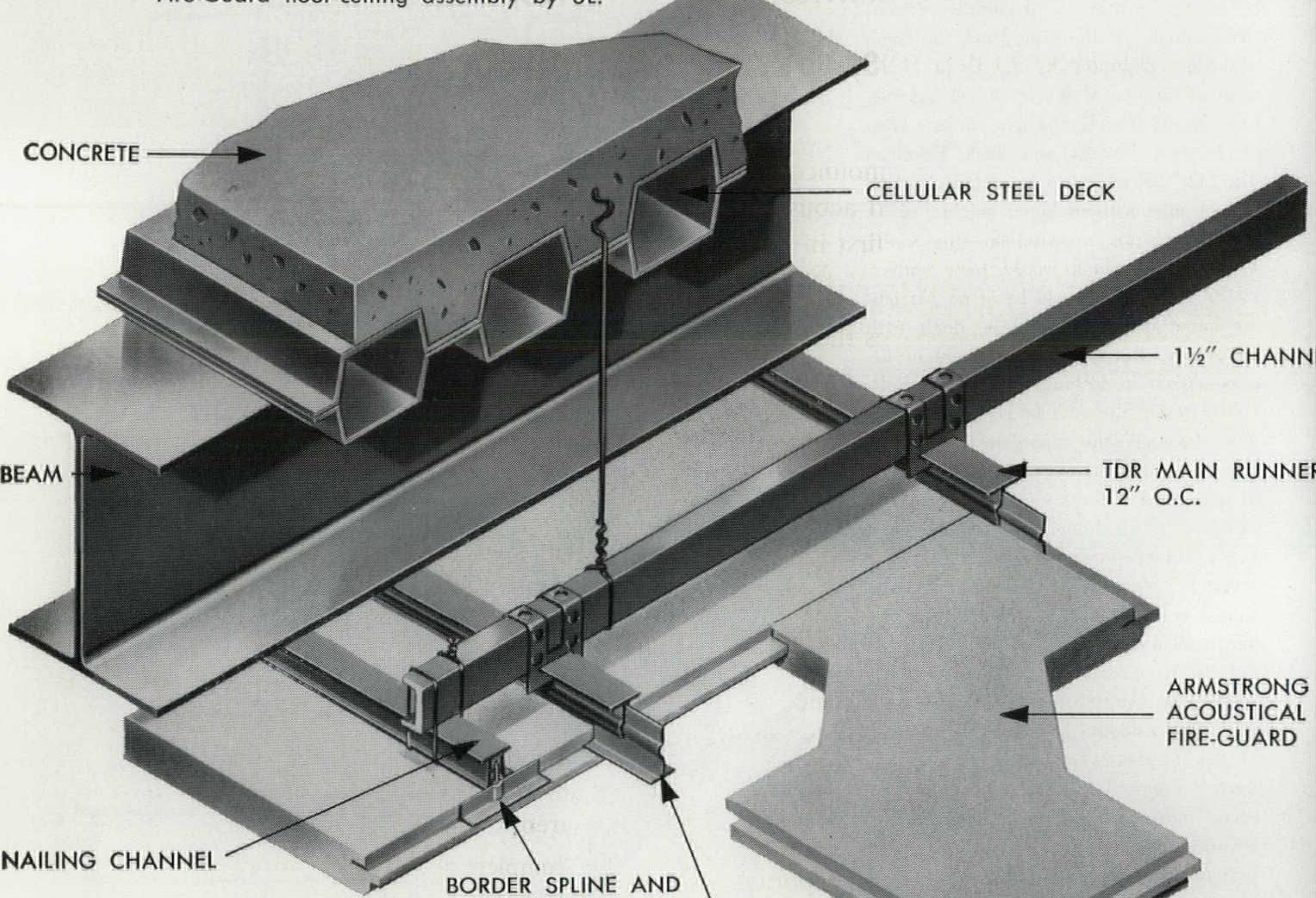


(Continued from page 229)

or from the wall—and the wish to make this separation permanent. Georges Salles, former director of the Louvre Museum, says in a recent essay: ". . . artists deliberately passed the frontier of the visible and allied themselves with the invisible which is perceived without being seen, sensed but not embodied." He cites the example of the Zen painters whose pictures are situated outside of the pictures and calls for the mediation of the "camera obscura" within the spectator's unconscious.[1] It remains doubtful, however, that participation with an impersonal presence, with a description of an absence, with a dispersal in being can take place at will; this must be left to chance within a framework of probabilities—the idle eye arrested by the formation of a lichen on a rock, by the outline on the sand of a receding tide. It could be said that some manifestations of art are now situated not in Heidegger's reign of the Neutral but in that space without dimension which exists between alienation and alteration: estranged from themselves and yet without the identity of *the other*, the one and the two of the Pythagorians.

And now we may ask: is it possible any longer for a *quantity* to exist because it is seen, because its very presence allows simple comparisons to take place with other adjacent quantities—including the one of the onlooker? Is it possible for a quantity to become the center not of a contemplation but of an elementary observation which might be at the head of a chain reaction in depth? Is it possible for *a seeing* person (who may or may not oscillate between being and nothingness, not yet inextricably identified with one part of the social maze) to notice analogies between *seen* quantities, to notice them in a simple play of the mind as in a game of solitaire, and to do so without being accused of anthropocentrism? *Modulor 2* offers to us a positive answer.

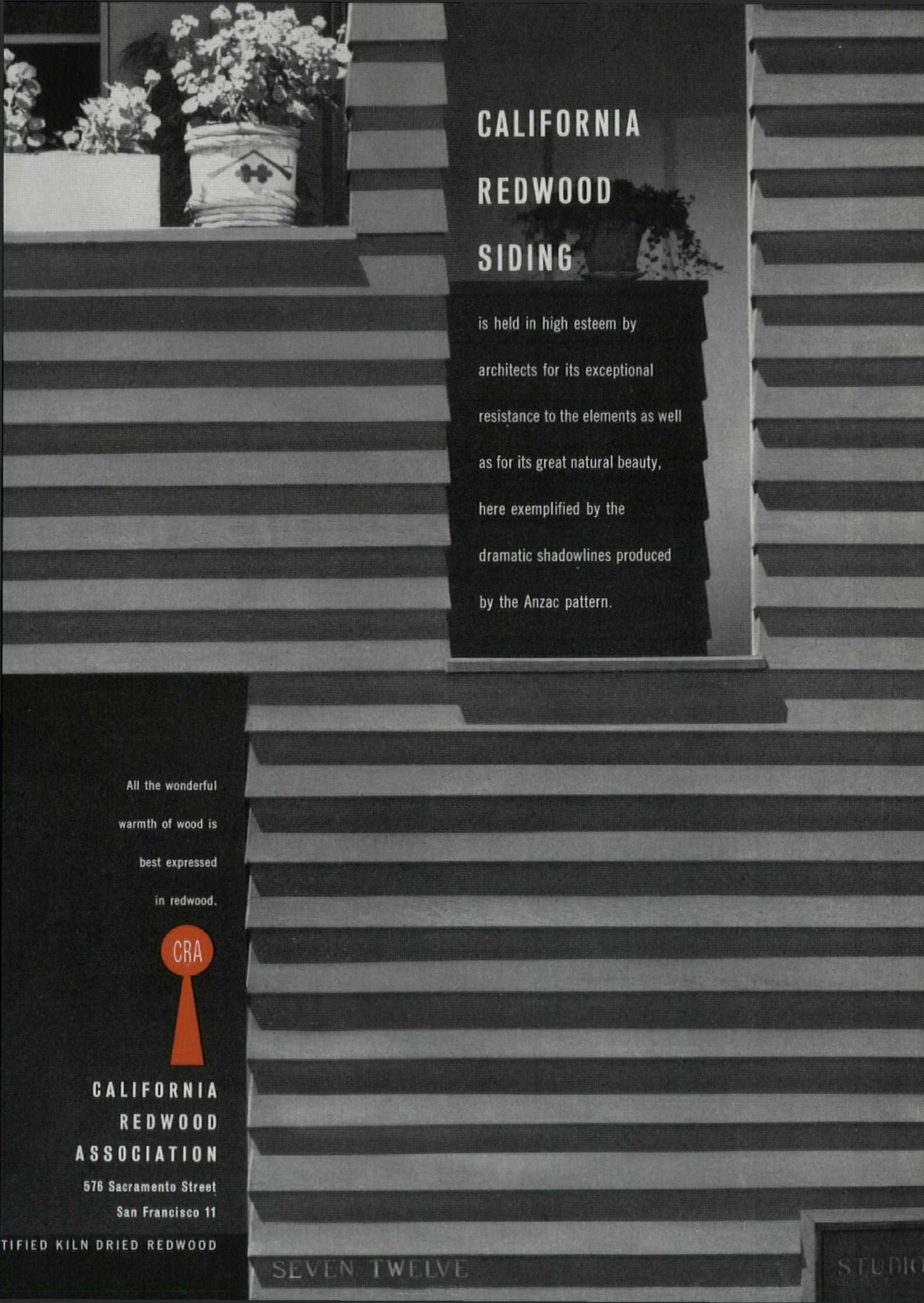
Here the style is convulsive, the grammar prophetic. The voice is of one in the wilderness, with real and imagined echos which produce hypothetical dialogues and plain soliloquies. Climaxes overlap or succeed each other with rapidity, paths that had been parallel suddenly criss-cross themselves, waves move in an outward or concentric direction, and passions are summarily covered with conventional, everyday clothing.

Modulor 2 deals essentially with onlookers' reactions to *Modulor 1*[2] in space (a few continents) and in time (six years). Thus, Dr. Sigfried Giedion asserts his preference for the Egyptian Pyramids to the Alpine Peaks (in spite of the fact that he is able to see the latter while lounging in his home). And from Pierre Curie Street's Institute of Physico-chemical Biology, from retired alumni of the Ecole Polytechnique, as well as from fifth-year architectural students, testimonials, proposals for adjustments, and counter-proposals appear in rapid succession and

(Continued on page 236)

[1] *One is tempted to think at this point that thanks to the "new painting" art critics are now free to present statistical information or to speculate without any reference to the work or to the artist, the "Imaginary Museum" of Malraux becomes, thus, understandable.*

[2] *See* August 1954 P/A, *p. 188.*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There is no substitute for safety, and Polished Misco (wired) affords proven protection for youngsters in the new Walt Disney Elementary School, at Tullytown, Pennsylvania.

Architect: John Carver, 2112 Spruce St., Philadelphia, Pennsylvania

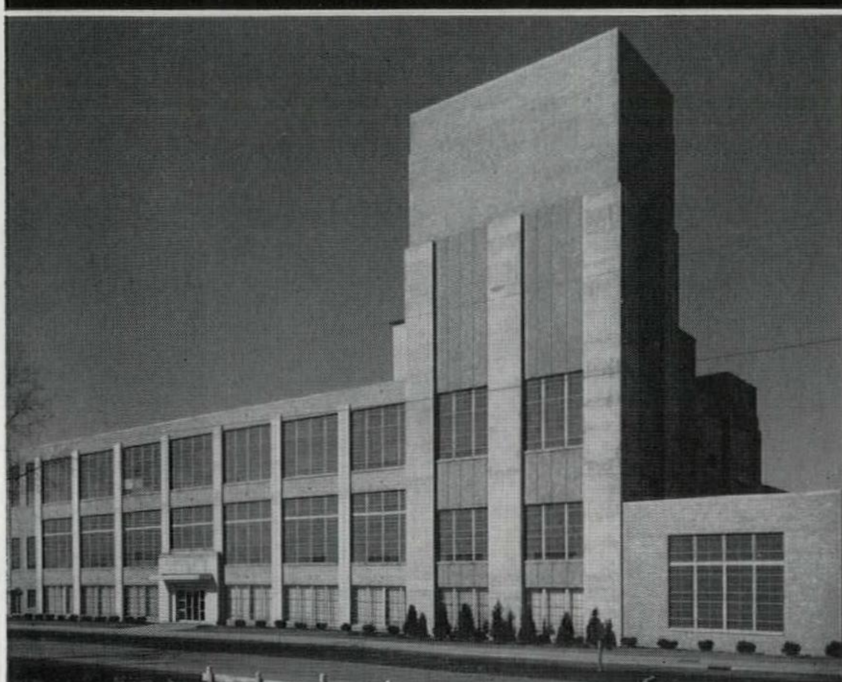
Heat absorption provided by 38,750 sq. of Mississippi Coolite glass make patients more comfortable in the John J. Kane, Allegheny County Institution District (Hospital for the Indigent Sick).

Associate Architects: Button & McLean—Mitchell & Ritchey, Pittsburgh, Pennsylvania
General Contractor: Sherry Richards Company, Chicago, Illinois
Glazing: United Plate Glass Company, Pittsburgh, Pennsylvania

At the Philadelphia International Airport, modern vistas are created by 10,000 sq. ft. of 60" wide lights of Polished Misco (wired glass).

Architect: Carrol, Grisdale and Van Allen, Philadelphia, Pennsylvania
Glazing: Pittsburgh Plate Glass Company

ROLLED GLASS . . . .



New factory of American Chicle Company, Rockford, Ill. where 14,000 sq. ft. of Coolite Wire glass, Glare Reduced, combines heat absorption with protection.

Architect: William Higginson & Sons, New York, N. Y.
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(Continued from page 232)

could serve as a proof and a sign of the enormous actuality of the subject. But the impact of *Modulor 1* on Le Corbusier's own atelier at 35 Rue des Sevres is exposed at length—and it outdistances in interest everything else.

Le Corbusier, during the long years of his architectural activities, developed a system of proportion, possible ratios of component parts. This system translated into numerical values based on a man's height was presented to the space specialists, architects, designers, and planners, in *Modulor 1*, the first edition of which appeared ten years ago. At that time we expressed the opinion that Modulor was an efficient but humble tool, closer to the drafting table than to Plato's concepts of cosmic harmonies, since it encompassed only dimensions which could be seen by the naked eye and could be used for the shaping of containers, contents, and assemblies. It was the humbleness of the tool that enveloped it with a sublime aura.

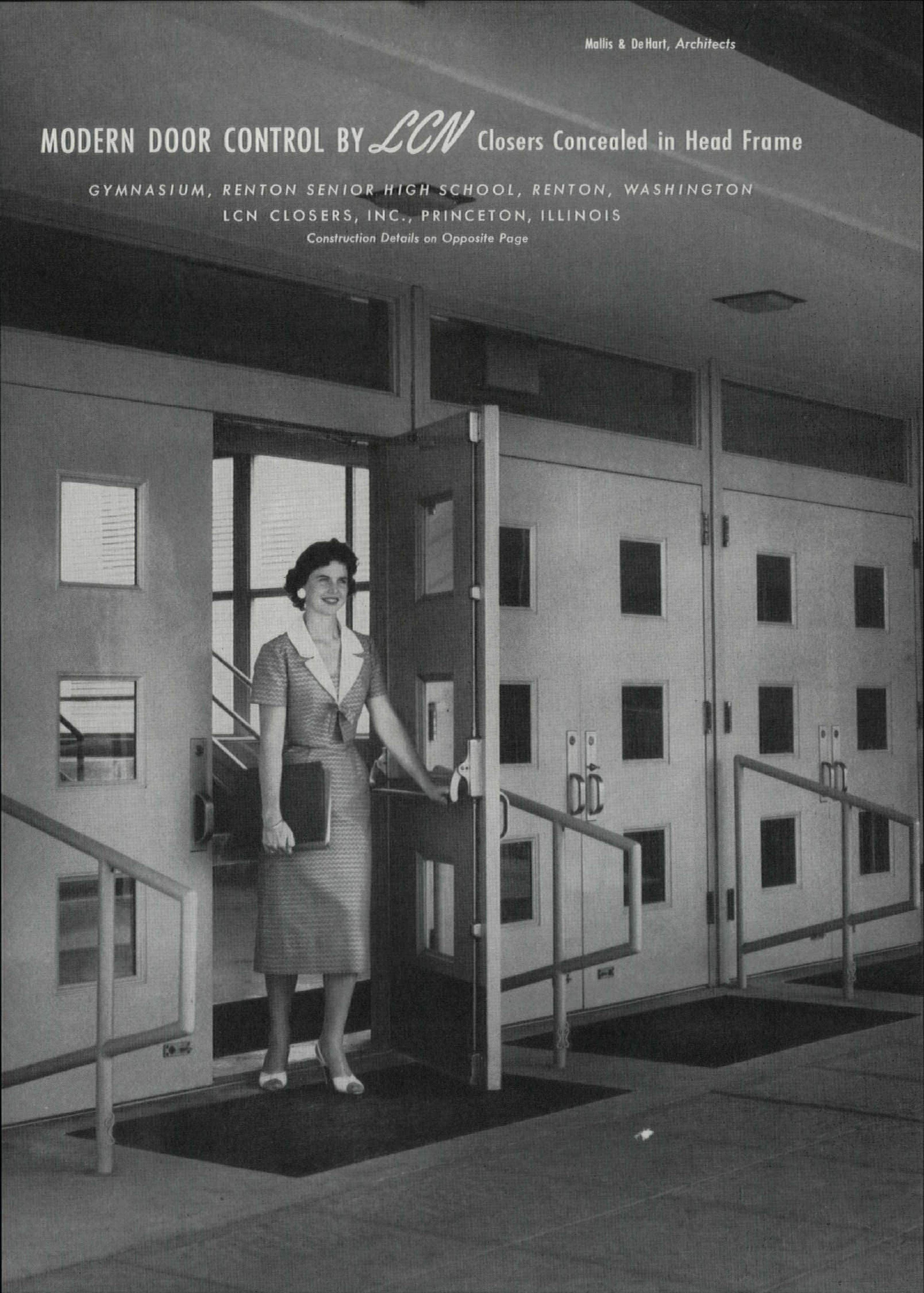
Le Corbusier is one of the blessed individuals of our time who can be accused simultaneously of materialistic determinism ("the dwelling machine") and of mystical outbursts ("stone is man's best friend"); thus, in the every day world of business he could well qualify as a man "who knows what he is doing." Fortunately for the age, reality escapes the activities. In reading him we find again the assurance that man is man that man-made things could be man-made things, that all other things ought to be and remain things, and that distances between man and things could be measured in other terms than zero and infinity. According to Aeschylus, Prometheus "brought to mankind the blind hope." This is by far the most efficient tool we possess.

abundant compendium

The Theory of Proportion in Architecture. *P. H. Scholfield. New York: Cambridge University Press, 32 E. 57 St., New York, N. Y., 1958. 156 pp., illus. $5.50*

Modern architects are becoming increasingly aware of the necessity for architectural research—not only to incorporate a newer technology into their buildings, but also to improve their understanding of the fundamental principles of architecture. Inquiry into the theory or nature of design is mounting and has probably reached its highest point since the inception of the modern movement. Any such work must incorporate a basic knowledge of all the facets of architecture—such as structure, light, color, and proportion. Of all the variables, proportion is the least known and therefore should be the subject of concerted research. In order to develop a modern theory of architectural design, all the variables must be studied and become known quantities; then these quantities must be studied further and related to one another so that a consistent theory may be evolved. Those who consider the study of proportion *un*important should also welcome such research as a means to prove their belief.

