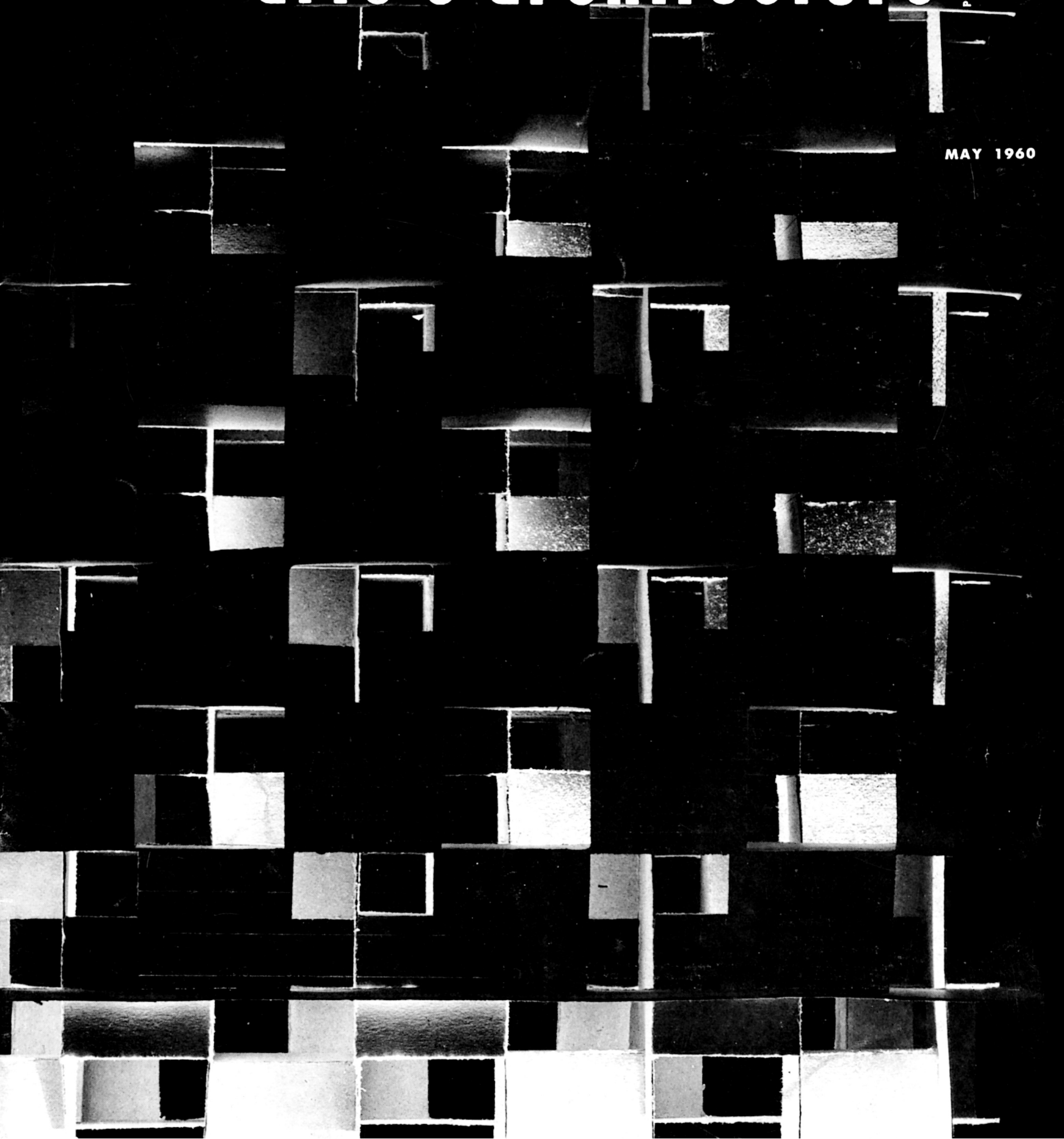


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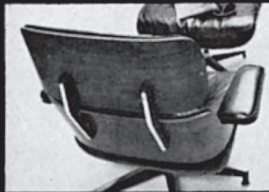
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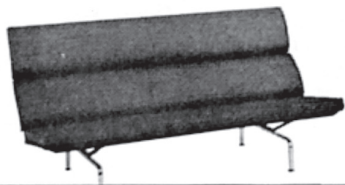


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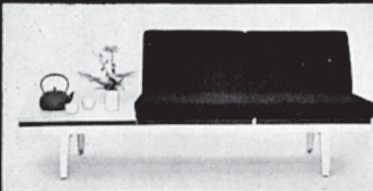
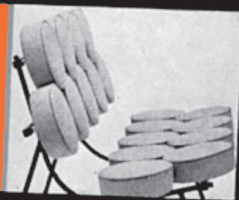


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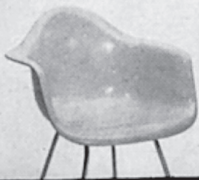
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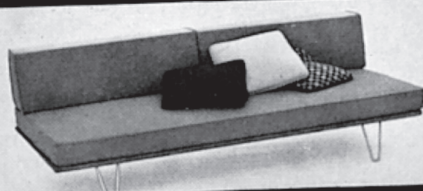