(Continued on page 240)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LCN CLOSERS, INC., PRINCETON, ILLINOIS
Construction Details on Opposite Page

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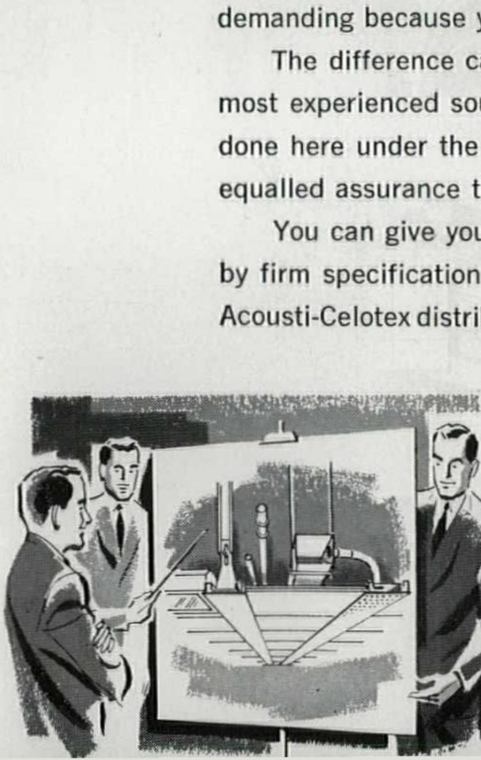

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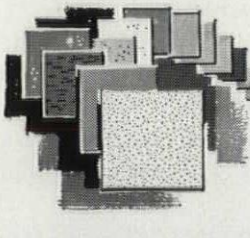

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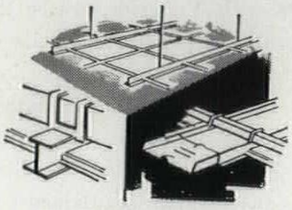

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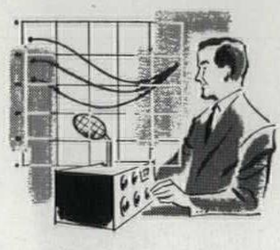

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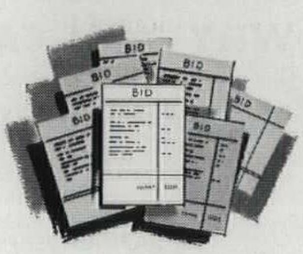

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reviews

(Continued from page 236)

This book is a most significant one, for the author tries to present a unified theory of proportion and, from a historical point of view, he succeeds. The book contains the most complete outline of the evolution of proportion which has been written in English. Most of the important systems of proportion used from the time of Vitruvius to Le Corbusier are evaluated and the evolution is skilfully traced. This is the first book to cover this wide and important field and must therefore be considered a significant contribution. Now that the field has been tied into an integrated whole, it is hoped that many scholars will follow and improve upon Scholfield's example, and also that they will go back even further; to Ancient Egypt, to incorporate the studies of Else Christie Kielland and other Egyptologists.

Being first is always very difficult, and there are numerous points in the book needing further clarification and considerable work; but, at last, we have a beginning worthy of discussion and improvement. The book begins with an excellent introduction to the field and explains simply some of the basic mathematical properties of proportional systems. The history starts with Vitruvius, where the author tries to reconstruct the details of Vitruvius' own system of proportion. This work is of a very tentative nature and merits additional study. The use of harmonic proportion during the Renaissance is successfully explained in terms of the new concept of number patterns, which the author relates directly to Vitruvius. It is by the use of number patterns that Scholfield obtains the basis for his unified theory. This is most interesting, for in some of the latest research into standardization and efficient building practice, the number-pattern approach appears to give the best results. This makes one wonder whether the mythology developed by the ancients to explain proportion was not just a rationalization of good building practice. The study of Renaissance proportion owes much to Professor Wittkower's book, *Architectural Principles in the Age of Humanism*. But the great merit of Scholfield's work is that he puts Renaissance proportion into a unified theory. The reasons for the decline of harmonic proportion are well presented. The musical analogy is shown to be lacking and many interesting quotations are cited to illustrate this point. Claude Perrault said that sounds cannot be altered without offense to the ear, as we realize when a singer is "off key," but visual proportions can be changed. Hogarth ridiculed the application of the musical analogy or indeed any system of mathematical proportion applied to the human figure, and Lord Kames introduced the idea of perspective changing visual proportions while musical notes are unaffected by such a consideration. It is in this criticism, and in the study of the incommensurable systems of proportion evolved from Gothic times to the present, that the most significant contribution of schol-

(Continued on page 244)

Heating, Ventilating and Cooling of Schools

By F. J. KURTH, Vice President in Charge of Engineering, Anemostat Corporation of America

Educational efficiency

The Anemostat Dual Duct High Velocity System provides a controlled and healthy environment in accordance with the highest standards of comfort and is therefore conducive to more vigorous activity in the classrooms. It is a modern heating and ventilating system, carefully researched and new in concept, and is economical to install and operate. It is an effective heating and ventilating system, which later can be readily adapted to air conditioning by the addition of a central-station type refrigeration system.

Because large sums of money must be spent for new schools, it is important to study all factors which will improve educational efficiency. Though well constructed and equipped, many new schools are not provided with modern heating, ventilating or cooling systems which furnish comfort during all seasons of the year. Experience has shown that a proper climatic condition will improve student and teacher efficiency to the extent of a cumulative gain of approximately twenty percent.

System design

First the volume of air required for a classroom must be determined. In most communities this is regulated by local codes on a cubic foot per pupil basis.

Although requirements vary in different localities from ten to thirty cubic feet of fresh air per minute, there are other factors which must be considered: for ventilation purposes, when cooling is not used, a large volume of air will, of course, do a better job than a small volume; however, the introduction of from 1000 to 1200 cubic feet of air per minute is adequate. If air conditioning is installed, the engineer may specify air temperature differentials of 30° or more between the supply air in the cold duct and the room temperature—Anemostat Air Diffusers will diffuse air at high temperature differentials without draft.

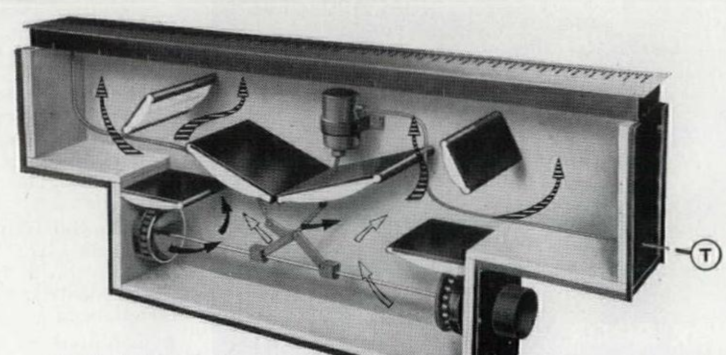
Location and type of units

The location of the units in the classroom is determined by the climate of the community in which the school is located and the construction of the school with particular reference to glass areas. When winters are severe the *under the window type units* must be used and two units per classroom should be installed as shown on the layout. The return air can be moved through corridors, ducts in corridors or exhaust plenums in the corridor ceilings.

In schools in mild climates or in colder climates where double glazing is used, the *sidewall units* will do an excellent job of year-round heating, ventilating and cooling. Two units providing from 500 to 600 CFM each per classroom are recommended. The return air can be returned to the fan through corridors, corridor ducts or plenums.

When two units are installed in a classroom, both are controlled by one

The Basic Principle of Anemostat School Units



Typical Anemostat
Dual Duct High Velocity Unit

The illustration shows a high velocity unit designed for a dual duct system for either heating and ventilating or complete air conditioning. To maintain ideal conditions, air is evenly and draftlessly diffused at high velocity throughout the classroom at controlled temperature; one duct carries cold air from the outside of the building, or cold air cooled by coils and mechanical refrigeration, the second duct carries warm air, which consists of a mixture of fresh and recirculated air heated by hot water or steam coils from heating boilers or by hot air furnaces. The thermostat in the classroom opens the hot air valve and closes the cold air valve, or vice versa depending on the room temperature requirements.

thermostat which should be located on an inside wall.

Ducts

The ducts can be installed in various ways depending on the type of structure: beneath the floor, on classroom or corridor ceilings, in roof spaces or on top of the roof. If tile or transite pipe is used the ducts can actually be buried in the ground. Because no water or steam is used, the ducts can be run in practically any space, as corrosion or trapping is not a problem.

Equipment room

For reasons of economy, the fan room or rooms should be so located as to keep the duct runs as short as possible. However, there is no problem in running ducts long distances; dual duct systems in commercial buildings often have duct-runs of over 500 feet. The fans are usually of the Class II type and can be either the forward or backward curve type. Consideration should be given to fans of the air-foil type, which are designed for quiet operation at high pressures.

Mechanical or electrostatic filters are generally used in high class commercial buildings and should also be considered for schools. Clean, filtered air properly diffused at controlled temperature is the answer to health and comfort in classrooms.

reviews

(Continued from page 240)

arship is made in the book. The comparison of Hambridge, Lund, Moessel, Henry Roberts, Sir Edwin Lutyens, and other theorists of this period presents a picture from which the reader can choose what he believes to be worthy in proportional theory. The appendices present additional technical information on proportion and study the additive properties of two of the most important of the irrational proportional systems, the Root 2 and Root 5 series, and their derivatives.

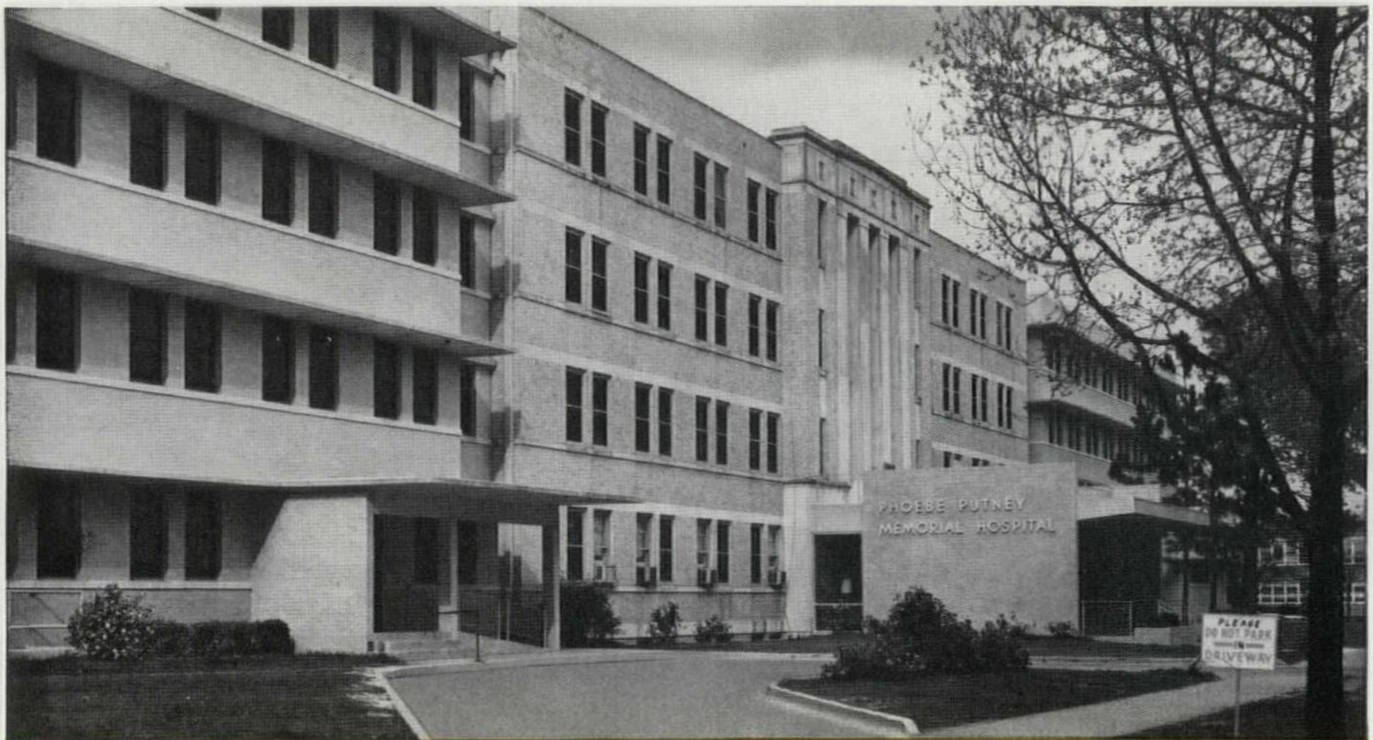
The author is on weak ground, however, when he leaves history and tries to make recommendations for the incorporation of proportion in present-day practice. The main reason for this weakness is that proportion is treated in terms of the nontechnical society of the past, where products were made by hand. Today, building materials are mass produced and must fit together simply. The author states that proportional systems based on whole numbers alone seem less likely to be effective than systems based on irrational numbers. He maintains that flexibility is increased when using incommensurable rather than commensurable ratios. This is not the case when one is dealing with factorymade components. When using incommensurable systems of proportion, each has products of different sizes which can only be used together as part of that closed system. Le Corbusier's use of two geometric series, one twice the size of the other, assures a link only in terms of this 1 to 2 relationship (**Table 1**). These series are developed in relation to the six-foot man.*

Table 1

Red Series	Blue Series
1"	2"
1½"	3"
2½"	5"
4"	8"
6½"	13"
10½"	21"
17"	34"
27½"	55"
44½"	89"
72"	144"
116½"	233"

(Continued on page 248)

* *Le Modulor by Le Corbusier, page 56.*



CHARLES H. McCAULEY, Architect*

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Installed in Phoebe Putney Memorial Hospital, Albany, Georgia

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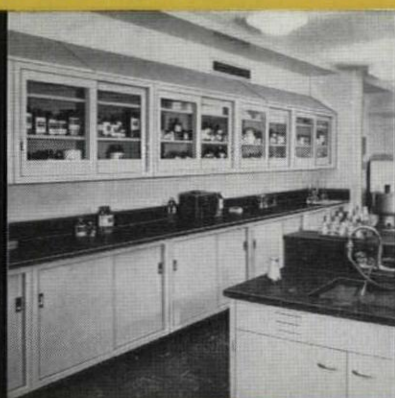
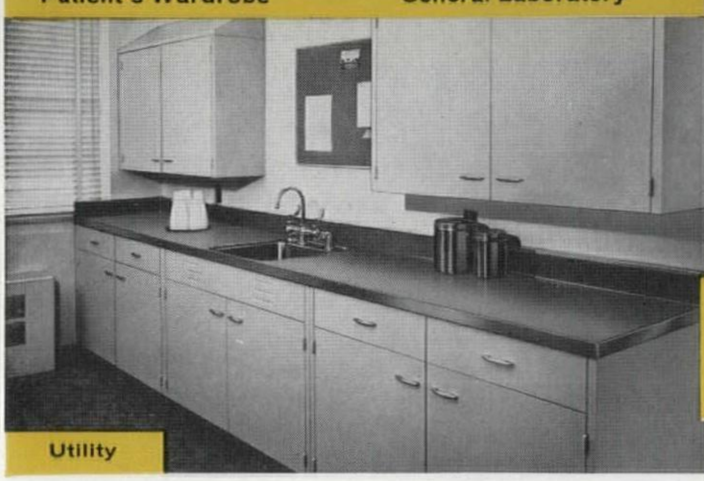


General Laboratory



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Henry County Hospital, Abbeville, Ala.
Carter County Hospital, Elizabethton, Tenn.
Alachua General Hospital, Gainesville, Fla.
North Jackson Hospital, Bridgeport-Stevenson, Ala.
Blount County Hospital, Oneonta, Ala.
Elmore County Hospital, Wetumpka, Ala.
Perry County Hospital, Marion, Ala.
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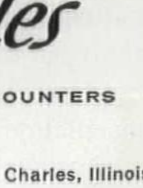

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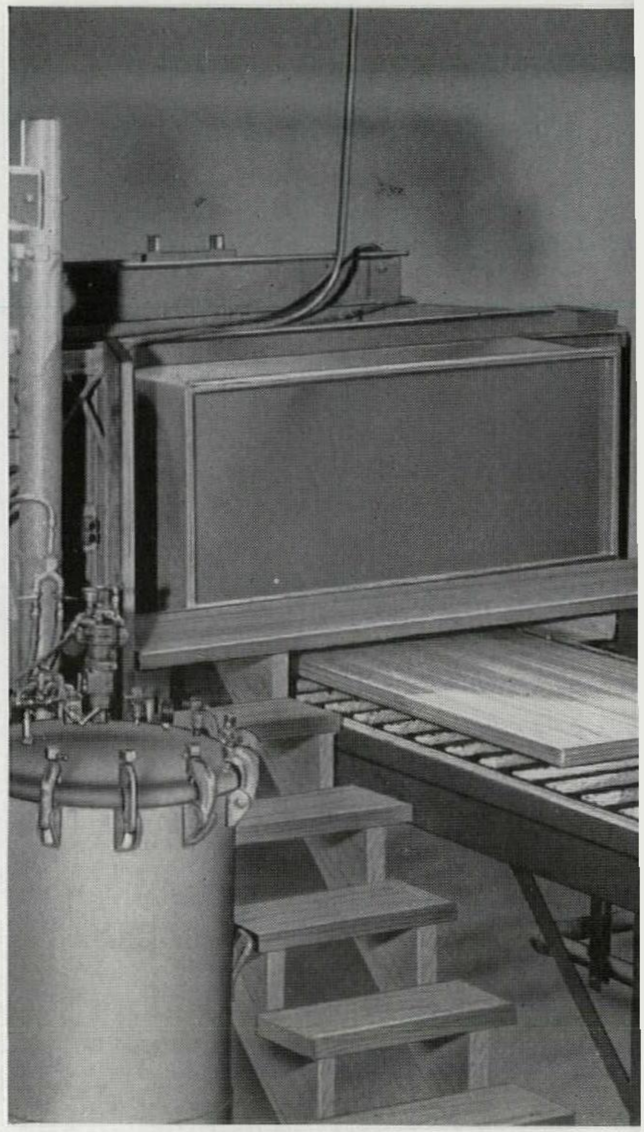

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The building expert will readily see the important quality, cost-saving and other advantages of having doors primed and sealed at the factory.

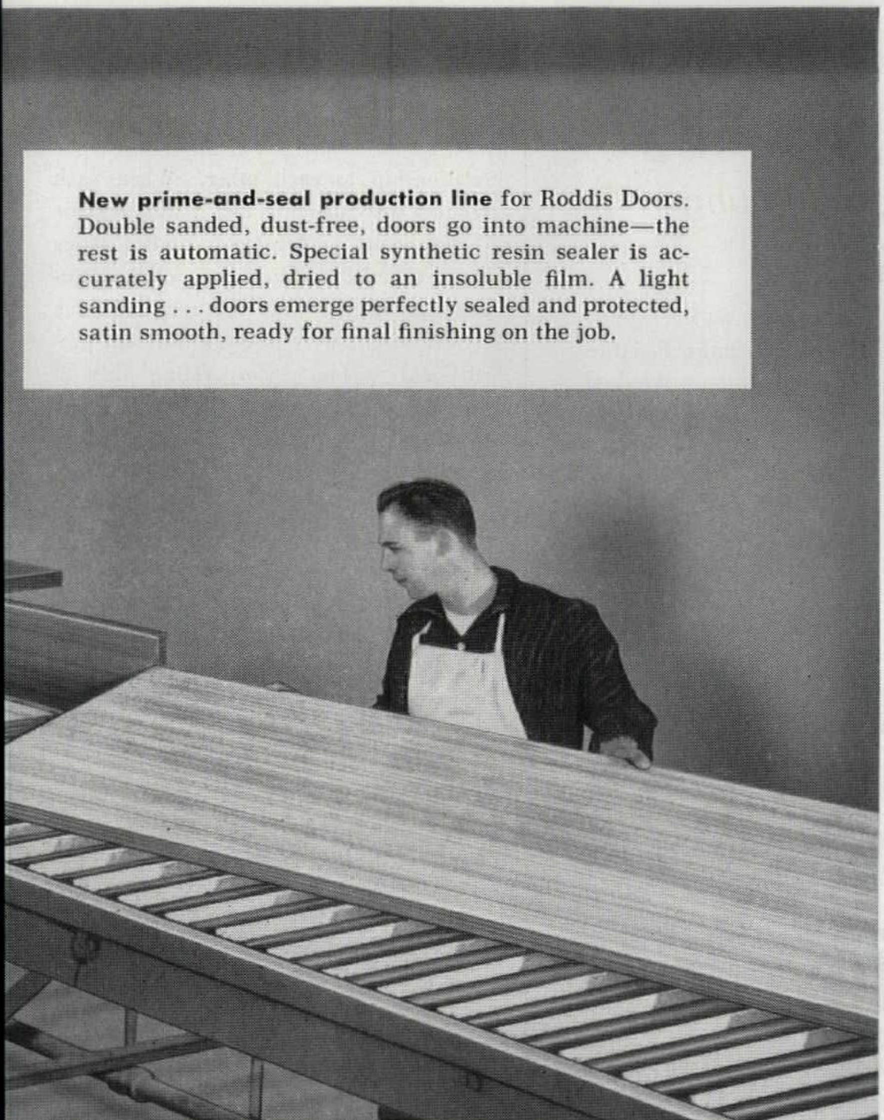
Roddis' new production line system means doors are always sealed under ideal conditions. The entire operation is automatically controlled. Special Roddis synthetic resin sealer is applied in an unvarying film depth to all surfaces and edges. The result is a *prime and seal* finish with perfect uniformity of coverage, unmatched smoothness.

Roddis *prime and seal* locks in wood beauty, shuts out dirt, fingerprints, disfiguring stains, and troublesome moisture during transportation and installation. Final finishing of doors on the job is made practically foolproof.

Specifying *prime and seal* on Roddis Doors costs very little extra—and this is more than offset on the job by savings in time and labor alone. Add to this your confidence that the final finishing will give the clean, lustrous, beautiful job you want.

You can also specify
complete custom pre-finishing
from prime and seal to final finish coat!

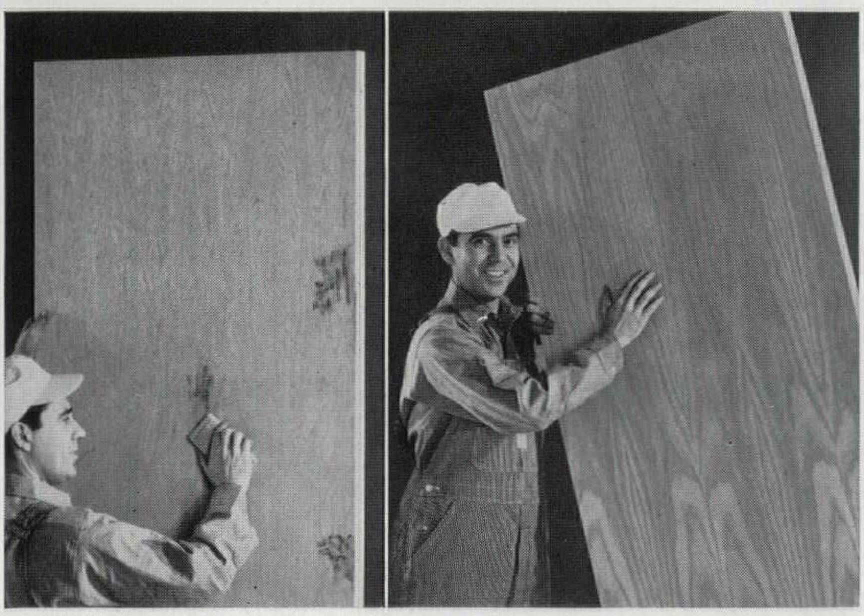
Doors professionally and beautifully pre-finished in color tones to match any of the 9 woods in the famous Roddis line of pre-finished Craftwall wood paneling . . . or to your color sample for those "special effect" doors you may be planning.



New prime-and-seal production line for Roddis Doors. Double sanded, dust-free, doors go into machine—the rest is automatic. Special synthetic resin sealer is accurately applied, dried to an insoluble film. A light sanding . . . doors emerge perfectly sealed and protected, satin smooth, ready for final finishing on the job.

No more "starved" door faces, from uneven penetration of final finish, with Roddis *prime and seal.* Automatic application-control assures uniform undercoating for lustrous final finishes. Factory sealing helps prevent moisture discolorations and "blue stain" on oak doors.

Doors clients will admire! Even Roddis Doors, known for quality, can *look* only as good as their finish. Factory *prime and seal* helps even skilled tradesmen do better finishing quickly—produce unblemished, beautiful doors you'll okay with pride.



What a difference prime-and-seal makes! Raw, unprotected door at left shows smudges, fingerprints, scuffs, so often inflicted during transportation and handling by tradesmen. Cleaning and re-sanding on the job take time to do properly. Door at right, Roddis *primed and sealed,* is unmarred, clean, dry . . . perfect for final finishing.

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City ____________ Zone ______ State ______

reviews

(Continued from page 244)

relationship to each other. When each product was custom-made, it was possible If one wants to develop a similar series based on an 8′ ceiling, none of the components will fit with the red and blue series! If one were to use a different proportional system incorporating this 8′ dimension, the products would bear no to use these irrational relationships in design, but today the basic additive property used in building construction is the repetition of identical products—whether bricks, windows, or panels—and structural sizes must incorporate different numbers of identical products.

Flexibility in modern design must be keyed to whole number relationships. Here, 6′ may be divided into two sizes of 3′, and 8′ may be divided into two 4′ sizes, or 3′ and 5′, as well as many other combinations. Then these different sizes may be combined in different ways.

Table 2

20' =	two 8's + one 4'
	two 3's + two 5's + one 4'
	two 5's + one 4' + one 6'
	five 4's
	two 6's + one 8'
	two 3's + one 6' + one 8'
	two 3's + one 6' + two 4's
	two 3's + one 6' + one 5' + one 3'
	four 3's + one 8'
	four 3's + two 4's
	five 3's + one 5'

Similar flexibility may be achieved at any foot interval. This is the approach needed in present-day construction. In some cases, this flexibility may be combined with incommensurable systems of proportion, but only where these systems may be approximated by whole numbers.

Another weak point arises where the author does not realize the effect of scale in geometric series when applied in practice. He states, for instance, that *Le Modulor*, whose lowest common denominator is ½″, would be equally effective if multiplied by another factor. Four inches was given as one possibility. If this were done, the entire scale would be changed, as can be seen by comparing *Le Modulor* (**Table 1**) with a similar system having 4″ as a common denominator (**Table 3**).

(Continued on page 252)

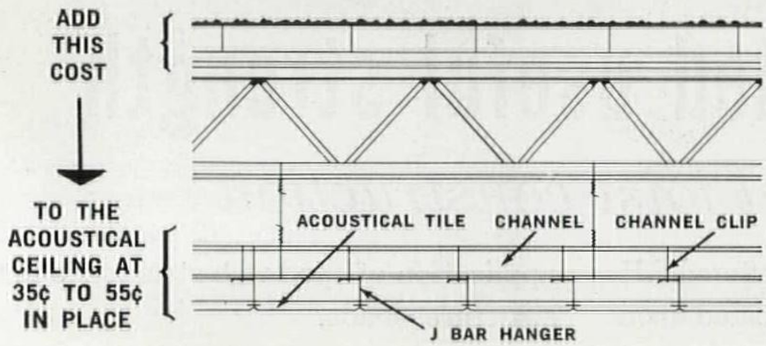

20,000 psi

Object lesson in acoustical ceiling costs

Tectum acoustical roof decks save 50% on acoustical control

Two accepted types of sound absorbing ceilings are illustrated below: The first is a standard mineral acoustical tile in a metal suspension system; the second is Tectum plank roof deck. The first type necessitates both a roof deck and a suspended ceiling. The second, only a roof deck. Let's look at a cost comparison.

35c to 55c installed ... ceiling only



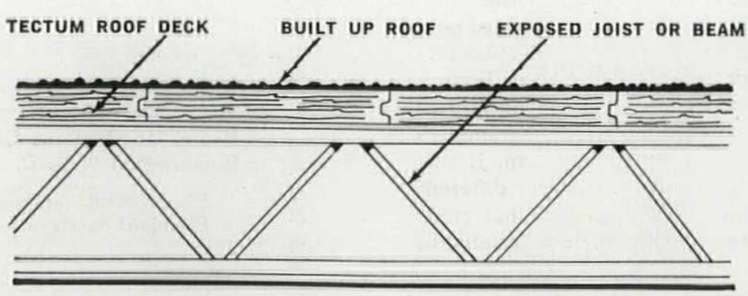
Typical suspension system

This is a conventional firesafe, acoustical tile ceiling in a standard suspension system. Costs range from 35¢ to 55¢ per sq. ft. in place, depending upon location. The suspended acoustical ceiling is best employed in areas where ceilings are to be lowered or where unsightly ducts and utility lines must be concealed.

For new construction, the cost of the suspended acoustical ceiling must be added to the cost of the insulated roof deck, for a true comparison with other methods.

Average 45c ... ceiling and roof deck complete

ONE MATERIAL
ONE LABOR COST



.70 TO .85 SOUND REDUCTION RATING

A Tectum roof deck, by comparison, is a one-step operation of erecting roof deck panels over joist, beam or sub purlin framing. Tectum deck, available from 2" to 3" thick, is a structural board with either tongue and groove edges or with rabbetted edges for use on bulb-tees. Tectum has excellent insulating, acoustical and load bearing values and is firesafe and durable. When it is left exposed, it provides sound absorption up to .70 for 2" material, .75 for 2½" and .85 for 3" thickness. When the Tectum roof deck is erected the acoustical ceiling is in place. One material cost — one labor cost. Tectum is widely used for acoustical ceiling requirements in schools, churches, factories, commercial buildings, residences and public buildings; ***saves up to 50% over other methods.***

reviews

(Continued from page 248)

Table 3

Le Modulor: 4" Common Denominator

Red Series	Blue Series
8"	16"
12"	24"
20"	40"
32"	64"
52"	104"
84"	168"
136"	372"
220"	440"
356"	712"
576"	1152"
932"	1864"

The anthropometric relationships upon which the system was originally based have been completely changed. The intended ceiling height of 89", has given way to two possible sizes—84" and 104" —one too small and the other too large. The door size which was tight at 34" for both frame and door is reduced to 32". Other relationships are thrown out of scale, and if the mutant had been used at Marseilles, the Unite d'Habitation would have been a freak.

Where one wishes to change a geometrical pattern so that the terms are divisible by a new module, scale must be taken into account. There is only one possible way of changing *Le Modulor*. This is in terms of a 9" module and is shown in **Table 4**.

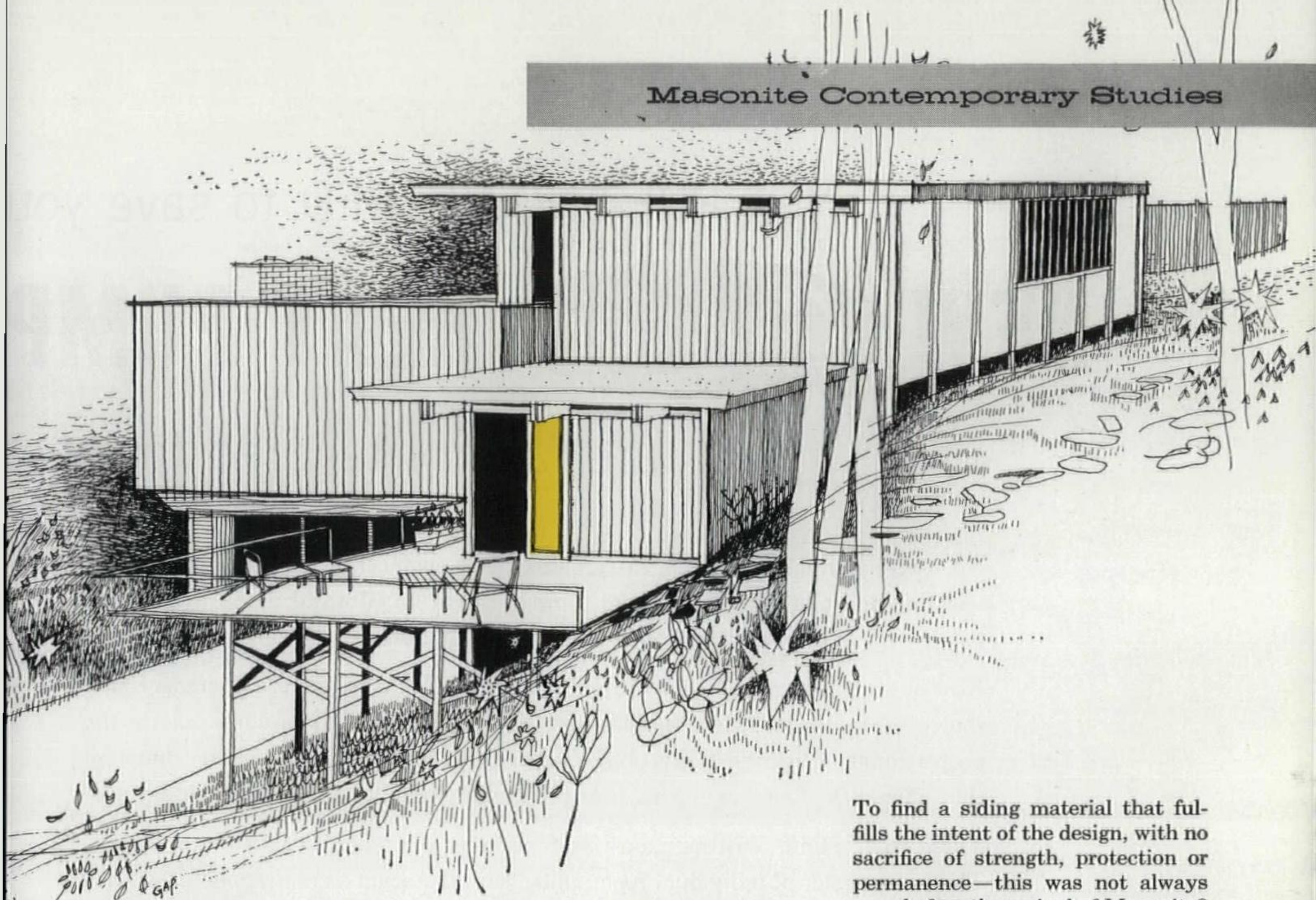
Table 4

9" Multiple	Red
18"	17"
27"	27½"
45"	44½"
72"	72"
117"	116½"
189"	188½"
9" Multiple	**Blue**
36"	34"
54"	55"
90"	89"
144"	144"
234"	233"
378"	377"

Here, the largest difference between the two sets of numbers is 2" (between 34" and 36") and it may be argued that 36" is a more suitable dimension. With these dimensions, the flexibility has been increased, for not only may 18" be doubled to give 36", but it may be used

(Continued on page 256)

Masonite Contemporary Studies



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are factory tailored to meet

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Now he need only refer to the Carrier Heat Pump Weathermaker* Systems Chart shown below to determine the pre-selected components that provide exactly the proper range of heating and cooling capacity. It's another first from the company that offered the first commercial heat pump more than a quarter of a century ago.

These Heat Pump Weathermaker Systems offer a maximum latitude of design. There is a choice of individual room units, central station or multi-zone units with duct work to distribute conditioned air. You may also select air-cooled condensers or water-chilling machines to match the heat source and capacity desired. And because all Carrier components come in a wide range of basic capacities, there is a system that is tailored to meet the requirements of any climate.