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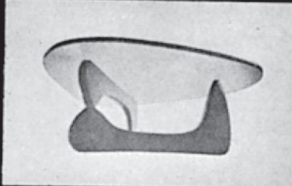
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MUSIC

PETER YATES

TEMPERAMENT OR TUNING

European music from early times until the present has been composed around a system of 12 fixed pitches in the octave. The chromatic intervals between the fixed pitches are known as half-steps. The system of fixed pitches and half-steps which has been in general use during the last 150 years is known as Equal Temperament. In Equal Temperament the half-steps are supposed to be and in practice usually are very nearly mathematically equal, and each of the half-steps is impure or, as a very precise ear would recognize, a little out of tune.

Out of tune with what? a musician may ask. To answer that question is the purpose of this article.

To simplify the discussion, let us distinguish the two words, Temperament and Tuning. *Temperament* has to do with the theory, and *Tuning* has to do with the application of that theory to an instrument.

Theorizing about the temperament of European music is supposed to have begun with the Greek philosopher Pythagoras, a religious mathematician who believed that all relationships in the essence of things could be expressed numerically. To support this belief he examined the properties of geometrical figures and relationships among the vibrations of stretched strings. Our understanding of these relationships is still based on the numerical fractions designating the pure intervals established by Pythagoras.

Using a string giving the note of middle C, vibrations of half the string give exactly twice the frequency, or high C one octave higher. A third of the string vibrates at the pitch of G, the first tone of the overtone series, a twelfth (an octave plus a fifth) higher than middle C. These two higher partials (a partial is an overtone), G and E, brought down into the same octave with middle C, form with it the perfect major triad. The whole business is complicated enough to have kept theorists working at it for 2600 years, so I shall not attempt to explain it fully.

I might add, the elementary terminology of music is so chary of precise definition that it constitutes a "secret art," which one goes to school to learn and employs thereafter as a way of keeping technical secrets from the laity, who are assumed, since they do not speak the language, to know nothing about music. This is by no means true, nor is it true that those who do speak the language are thereby informed. This secret language is clumsy, often imprecise, it hides as much as it explains, and we might do better to get along entirely without it or at least use it as sparingly as I have tried to in these chapters.

For example, the *fifth* in musical terminology does not mean the tone produced by the vibration of the fifth of a stretched string; such a division of the string produces a *third*. A *fifth* is an interval embracing five successive notes of a diatonic scale, a *third* an interval embracing three successive notes of a diatonic scale: on the keyboard C-G is a fifth, C-E a third. But the fifth C-G embraces eight notes of the chromatic scale, or seven half-steps, or three whole-steps plus one half-step.

The fifth, being the first partial or overtone of the overtone series, would be the first tone within or outside the octave to be arrived at melodically by ear. Pythagoras, as a mathematician, was more interested by the fact that an octave made up of mathematically perfect (acoustically pure) fifths would be larger, or, as a tuner would say, wider, than a pure octave. This fraction of difference is named after him the "Pythagorean comma."

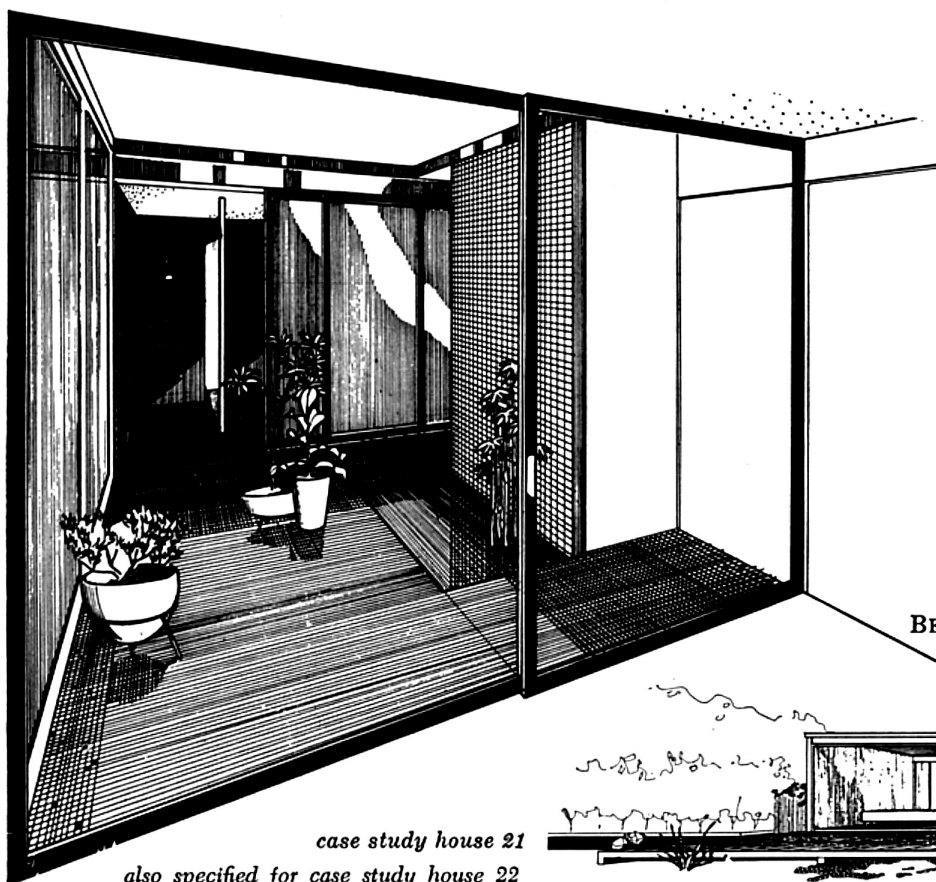
In the same way an octave made up of any accumulation of pure intervals would be other than a pure octave.