The new pre-engineered Heat Pump Weathermaker Systems are available in factory-rated capacities from 5 tons and in four basic types: air to air, air to water, water to air and water to water. Selected representative sizes shown in charts below. Call the Carrier dealer listed in the Yellow Pages of your telephone book for details now, or write Carrier Corporation, Syracuse, New York.

*Reg. U.S. Pat. Off.

Selecting components is simple as ABC wi

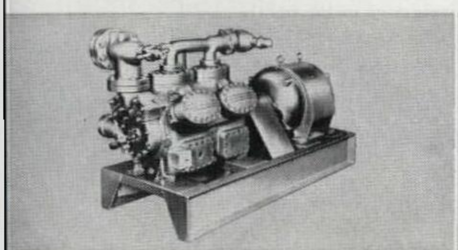
AIR TO AIR COOLING CAPACITY†			HEATING, IN 1000 BTUs/HR††			EQUIPMENT					
TONS	CONDENSING TEMPERATURE °F	COMPRESSOR BHP	OUTDOOR AIR DESIGN TEMP. 0° F	+10° F	+20° F	COMPRESSOR UNIT REFRIGERANT R-12	C-500	COMP. MOTOR HP	OUTDOOR AIR UNIT	INDOOR AIR UNIT MODEL No.	CFM
12.4	116	14.9	65.1	79.1	95.6		5F40	15	9A14	39AC7	3,320
22.9	116	28.7	127.0	154.0	185.0	5H40		30	9A25	39AC8	5,170
43.2	116	50.0	234.0	284.0	343.0		5H60	50	9A52	39AC10	11,800
70.0	119	88.0	382.0	470.0	570.0	5H120		100	9A75	39AC12	18,900
116.0	115	131.0	602.0	740.0	897.0		5H80/80	125	9A121	39AC14	31,400

††Capacities based on 70° F air entering indoor coil, and nominal liquid sub-cooling with ventilation air.

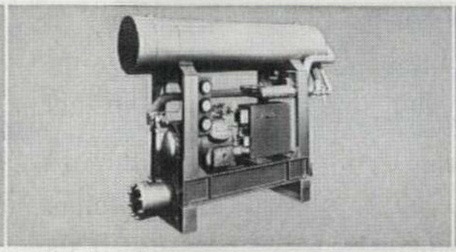
hours of selection time!

WEATHERMAKER SYSTEMS

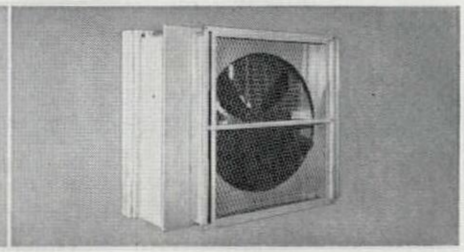
commercial and industrial requirements



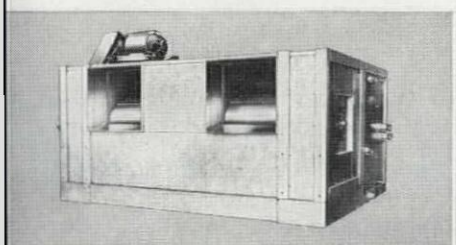
Heart of Heat Pump Weathermaker Systems: Dependable Carrier Compressors are the product of more than 50 years of refrigeration experience.



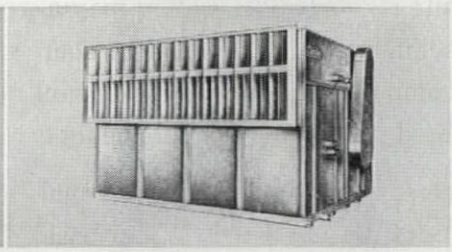
For water source or distribution: Carrier Water-Cooling Machines match coolers, condensers and hermetic compressors for maximum efficiency.



For air source application: New Carrier Air-Cooled Condensers are installed singly or in multiples to perfectly match required capacity.



To heat and cool through ducts: Carrier Central Station Weathermakers feature building block design with system mated fans and coils.



For zone control: Carrier Zoning Weathermakers permit heating or cooling of up to 14 zones or rooms. Heats and cools different zones simultaneously.

For room-by-room conditioning: Carrier Room Weathermakers give individual control for chilled and hot water air conditioning.

this new Carrier Heat Pump Weathermaker Systems Chart

AIR TO WATER COOLING CAPACITY†			HEATING OUTPUT, BTU/HR			EQUIPMENT					
			OUTDOOR AIR DESIGN TEMP.			COMPRESSOR UNIT REFRIGERANT				CONDENSER-CHILLER	
TONS	CONDENSING TEMPERATURE °F	COMPRESSOR BHP	0° F	+10° F	+20° F	R-12	C-500	COMP. MOTOR HP	OUTDOOR AIR UNIT	MODEL No.	GPM
21.1	116	28.0	95,500	122,700	154,000	5H40		30	9A25	DXH1209K	50.6
42.0	116	55.0	193,000	246,000	308,000	5H80		60	9A52	DXH1611L	101.0
52.8	116	69.5	244,000	314,000	393,000	5H40-60		75	9A63	DXH1613L	126.7
71.8	119	96.7	332,000	428,000	538,000		5H120	100	9A75	DXH2012L	172.0
98.1	117	127.0	461,000	590,000	744,000		5H80/80	125	9A121	DXH2411L	235.0

Comparable charts for other types of systems available from your Carrier dealer

reviews

(Continued from page 252)

three times to give 54″, four times to give 72″, and five times to give 90″.

There is room for disputing some of the author's concepts and interpretations of history, particularly on the use of number patterns to explain Vitruvius' ideas. This weakness is apparent in the patterns he uses to relate three geometric series where the relationships are rather obscure. However, this point is debatable. As long as the author keeps to history, he is, at worst, on grounds which are disputable. It is unfortunate that he did not write the book entirely from the historical point of view. *The Theory of Proportion in Architecture*, however, must be considered an important contribution; and future scholars, when writing on the theory of proportion, may well cite Scholfield in defense of their ideas—or find it necessary to prove him wrong before continuing with their own theories.

EZRA D. EHRENKRANTZ
College of Architecture
University of California
Berkeley, Calif.

avant-garde art series

Fautrier. *Michel Ragon. Pocket Museum Series, Golden Griffin Books, Inc., 667 Madison Ave., New York, N. Y., 1958. 60 pp., illus. $2.95*

Poliakoff. *Michel Ragon. Pocket Museum Series, Golden Griffin Books, Inc., 667 Madison Ave., New York, N. Y., 1958. 48 pp., illus. $2.95*

These books, both written by Michel Ragon, are the first of a series. Each is a flattering account of the painters, Fautrier and Poliakoff, rather than a critical evaluation. The texts can be read in ten minutes. The illustrations, approximately postcard size, are their virtue, and they are indeed excellent.

The project, sponsored by Arts, Inc., deals with established avant-garde painters and sculptors. The reader may well question the value of such works—loaded with complimentary quotations and fulsome praise. They have the aura of promotional publications.

And what of Fautrier and Poliakoff? Both better known in their native France than in the United States, the latter im-

(Continued on page 262)

always a good combination...

*when independently hinged door control is preferred

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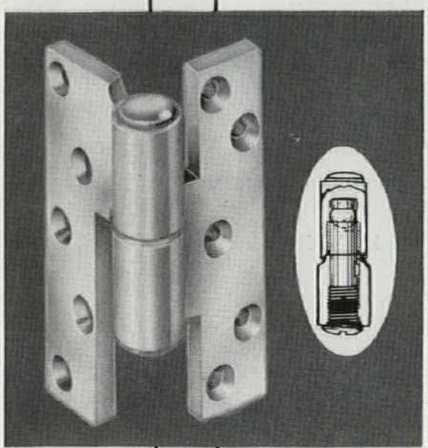

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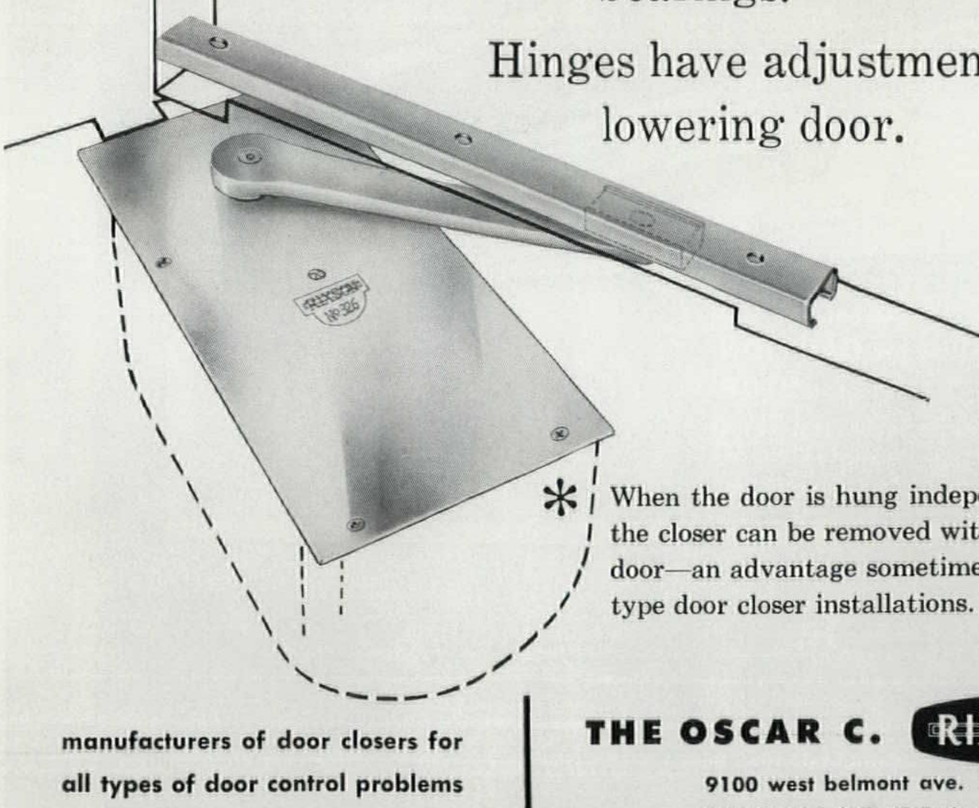

* When the door is hung independently on butts, the closer can be removed without removing the door—an advantage sometimes desirable in floor type door closer installations.

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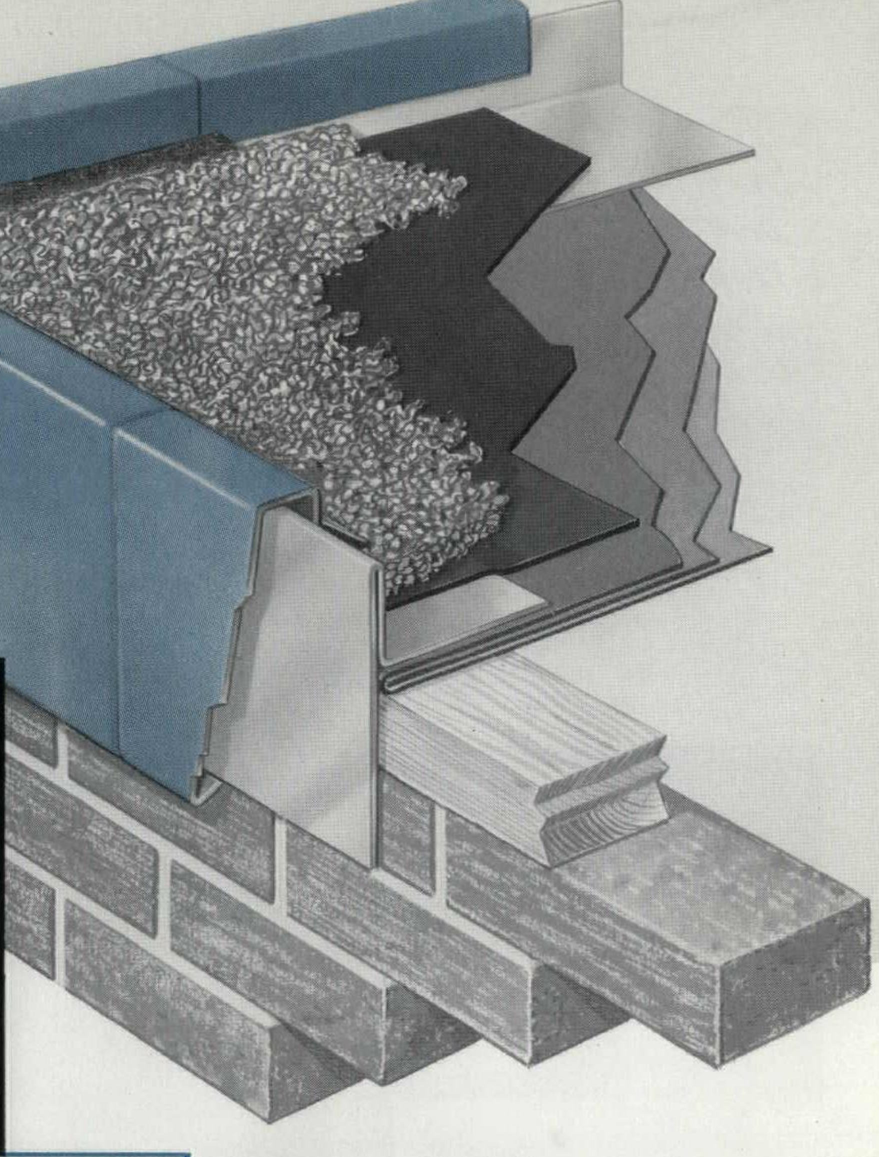
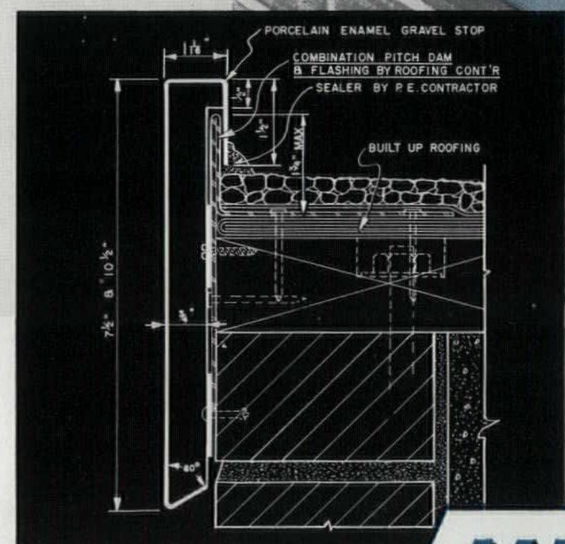
Photo by Hedrich-Blessing





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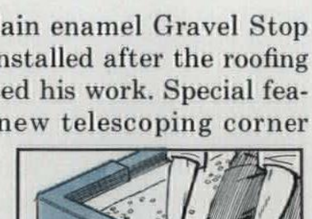
Davidson's new porcelain enamel Gravel Stop Fascia System can be installed after the roofing contractor has completed his work. Special features include the *all* new telescoping corner which eliminates field measurements and permits flexibility of design, accuracy of installation, and weather tightness.



Available in standard face dimension sizes — 7½" (#750), and 10½" (#1050), the new Davidson Gravel Stop fits over roof flashing already in place. This new Gravel Stop is also available with flush corner instead of telescoping corner.

As an added extra advantage, the Davidson Gravel Stop Fascia System has two coats of porcelain on all surfaces and is available in an extensive range of one and two colors, gloss, stipple, and semi-matte finishes.

For further detailed information on this new Gravel Stop, write . . .

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reviews

(Continued from page 256)

presses one more, on the strength of the presentations. That is, unless one sets up Malraux as an infallible critic. If so, primal place goes to Fautrier. Ragon as an author (not a critic, here) suffers from a somewhat uninspired translation. But, apart from the monographs, one generally regards Poliakoff as an "abstract academic," Fautrier as an experimenter in technique with monotony in presentation. Michel Ragon never admits less than adulation. It will be interesting to see how writers on Soulages, de Staël, etc., will handle their subjects in the future "Pocket Museum."

MILTON E. FLOWER
Dickinson College
Carlisle, Pa.

selection versus chronicle

The Pelican History of Art. *Edited by Nikolaus Pevsner. Volume Z14:* **The Art and Architecture of Ancient Egypt.** *W. Stevenson Smith. Volume Z15:* **Architecture: Nineteenth and Twentieth Centuries.** *Henry-Russell Hitchcock. Volume Z16:* **Art and Architecture in Italy: 1600 to 1750.** *Rudolf Wittkower. Penguin Books Inc., 3300 Clipper Mill Rd., Baltimore, Md., 1958. Illus. $12.50 per volume.*

It might seem illogical and arbitrary, at first sight, that three volumes dealing with such vastly different epochs as Ancient Egypt, Baroque Italy, and modern civilization should be reviewed together. Yet the points of reference are many, enough to set the reader thinking about two problems of interest to anyone whose business is architecture as cultural continuity.

The first problem is one of method. With a noticeable reawakening of historical interest among America's top designers, the illustrated textbook on past architectural epochs will gain in importance. It is obvious that Saarinen's references to Palladian plans, Yamasaki's claims to Egyptian and Gothic inspiration, Johansen's recent tie with the Celtic round plan, and many other such instances have to come from books rather than personal experience. The question

(Continued on page 266)

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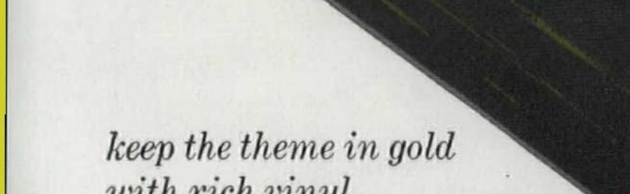

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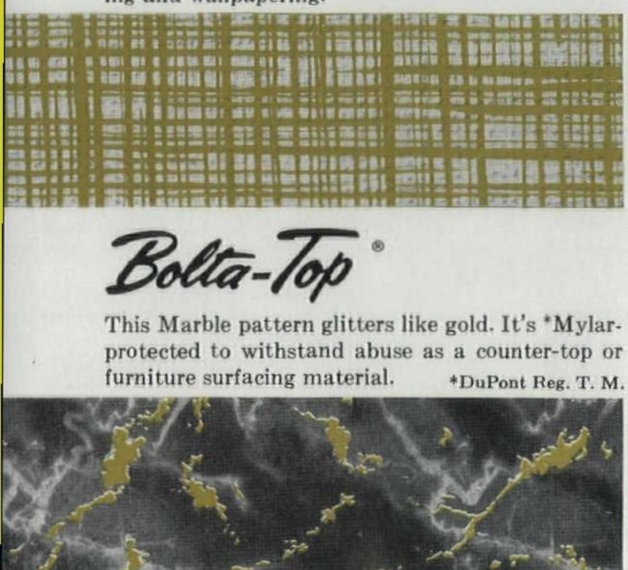

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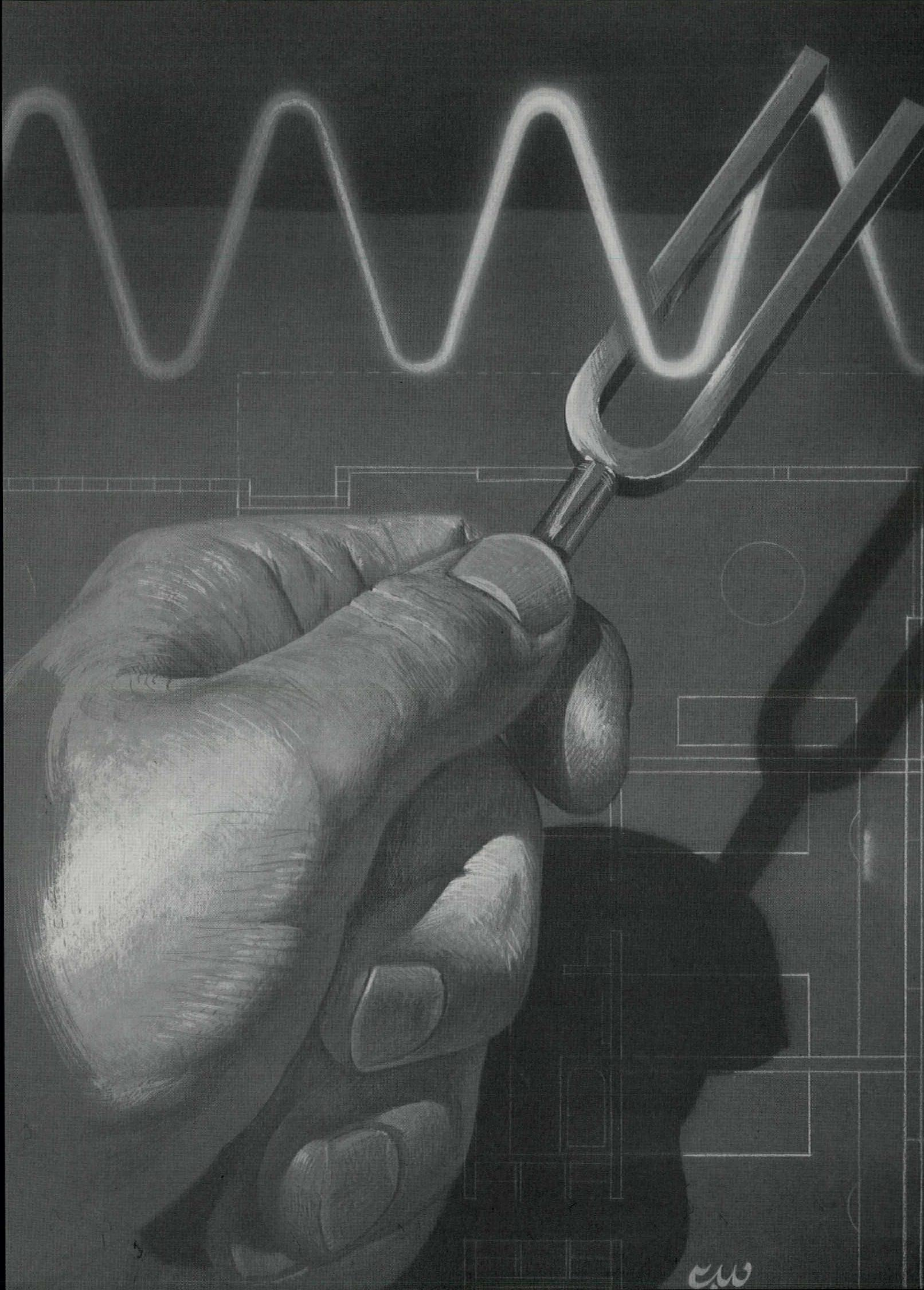

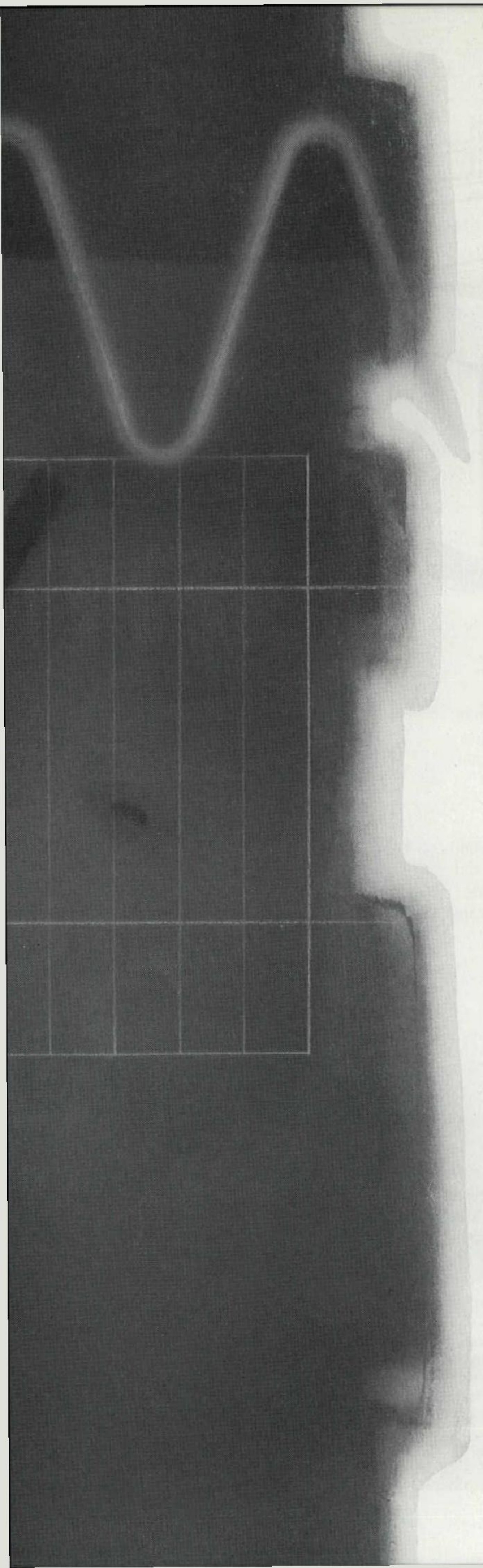

reviews

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is: how much should the ideal historical account cover? The decision lies between selection, based on expert knowledge and inevitable personal idiosyncrasies, and blanket coverage, based on the objective conscience of the historian who serves history impartially. The two approaches are very well formulated in two of the new Pelican volumes. Professor Wittkower, in his *Art and Architecture in Italy: 1600-1750*, writes: "Instead of saying little about many things, I attempted to say something about a few things. . . . It was necessary to prune the garden of history not only of dead, but, alas, also of much living wood. . . . In doing this, I availed myself of the historian's right and duty to submit to his readers his own vision of the past. I tried to give a bird's-eye view and no more of the whole panorama, and reserved a detailed discussion for those works of art and architecture which, owing to their intrinsic merit and historical importance, appear to be of special interest. . . . History degenerates into chronicle if the author shuns the dangers of implicit and explicit judgments of quality and value."

The result is a book of superb taste and awesome erudition. Being a writer of exceptional fluidity, Wittkower makes the reader forget that he never intended to learn so much about so little. He succumbs easily and admiringly to the presentation of *the leaders* whose overriding genius can, perhaps, best be judged against an inborn resistance, native to the 20th Century, to their style.

Henry-Russell Hitchcock's *Architecture: Nineteenth & Twentieth Centuries*, on the other hand, is sheer chronicle. Here the description on the cover states: "The scope of this volume is international; it covers not only the countries of Europe but also North and South America and Australia, and considers the works of the most influential architects and movements." Since the whole text comprises 427 pages, a mere listing of names and buildings is inevitable, with the notable exception of a very few outstanding men. The result is unsatisfactory

(Continued on page 270)

Exciting new masonry walls, exterior or interior, are made possible with decorative masonry units now available from concrete block manufacturers. For example, this unusual masonry wall was created by Architect Victor Lundy of Sarasota, Florida, for showing at Cleveland meeting of National Concrete Masonry Association. The block was produced by Shaffer Block Works, Somerset, Pa.

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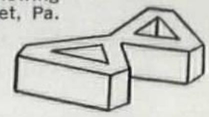

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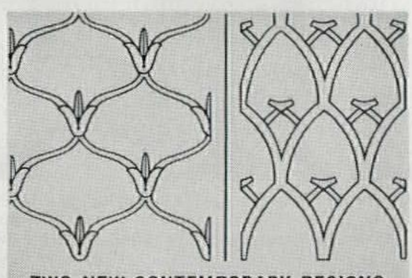

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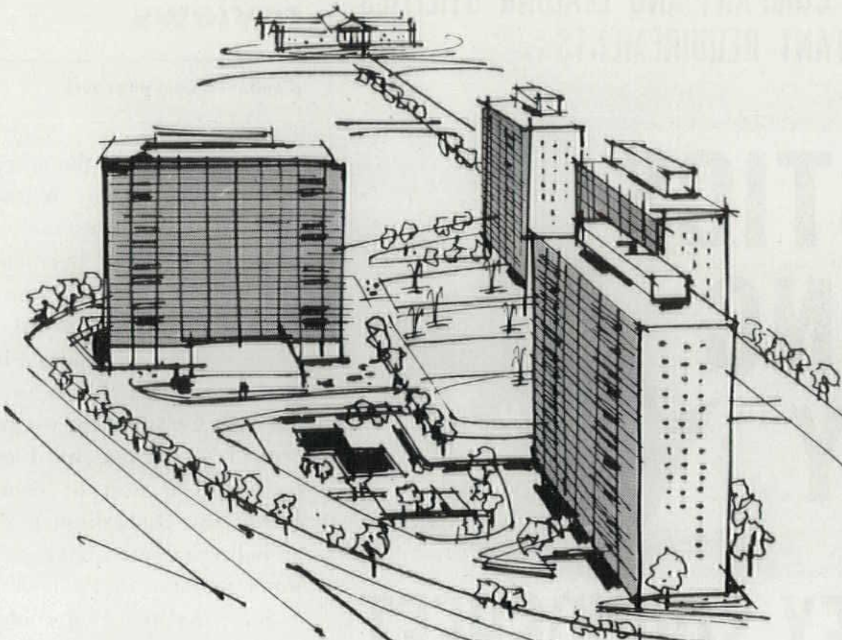

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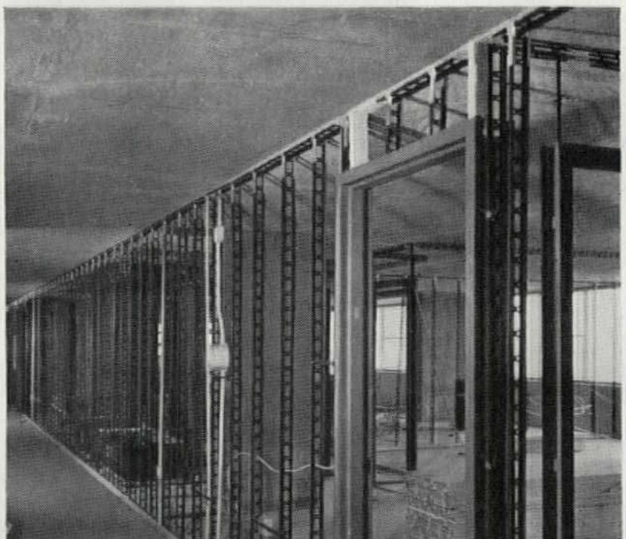

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reviews

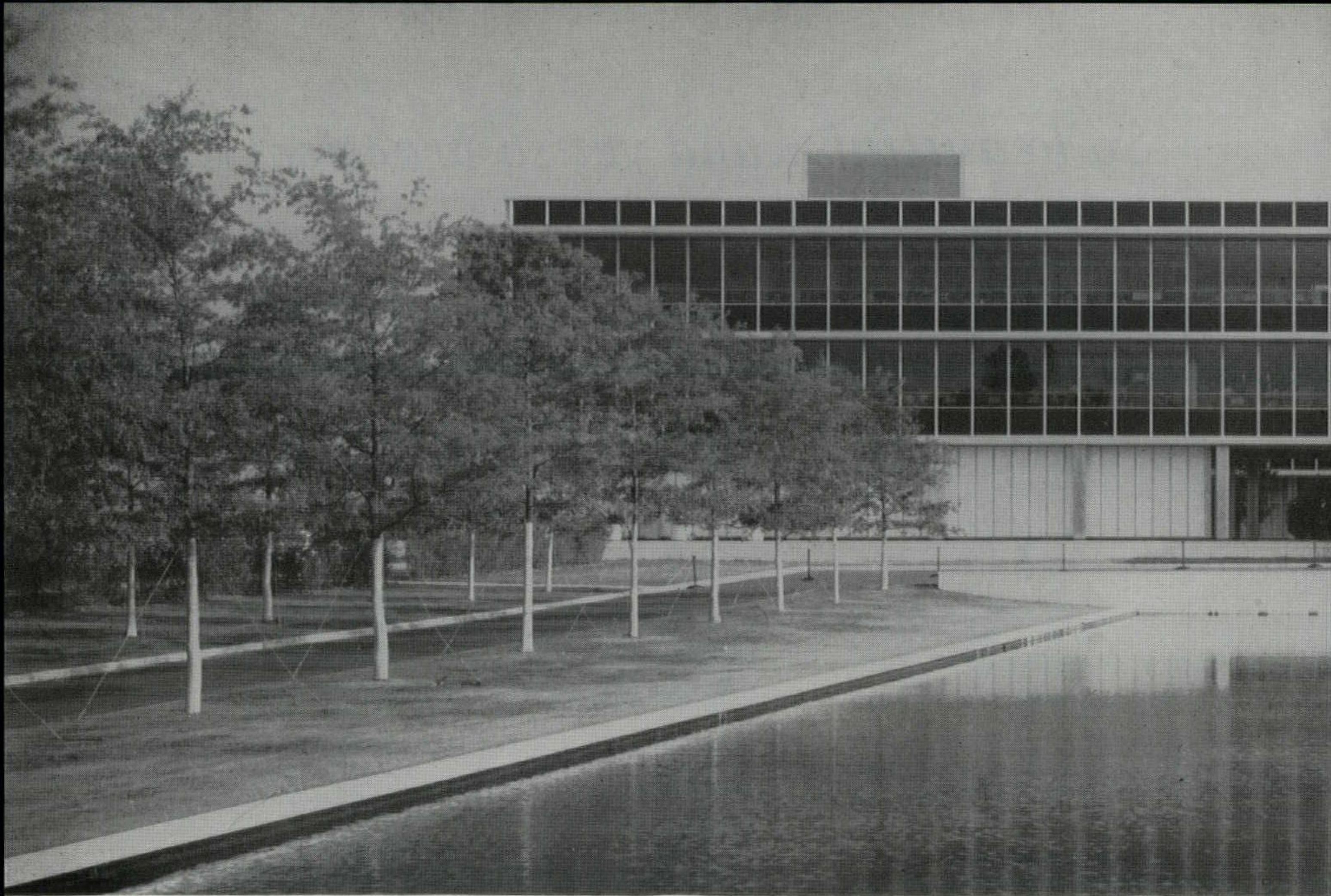
(Continued from page 266)

and detrimental to the acceptance of the treated styles. Where Wittkower's aristocratic taste manages to "sell" such extravagant forms as Borromini's architecture and Bernini's sculpture by omitting (mercifully) the dreadful pastiche Baroque that flooded Europe in their wake, Professor Hitchcock is so in love with the 19th Century that we get a complete retread of his massive *Victorian Architecture.* The best of Soane, Schinkel, Webb, and Richardson is devaluated by an indiscriminate juxtaposition with their worst imitators.

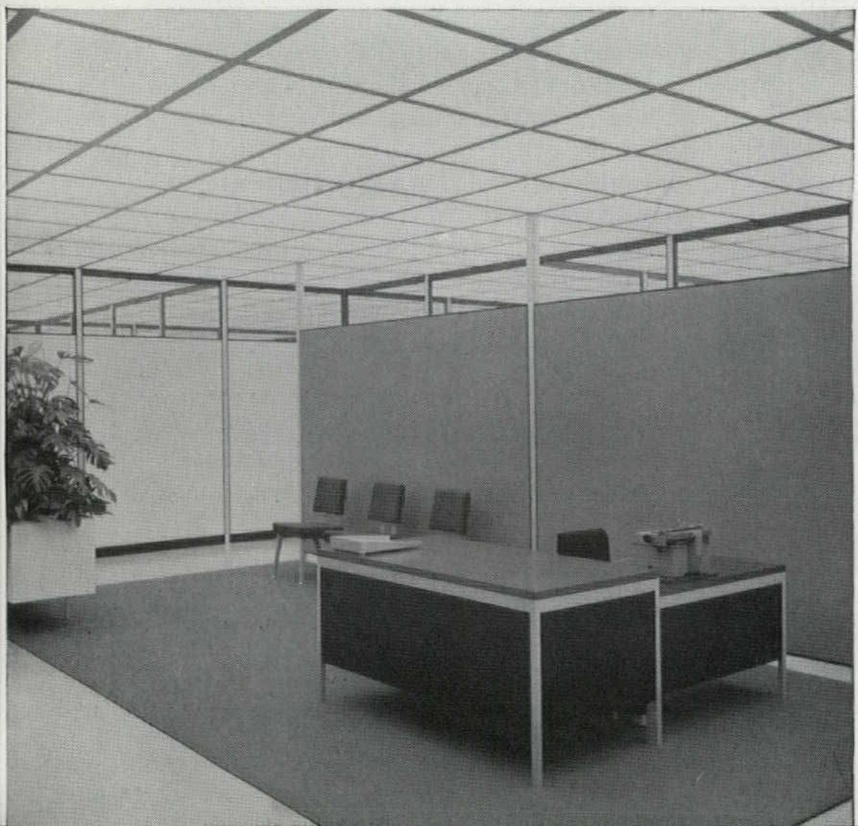
Since the aim of a study of architectural history can no longer be imitation but must be *inspiration through the admired precedent,* the selective method seems more desirable.

A third kind of selection becomes evident in *The Art and Architecture of Ancient Egypt,* presenting a selectiveness of material that was already deplored in earlier volumes of THE PELICAN HISTORY OF ART. Smith is in love with the brilliant art of portraiture in Egyptian statuary and relief, and he indulges his preference to the exclusion of other extremely salient aspects of that great mother art of Western civilization. One cannot quarrel with the beauty of Professor Smith's selections, but his is a Renaissance view of Egypt, carefully leaving out all evidence of the animistic death cult, of mummies and mummy cases, of the fearful or ludicrous animal-headed deities, even of the Great Sphinx, and of the fascinating evidence of Sacred Geometry, so important in the orientation of pyramids and temples. The index makes no reference to any objective terms (mastabas, obelisks, the columnar order, hypostyle halls, etc.) but abounds in the names of personages depicted in the first great flowering of portraiture. If this volume had been called *The Art of Egypt,* it would have been highly satisfactory: as a supposedly complete volume of *The Art and Architecture of Ancient Egypt,* it is misleading through its selectiveness, which is not, as in Wittkower's case, one of quality but a nonpermissible one of kind.

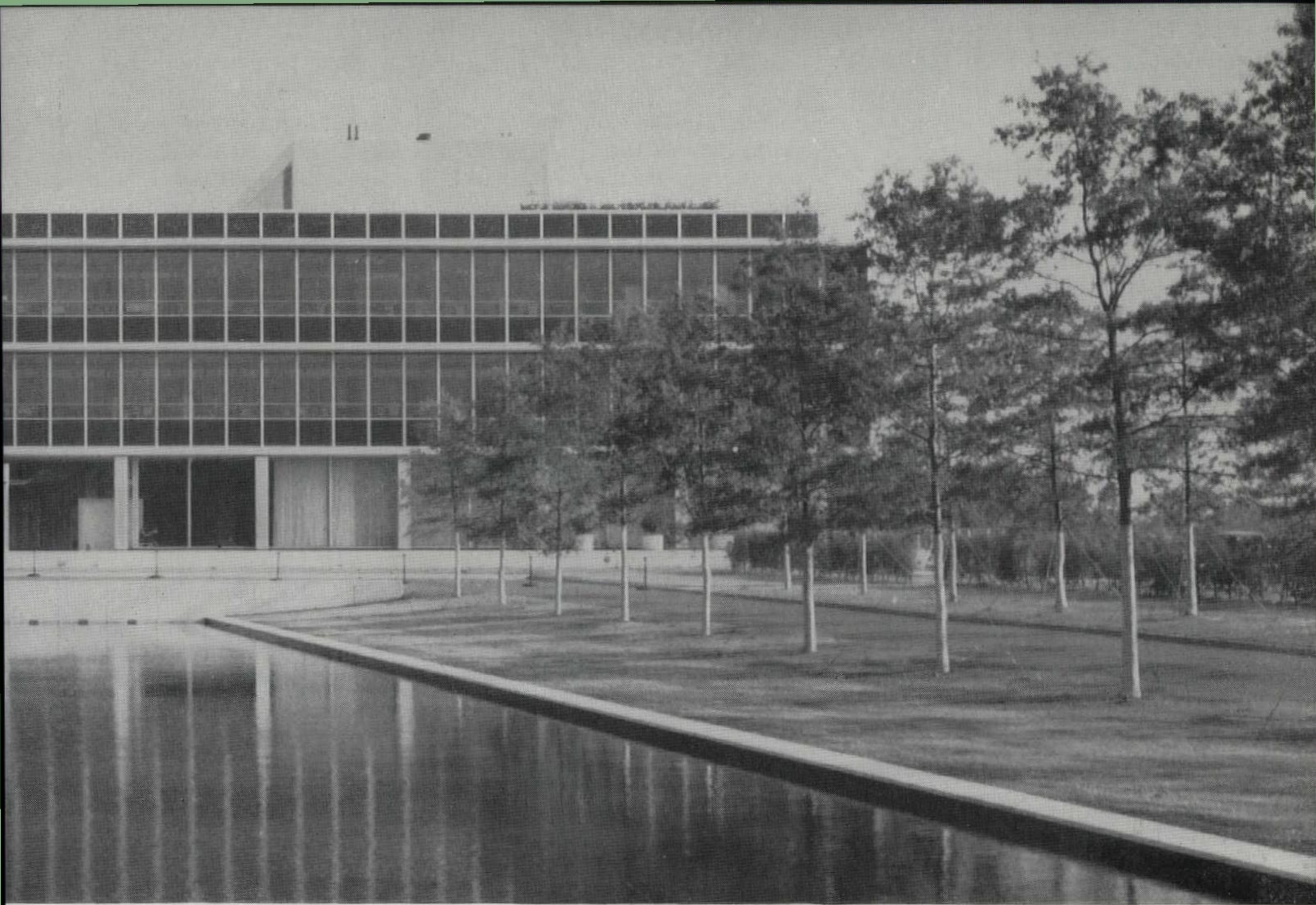
(Continued on page 274)



▪ Maximum flexibility in space utilization is achieved at Reynolds through partitions that easily can be moved to expand or decrease area sizes. This can be accomplished without making costly changes in the lighting system. The Curtis wall-to-wall ceiling of light provides 80 ft. candles of maintained illumination. Attractive Hexcel Honeylite aluminum diffusers complement the inviting decor.



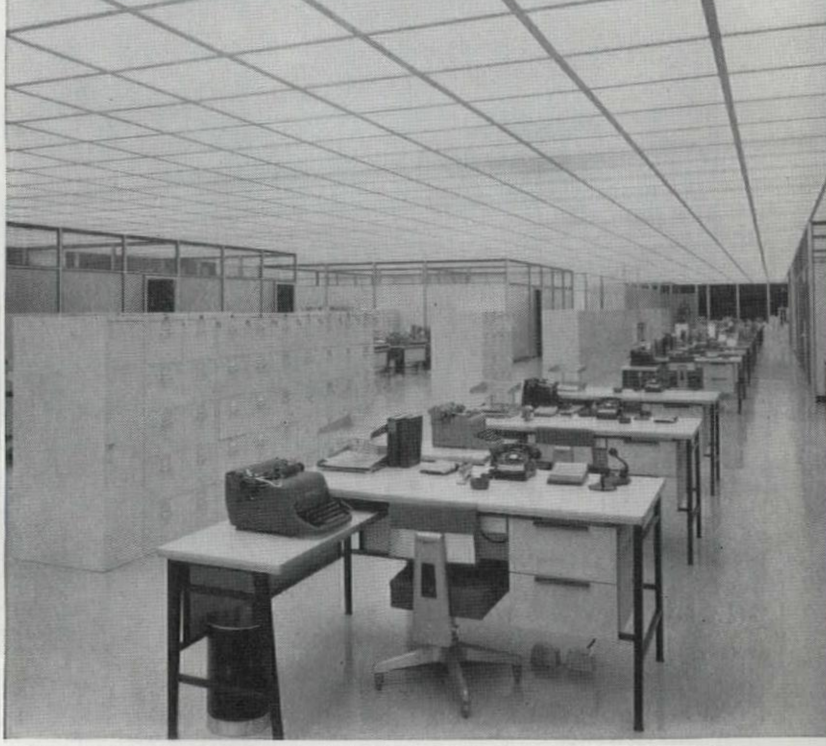
How a special Curtis Lighting system saved Reynolds Metals $50,000 . . .



■ Here is the new home of Reynolds Metals Company, Richmond, Virginia. It is dramatically placed at the end of a reflecting pool bordered by willow oaks. The classic beauty of the building is enhanced by this unusual setting. Architect: Skidmore, Owings & Merrill; Consulting Engineer: Ebasco Services, Inc.

Jnique all-aluminum folding grids in 100 sq. ft. units cut installation time 8,000 man hours . . . provided wall-to-wall illumination with low brightness quality

nstalling a lighting system so flexible it can adapt to any internal building change without relocation is quite a feat. But when hat is accomplished at important savings it calls for exceptional ngineering ingenuity. That's what Curtis Visioneers achieved vith a special custom-made aluminum folding grid system t Reynolds Metals Company, Richmond, Va. The unique olding "packages" made it possible to install 100 sq. ft. of ighting at one time. Result: a saving to Reynolds of an estimated ,000 man hours, or approximately $50,000. A wall-to-wall eiling of light was created with a beautiful satiny aluminum ighting tone of low brightness quality. Over-all ceiling illumination solved the problem of how to obtain stationary lighting for 100,000 sq. ft. area, even though wall partitions would be noved in the future. Write today for the name and address of the Curtis Visioneer in the principal city nearest you. Curtis Lighting, Inc., 6135 West 65th St., Chicago 38, Ill. In Canada: 195 Wicksteed Ave., Toronto 17, Canada.



■ Large office areas are as effectively illuminated as small areas with a high degree of visual comfort assured. In this special Curtis grid installation, aluminum materials were used throughout. Maintenance features of the system include ease of relamping, ready access to wiring, and simple replacement of the ballasts.

CURTIS

Visioneers in Planned Lighting

(Continued from page 270)

If the first problem of general interest touched by these three additions to the PELICAN series is one of method, the second problem is one of content. The reader of these histories of Egyptian, Baroque, and Contemporary visual expression is invited to make a comparative study of Mannerism that might give him pause in his own design activities. Richard Bernheimer once characterized Mannerism as: " . . . the style of interlocking forms and of conflict without issue," a brilliant and concise characterization of the universal fate of all art epochs. This fate is explicitly illustrated in the three PELICAN volumes. The "exuberant virtuosity" with which the artists of the Old Kingdom glorify its pure theocracy freezes into formalistic ritual toward the close of the 6th Dynasty. Smith ably shows how—in the arts—foreign influences infiltrate the lifeless hull that comes to a new flowering with the individualistic portraiture of the Middle Kingdom, which also produces the world's first coherent decorative style in the minor arts. Political insecurity (Hyksos invasion) produces a coarsening of old patterns, finally an extinction of all that had meant Egypt in the old tradition, and a fermentation of new impulses that results in Egypt's Golden Age in the incomparable 18th Dynasty. When the rebellious Ikhnaton dies, the security of the ancient order has been destroyed, and Mannerism produces a diminishing art of historicism that invokes the old art forms of the past as if their mechanical repetition could ward off the imminent decline.

The Wittkower volume echoes this equation, Absolutism equals Great Art, because it was the outright Absolutism of the Church that gave to Italy and Western culture the Baroque style after the stultification of Renaissance Mannerism. As long as the imperious strength of the reorganized Church and its patronage through the princely houses of Italy lasts, Baroque architecture, painting, and sculpture are of breathtaking vitality. One can almost date the onset of Mannerism—in architecture earlier than in the arts—when the Peace of Utrecht (1713) makes Italy a colonial grab-bag for every European sovereign, and the persecution of the Jesuits from 1730 onward destroys the unity of the Church. The "democratization of the arts," so dear to our times, puts a fake Borromini cupola and a fake Bernini altar into every village church of the 18th Century, but the content is gone, only the manner remains.

The manneristic character of the 19th Century, treated by Hitchcock, is too much with us to need emphasis. The irony of his book is its distribution of material. Exactly two thirds deal with the empty involvement of inherited forms and "conflicts without issue," while a meek third is devoted to attempts toward a new genuine style of the 20th Century.

If there is a lesson to be derived from this trinity of Egypt, Italy, and the "Western Hemisphere International," it is the fact that the cycle from new beginning to Mannerism seems to become

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reviews

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shorter and shorter. It took Egypt more than 2000 years to arrive at the ultimate in Mannerism under the Ptolemies; the Gothic period in 300 years ran to flamboyant sugar confections; and the Baroque was really creative for a mere 150 years.

Let us re-examine the ideological and sociological content of our own art and architecture in the light of this historical lesson. Are our *isms* still valid? THE PELICAN HISTORY OF ART has 33 more volumes to go. Will our future critics and historians have anything to select from, except Mannerisms?

SIBYL MOHOLY-NAGY
School of Architecture
Pratt Institute
Brooklyn, N. Y.

warm tribute to the past

Architecture of the California Missions. *Kurt Baer. Photographs by Hugo Rudinger. University of California Press, Berkeley, Calif., 1958. 212 pp., illus. $10*

The California Missions, 21 in number, were erected between the years 1769 and 1823. They were located along a 500-mile stretch of coastal land, separated from one another by the approximate distance that could be covered on foot in a day's travel. The land was part of Mexico's colony under the dominion of the Spanish Crown; and, at the time of the start of the Missions, the territory was officially named Alta California. The path connecting the Mission sites was called El Camino Real (The Royal or King's Road) in recognition of the Spanish dominion.

A series of foundations similar to the California Mission system cannot be found anywhere. Despite great difficulties, they became prosperous centers of farming, industry, education, and religion. The Coastal Indians, for whom these centers were founded and maintained, had no established culture. They had progressed only slightly beyond the most primitive state and were without arts, architecture, and organized religion. Under the devoted tutelage of the Franciscan padres, remarkable progress was achieved: progress in religion was manifest in the conversion of 100,000 Indians to Catholicism; achievements in industry, crafts, and agriculture were equally impressive; and sepecially notable were the acomplishments realized in the arts—architecture, sculpture, painting, and construction.

Without the assistance of architects, artists, or trained builders, the Franciscan missionaries created an outstanding architectural style, which has exercised lasting influence. The missionary style is unparalleled: partly original and partly eclectic, comprising both contradictions and anachronisms. As the author of this book points out, the structures appear to have sprung out of the adobe earth from which their bricks were formed. With the simplicity born of necessary restrictions, echoes of remembered glories in church buildings in Spain and Mexico are revealed. "The padre-builders used the basic materials and adapted them to the buildings they established in a wilderness, for the heathen, and dedicated to the greater glory of God." Even though the structures of the Sons of St. Francis at times appear awkward and crude, the decorations gaudy, and the forms clumsy, the builders ". . . followed the basic tenet of good architecture—form follows function. Perhaps no architectural style in history has created so much with so little; so much that is still ennobling with so little good material to work with; so much that is warm and touching in its beautiful simplicity with so little creative experience to fall back on. Perhaps more than anything else, the priceless ingredient that the padres put into their buildings was the very one that prompted them to venture into the wilderness in the first place: that ingredient was Faith."

In addition to the author's competent and interesting review of the social, material, and religious influences, attention is given to the architecture itself: sources of the various styles; plans; construction materials; and characteristic features, such as belfries, towers, choirs, arcades, sculpture, and painting. A study of each of the individual Missions is included.

Among books on the California Missions, this is one of the very few that provides a thorough study of their architecture. The artistic photographs richly supplement and pleasantly complement the otherwise adequate text.

(Continued on page 282)

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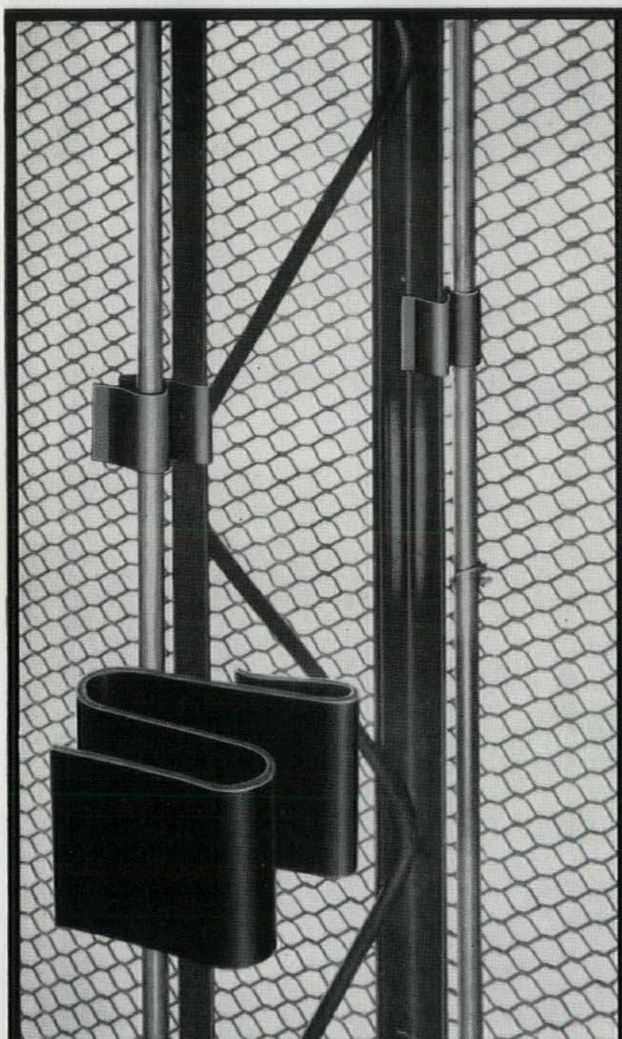

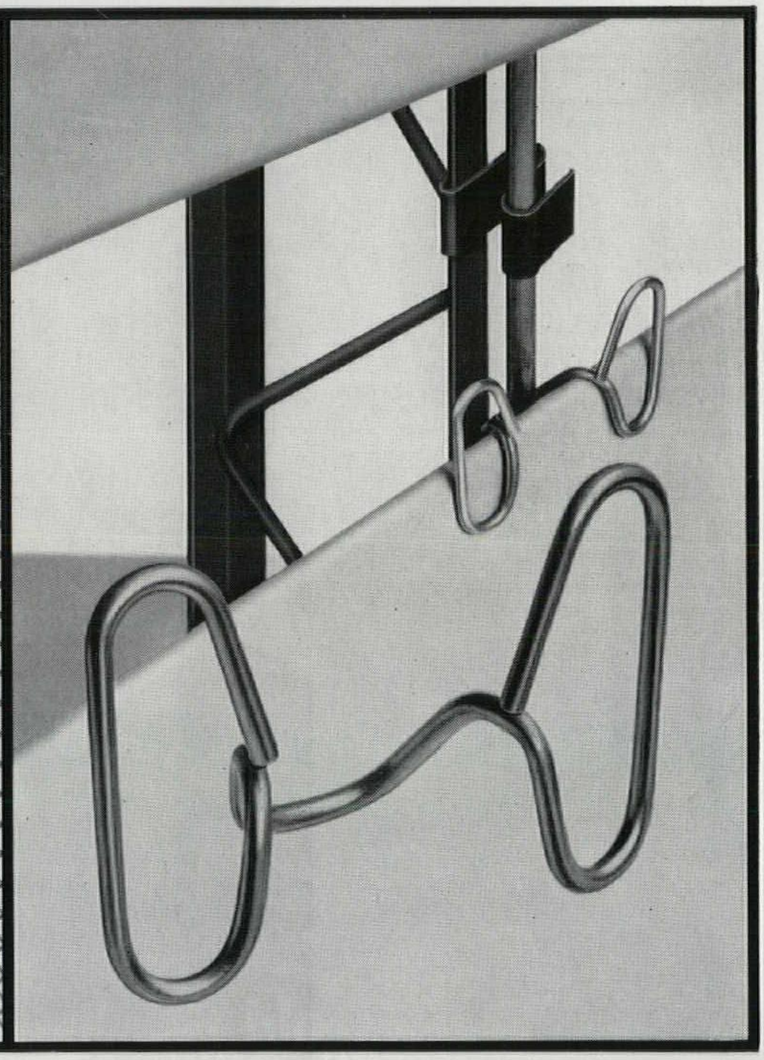

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reviews

(Continued from page 276)

Despite unscrupulous confiscation, pillage, vandalism, and legalized ruination of the Mission buildings, they still exercise a warmly emotional and richly satisfying appeal to millions of visitors—a phenomenon that provides perennial proof of their basic integrity.

LAWRENCE E. MAWN
Alhambra, Calif.

creative color engineering

Color Planning for Business and Industry. *Howard Ketchum. Harper & Brothers, 49 E. 33 St., New York, N. Y., 1958. 288 pp., illus. $5.95*

The subject of this book is creative color engineering, defined by the author as ". . . the ability and art of increasing the impulse appeal of a product. It is the intangible ingredient which, when well engineered, creates visual value and lasting satisfaction with the merchandise, product, or environment." His intention was to provide case histories and proved methods of practical color work. The result is not only a book on color theory, but also a book incorporating workable ideas of color engineering applied to business and industry.

The author has had extensive experience in color engineering related to sales, packaging, advertising, and design of commercial products. The bulk of this book is concerned with such color use.

The architectural profession will find useful information in the chapters on color and lighting in the factory, office, and home. This information is sound, plentiful, and helpful; and the architectural reader should not be put off by the language of the sales manual, which pervades the book.

LAWRENCE E. MAWN
Alhambra, Calif.

pull up a chair

The American Chair: 1630-1890. *Marion Day Iverson. Drawings by Ernest Donnelly. Hastings House, 41 E. 50 St., New York, N. Y., 1957. 241 pp., illus. $10*

Without attempting to be encyclopedic, *The American Chair* manages to give the

(Continued on page 286)

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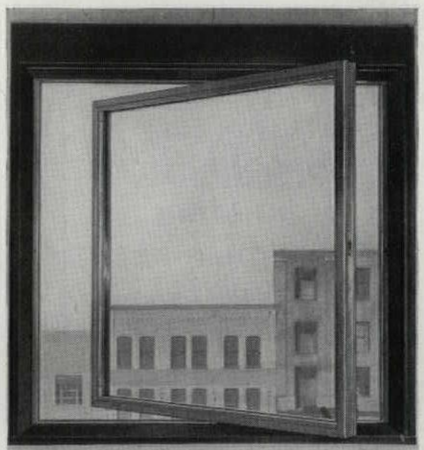

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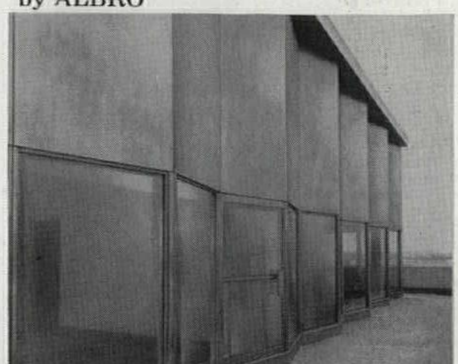

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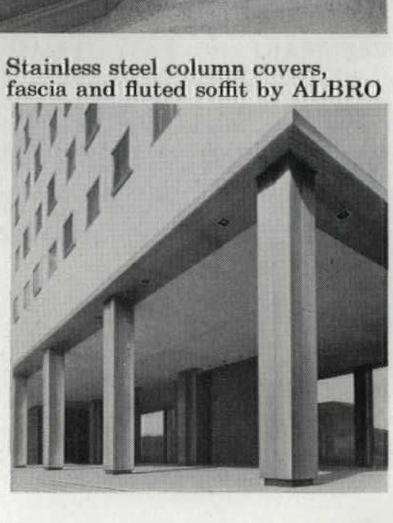

A city steeped in Colonial traditions skips two centuries into the architectural present with a 17-story building employing stainless steel at its attractive best.

The new Philadelphia State Office Building is capped by a penthouse enclosed in flawless stainless steel. Within the rooftop structure are executive offices for top state officials, a conference room, and the building's mechanical equipment. Here, as elsewhere in the \$10,250,000 marble-faced building, stainless steel appears in all details requiring architectural emphasis.

Vertically pivoted windows—the widest of their type yet specified in the area—are fabricated, too, from stainless steel. The monumental facade is subtly "textured" by the slight projection of alternate pivoted windows. The total effect is impressive, creating a home of distinction for the 1800 State employees who will occupy it.

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reviews

(Continued from page 282)

reader a comprehensive account of the different types of chairs used in the United States, from earliest colonial times up through the Victorian era. Represented in 176 handsome, large scale, and well documented drawings are the most important types and styles of chairs, used in many cases by celebrated American personalities.

The first chair illustrated is the Wainscot chair, presumed to have been used by John Winthrop, Jr., at his inauguration as Governor of Connecticut. One of the last chairs shown is the Victorian rocker in which Abraham Lincoln was seated when he was assassinated at the Ford Theatre. Always distinctly American, the intervening series between the styles of these two chairs are carefully shown: Windsors, Queen Anne, Hepplewhite, Chippendale, Sheraton, Greek Revival, etc.

Mrs. Iverson's text, while concerned principally with chairs and chair styles, is authoritative enough to give the reader points of style that will help form an understanding of other furniture from the same period. There is also a chapter on the chairs and other furniture owned by George Washington. An appendix lists museums and houses where the public may see many of the historic chairs represented in this book.

The American Chair is a good book for those interested in furniture styles and Americana.

FRANCIS J. S. HUGHES
New York, N. Y.

photography: science and art

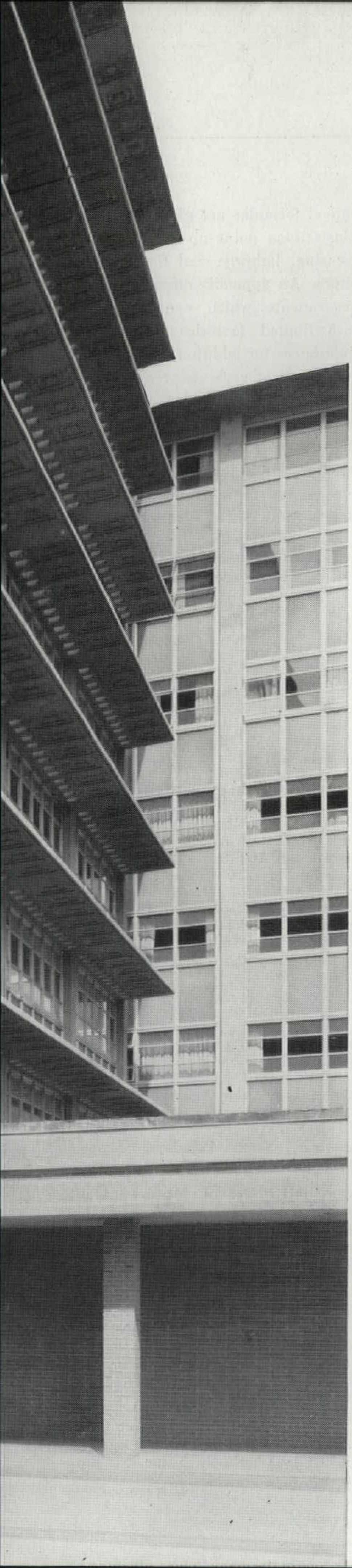
Introduction to Photographic Principles. *Lewis Larmore. Prentice-Hall, Inc., 70 Fifth Ave., New York, N. Y., 1958. 240 pp., illus. $8*

Although the author assumes no previous knowledge of the subject on the reader's part, this book definitely is not one that the "rank amateur" should add to his library. However, an advanced student of photography, with a basic knowledge of physics, optics, and chemistry, should find this volume extremely valuable.

The author, a senior scientific advisor

(Continued on page 290)

DECORATIVE MULLION PATTERNS and sharp, clean exposed holes are formed in cantilevered floor slabs at the University of Arkansas Medical Center, Little Rock. The job was performed easily and economically with little finishing required ... one of the many "plus" advantages



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reviews

(Continued from page 286)

to the Lockheed Aircraft Corp. with more than 20 years experience in photography, begins by explaining the various types of cameras, and what they can and cannot do. He then reviews elementary optical problems, including that of image intensity. Several chapters consider the properties of film, and show why a good negative depends to an equal extent upon camera optics and film sensitivity. Also covered are the elements of photographic chemistry and printing. Subsequent chapters discuss more advanced phases of optical theory and the essentials of stereoscopic (3D) photography, color photography, and colorimetry. Throughout the book processing and optical formulas are given, and over 100 illustrations point up key principles of focusing, lighting, and the use of light filters. An appendix offers 15 laboratory experiments which can be conducted with limited facilities and equipment. References for additional reading appear at the end of each chapter.

A book of this scope cannot include a discussion of all of the available gadgets associated with photographic practice, but it does present a comprehensive statement of the scientific laws of photography, together with their practical applications.

ELEANOR WOLFE
Staff Photographer, Reinhold Publishing Corp.
New York, N. Y.

BOOKS RECEIVED

Green Power. James Stevens. Superior Publishing Co., 2809 Third Ave., Seattle, Wash., 1958. 96 pp. $3. The story of Public Law 273, conservation of the forest resources on the Northwest's Olympic Peninsula.

Drums in the Forest. Alfred Procter James and Charles Morse Stotz. Historical Society of Western Pennsylvania, 4338 Bigelow Blvd., Pittsburgh, Pa., 1958. 230 pp., illus. $3.50. Part one, *Decision at the Forks*, by James, is an historical account of the 18th Century struggle for empire in America. In the second part, *Defense in the Wilderness*, Architect Stotz writes descriptively of the military architecture of the period, particularly of the five forts (illustrated with sketches and plans) built at the Forks of the Ohio River.

1958 Day Hospital Conference. American Psychiatric Association, 1700 18 St., N. W., Washington, D. C., 1958. 131 pp., illus. $2 (paperbound). Proceedings of the Mental Hospital Design Clinic conducted by the Architecture Study Project and the General Practitioner Project of the American Psychiatric Association.

Zevulun New Town. Preliminary Development Plan Haifa Bay Area. Karl H. Baruth Israel Business Books, Haifa, Israel, 1958. 84 pp., illus. $2.75 (paperbound)

Experiencias Sobre Vivienda Rural En Panama. Inter-American Housing and Planning Center, Scientific Interchange and Documentation Service, Apartado Aéreo 6209, Bogotá, Colombia, 1958. 84 pp., illus., Spanish text $2.50 (paperbound)

Manual for Organizing and Managing the Building Program. Department of Church Architecture, The United Lutheran Church in America, 231 Madison Ave., New York, N. Y., 1958. 70 pp. $1 (paperbound)

Vita Dei Materiali Nella Architettura. Giulio Roisecco. Soc. Editrice Vitali e Ghianda, Casella Postale 264, Genova, Italy, 1958. 188 pp., illus., Italian text. $4.88 (paperbound)

Rental Housing: Opportunities for Private Investment. Louis Winnick. McGraw-Hill Book Co., Inc., 330 W. 42 St., New York, N. Y., 1958. 318 pp. $8.50. Second book in the ACTION series on housing and community development.

Subject Guide to Books in Print. Edited by Sarah L. Prakken. R. R. Bowker Co., 62 W. 45 St., New York, N. Y., 1958. 1452 pp. $17.50. Library and reference tool.

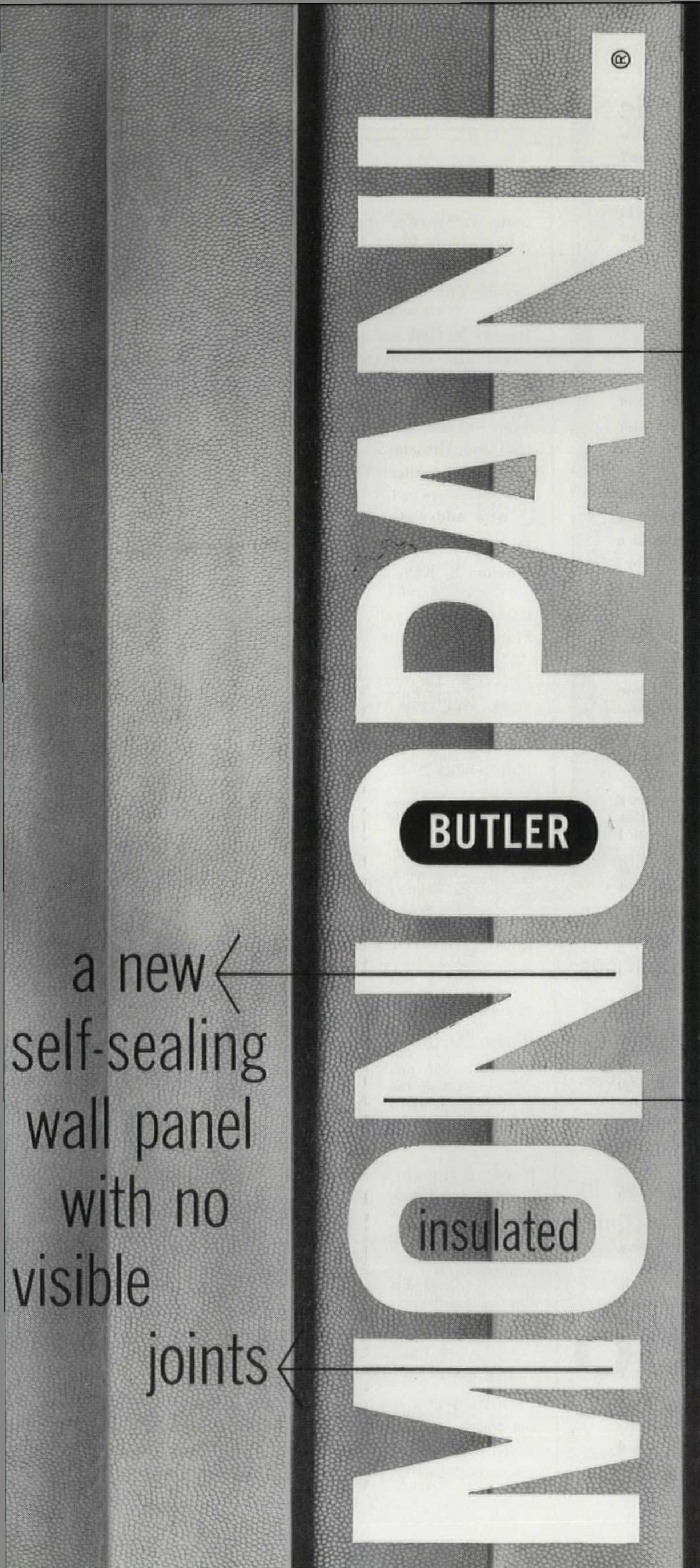
Japanology

Arts and Crafts of Japan. 14 volumes. Distributed by Charles E. Tuttle Co., Rutland, Vt. Illus. $3, each. Titles include: Archaic Claywork, Bronze Sculpture, Ceramics, Dolls & Puppets, Folk Art, Gardens & Tearooms, Houses, Lacquer, Masks, Panel Paintings, Scroll Paintings, Temples & Shrines, Textiles, and Wooden Sculpture.

Form and Space of Japanese Architecture. Norman F. Carver, Jr. Shokokusha Publishing Co., Tokyo, Japan. Distributed by Charles E. Tuttle Co., Rutland, Vt. 200 pp., illus. $12

Oriental Art Motifs. Takasashi Sohei. Distributed by Charles E. Tuttle Co., Rutland, Vt. 82 pp., illus. $2.50 (paperbound). Subtitled *A Sketchbook for Artists and Connoisseurs*, this is a collection of 273 illustrations, copied from the paintings of Oriental masters.

A Thousand Years of Japanese Gardens. Second edition. Samuel Newsom. Distributed by Charles E. Tuttle Co., Rutland, Vt. 318 pp., illus. $12.50



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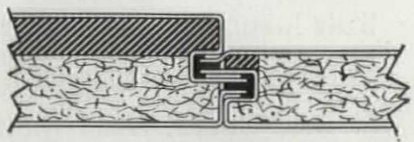

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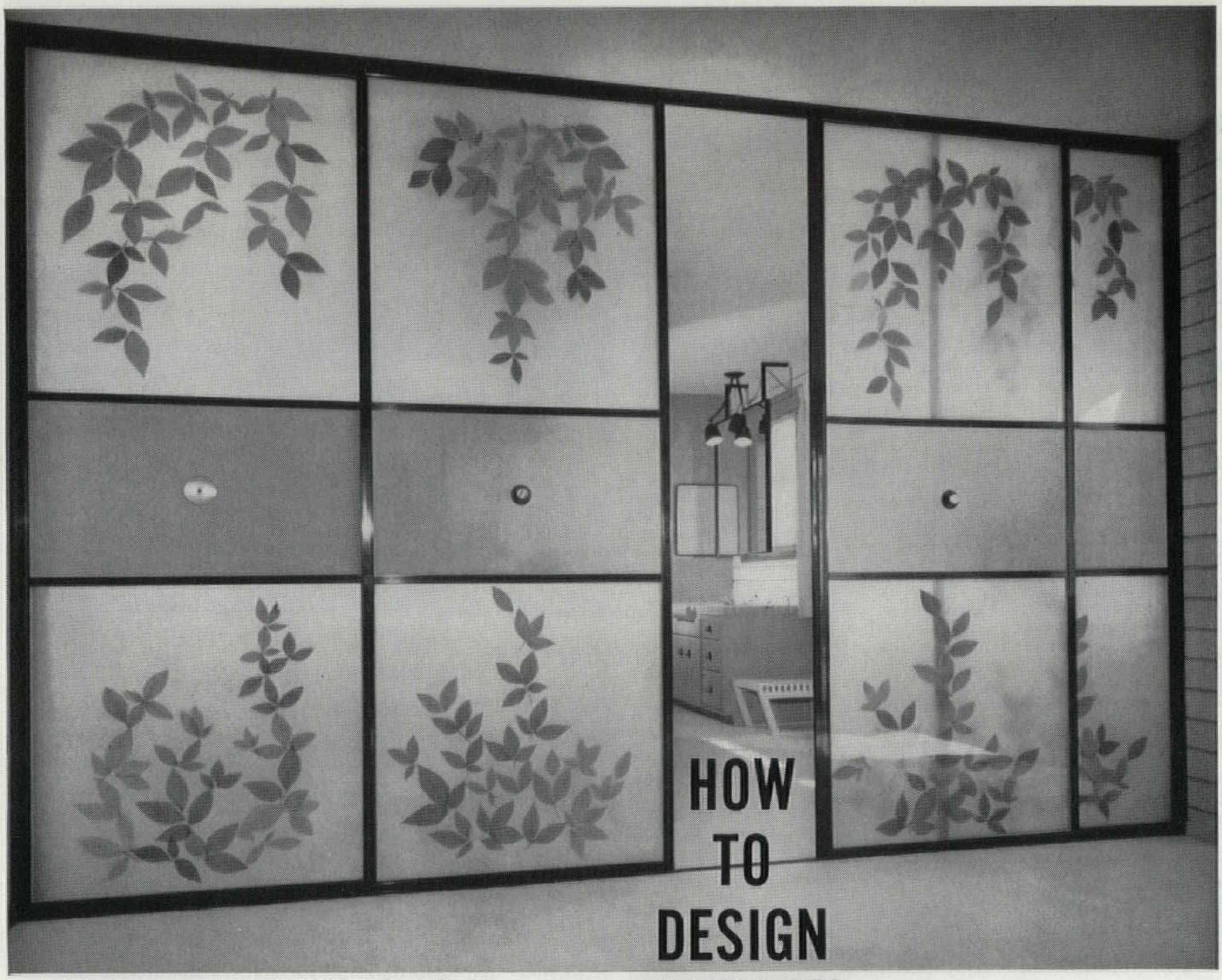

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(Continued on page 298)

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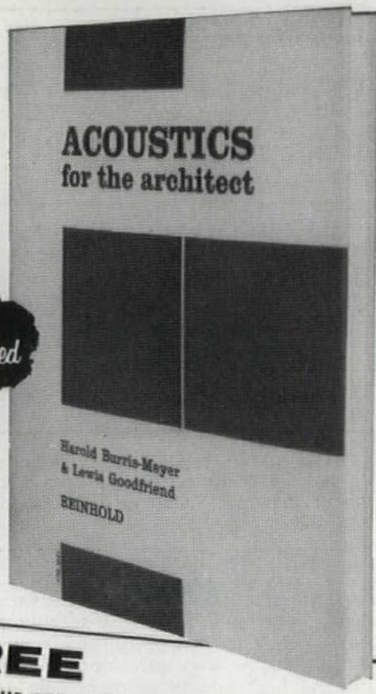

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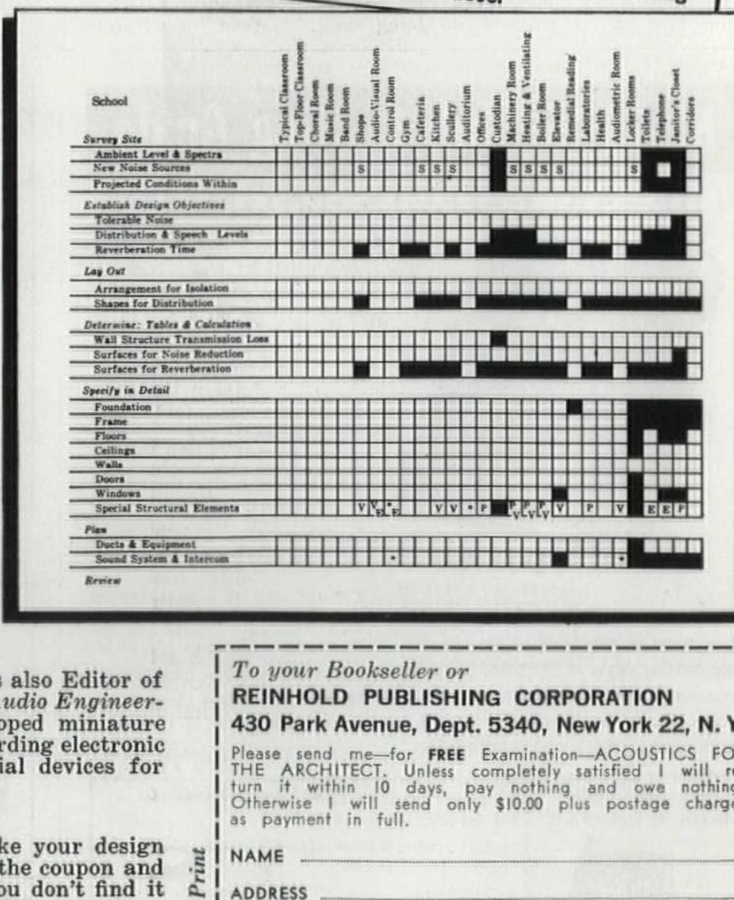

CONTENTS

1. The Problem; 2. What Sound Is and How It Behaves; 3. Structure; 4. Materials; 5. Shapes and Surfaces; 6. Electronic Devices; 7. Surveys, Computations, and Tests; 8. Acoustical Design Procedure.

THE AUTHORS:

HAROLD BURRIS-MEYER, a pioneer in applied psychoacoustics, is a consultant on Acoustics in Washington. He was formerly Professor and Director of Research in Sound at Stevens Institute of Technology. He developed *Synthea*, a device for controlling acoustical conditions on the concert and opera stage, conducted the first definitive studies of music in industry, and developed the first complete control of sound in the theatre.

LEWIS S. GOODFRIEND is a Professional Engineer. He is also Editor of *Noise Control* and former Editor of the *Journal of the Audio Engineering Society*. Mr. Goodfriend has designed and developed miniature electronic amplifiers for military applications; tape-recording electronic complements; noise suppression equipment; and special devices for analysis of acoustical conditions of rooms.

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(Continued from page 294)

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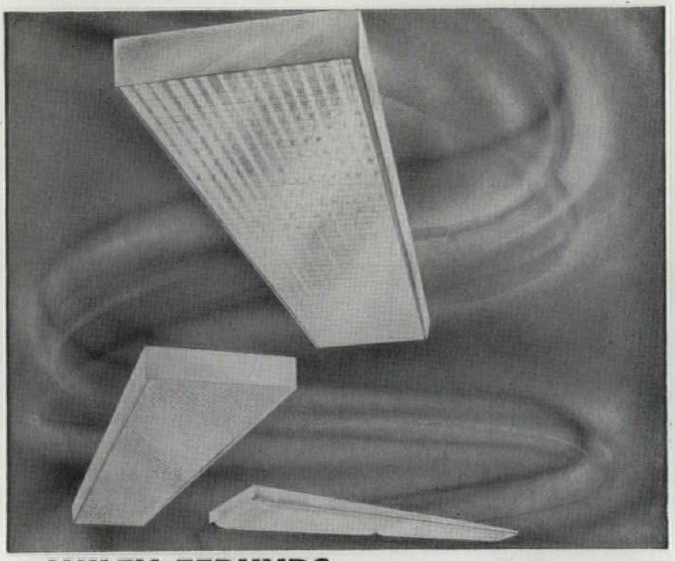

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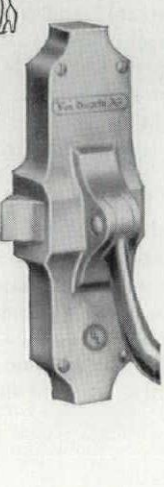

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P.S.

things to see and ways to see

Things to see

Ways to see	SOCIAL FUNCTION (commodity)	TECHNIQUE (firmness)	SPACE USE
PLEASURE (delight)			
CONTEXT (situation)			
RECOGNITION (symbols norms)			

This is one more (final) take on the question of how to see architecture. Whether or not anyone else has been interested, thinking about the subject has made me realize that much of what passes for criticism of architecture is not really complete criticism but is rather a discussion of just one aspect of a building—its form, its emotional appeal, its technique, or whatever the critic was particularly and exclusively interested in.

How can someone who wants to evaluate a building (even if only for his own benefit) avoid this trap? I ended my last column on this theme with the thought that several *things to see* might be looked for (values, characteristic of the building) and that each of these might be looked at in several *ways to see* (value judgments, responses of the person looking at the building). I'd love to hear suggestions of other *things* and *ways;* my own nominations are as follows.

I choose as three *things to see,* function, technique and space; it seems to me that all of the systems, hypotheses and interpretations based on characteristics of architecture (some of which I reviewed in the March P.S. column) can be included under one or another of them. Function includes Vitruvius' "commodity," Greene's "secondary use," and many of Zevi's "interpretations of content." Technique takes in the "firmness" of Vitruvius and all of the later technical interpretations of architecture. Space, in itself, is the prime method of interpretation to many critics.

Social function may be difficult for the man in the street to see and judge. Looking at a building, he cannot know the detailed program of needs that a client gave to an architect. Even budget considerations are functions which the outside-viewer cannot evaluate. Granting this, however, it would seem possible to have judgments of function ranging from simple to sophisticated, based on fairly reasonable value standards. Certainly, whether the building works well (or doesn't) is a question that *must* be answered.

Technique can also be judged at various levels of understanding-depth, although it also is often difficult for a layman to evaluate, for two reasons: first, many of its factors require engineering knowledge in some depth; second, many of its factors, such as acoustics, subtleties of lighting, choice of materials for technical reasons, are "hidden"—not at all obvious at first glance to a nonprofessional. However, even in the broad, obvious technical considerations there is much to see and judge. Today we have the skeleton-frame vs. the organic-humanistic vs. the free-plastic-form structures, all technically defensible, all with their own visual, contextual, and appropriateness arguments. This value, to many, is the principal *yes* or *no* of modern architecture. It would be good if the viewer looked more carefully and critically at technique.

Space as a basic ingredient of architecture is also difficult to *see.* It must, however, be evaluated as a judicable *thing* on various levels of understanding. A given space can be reacted to quickly and intuitively, through experience, or with the understanding of study: it has balance, harmony, depth; it leads, directs, depresses, or exhilarates; it pleases (or displeases) under various situation-impressions; it expresses well (or badly) the ideologies we consider important.

So from "I like" to "I like because" it is possible, I believe, for a public to judge function, technique, and space.

Now, having considered three *things to look at,* let's consider three *ways to look.* The terms mechanistic, contextualistic, formistic are cumbersome: let me propose as value judgments the simple concepts of pleasure (one judges, I think, *with pleasure* or displeasure); context (one sees a building *in relation to a situation,* or *in context*); and recognition (one reacts to architecture, as to any other esthetic experience, at least partly *by recognition* or lack of it).

Pleasure—the "delight" ingredient of Vitruvius, the mechanistic and the hedonistic hypotheses—can range from the simple "I know what I like" response to extremely sophisticated judgments by accepted design standards. Mechanistic standards work best in a time of classic formulation; reaction to a work of art is apt to be unfavorable when its method of composition is unfamiliar. In a time of development such as ours, it is not easy to know which standards are basic and which are semantic abstracts based on shifting referents. But whatever the rationale, the public reactions ranging from "Wow!" to "Ugh!" are basic, and can be made more thoughtful.

Context as a means of judging can range from relationship of a building to its surroundings to evaluation of it through a sum total of experiences and impressions. It would include such factors as daytime and nighttime impressions, and, in a broader sense, the whole question of judgment of buildings as a part of judgment of towns and cities.

Recognition (the formistic reaction, which Pepper defines as the normal reaction of the normal man) ranges from the "I know this and therefore I like it" response to the "this is in fashion now (or is ideologically correct) and therefore good" judgment. Ames' studies in psychological-esthetic response, Whitehead's studies in symbolism, evaluations of our present ideologies of functionalism, expression, honesty—and the current ones of warmth, humanity, delight—all enter here. Fashions, fetishes, symbols, styles, clichés, ideologies—we will have to try to sort them all out in order to use (or understand how the viewer "normally" uses) this way to see.

I am not suggesting that we ask people to set up a sort of graph of co-ordinates—three values across the sheet and three value judgments up the sheet, intersecting at nine points. Although it may be healthy to keep such a chart in mind, this would obviously not be a workable, empiric system of criticism for the man in the street; it would be much too complicated. And I don't think that even the professional critic need use all these judgments of all these values.

The important point, I believe, is that all of us—layman and architect and critic—must realize that there are more ways than one to see architecture, and more things than one to look for in a building or a group of buildings.

Next month, in a discussion of Seagram House, I will try to put some of this approach to use.

Thomas H. Creighton

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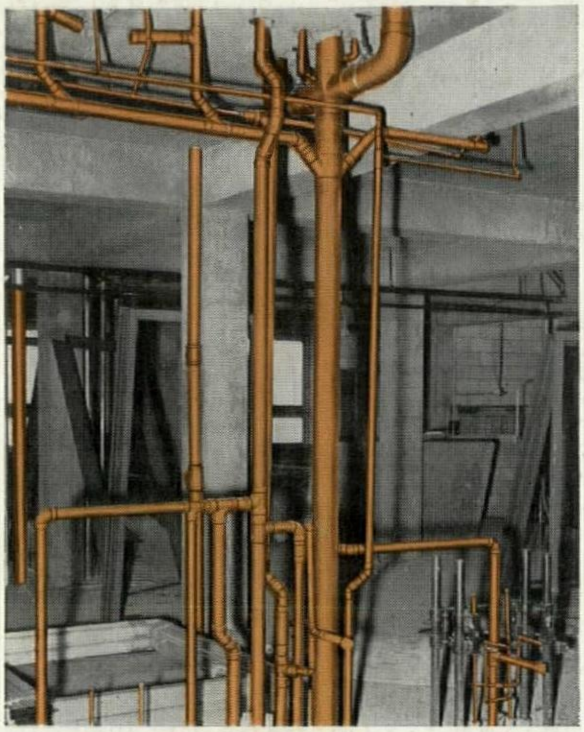
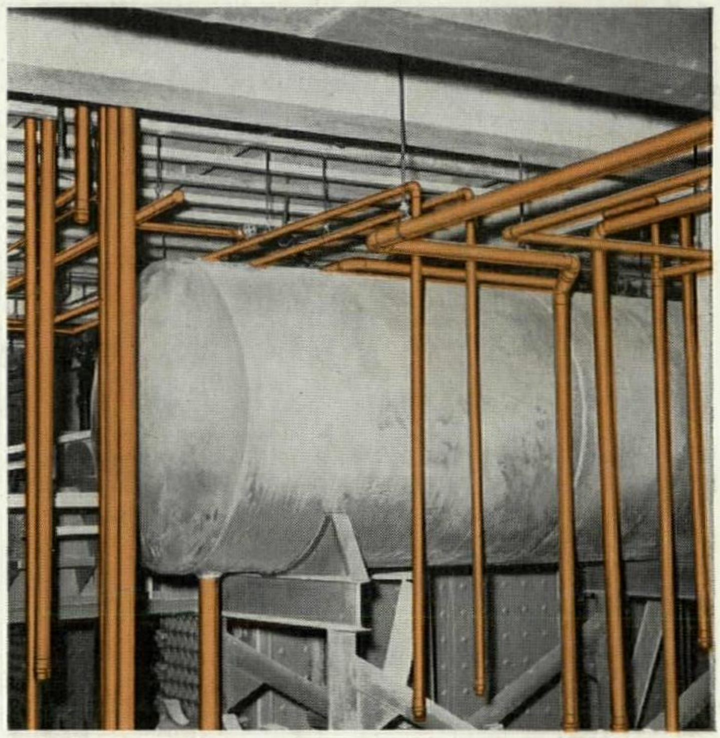
plumbing chosen for new Butte hospital because it cost no more—saved space—offered economies in maintenance



WATER SUPPLY AND SANITARY DRAINAGE. Roughed-in piping system for rest rooms and therapy service shows how compact assemblies of copper tube and solder-joint fittings save valuable floor and overhead space. General Contractor was Dan J. Mooney, Butte, Mont.



HEATING SYSTEM: Copper tube piping for hot-water heating system, awaiting installation of boilers. Over 6 miles of Anaconda copper tube in sizes up to 6" and about 10,000 Anaconda wrought-copper and cast-brass solder-joint fittings for plumbing and heating system supplied through M & L Supply Co., Inc., plumbing wholesaler, Butte, Mont.

The $2,100,000 Silver Bow County Hospital, Butte, Montana, is the first major public building in the state to have all-copper plumbing—for sanitary drainage lines, water supply, and heating.

What the architect says: "In specifying materials to be used in a building, we feel it incumbent on the architect to select those materials that have longer life and contribute to low maintenance costs. For this reason, we selected copper tube for all plumbing lines in Silver Bow County Hospital. In a hospital there are many plumbing lines; they are all concealed; and the use of less durable materials would not give true economy in the operation of the building." Norman J. Hamill, Norman J. Hamill & Associates, A.I.A., Butte, Montana, and Idaho Falls, Idaho.

What the plumbing contractor says: "In a hospital, intricate systems are the rule rather than the exception and the use of copper in Silver Bow County Hospital made it possible to complete all lines with greater ease and speed than would have been possible with other materials. . . . Copper tube requires less space in partitions and other areas of concentrated services. Its use also made it possible to fabricate bends, connections, etc., at a workbench with the result that final installations were made in one operation with a minimum of effort. . . . Particularly in hard-to-get-at places overhead, copper's lighter weight than other materials was a factor that appealed to us." Floyd J. Stewart, Reardon Plumbing & Heating Co., Butte, Montana.

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