Early European composers were not troubled by harmony, the vertical relationship of tones simultaneously sounded. They were interested only in the melodic scale, as it would be sung. Their habit therefore was to assume a scale of pure fifths and to adjust the intervening intervals more or less by ear. Melodies sung in this way were harmonized by pure concords only at the fifth and the octave, and the notes between these concords were allowed to go their own way.

Now a Pythagorean scale of pure fifths can be tuned, and there is little doubt that it began to be tuned somewhat along these lines, though the establishment of an accurate tuning order must have been a gradual process. Beginning with C, pure fifths



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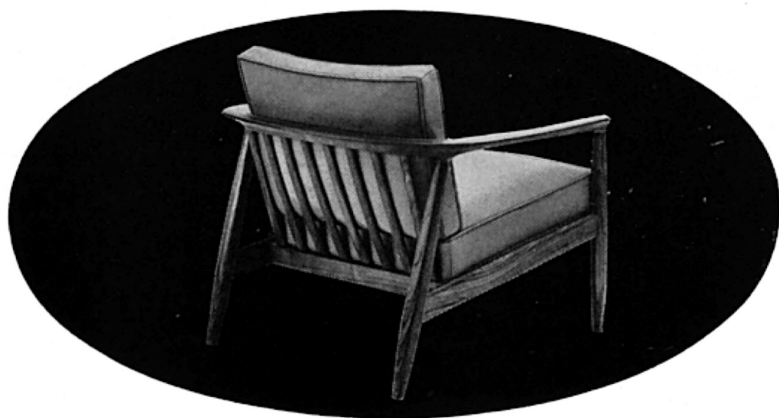
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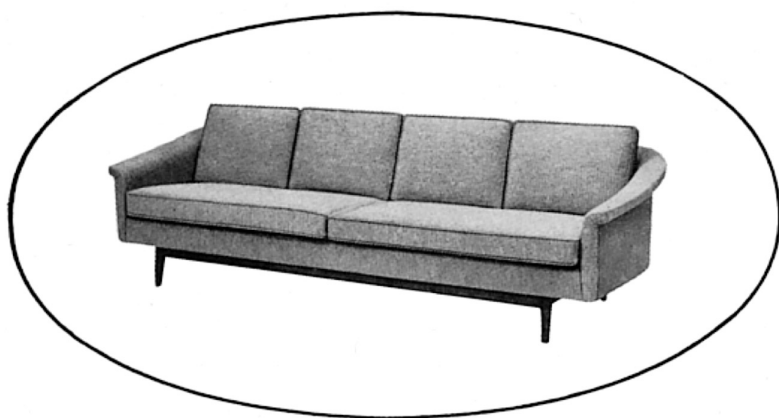




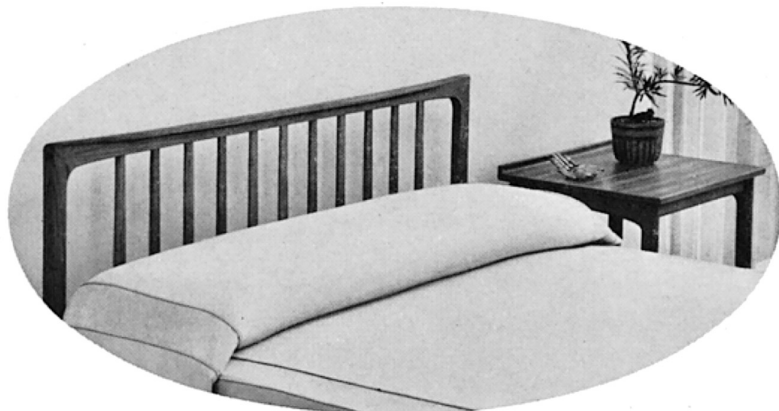
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would be tuned forwards (that is, upwards) through G sharp; then beginning once more with C, pure fifths would have been tuned backwards (downwards) through F, B flat, and E flat.

These two directions from C, upwards and downwards (from A in modern tuning), are the two cycles of fifths fundamental to any tuning order.

In the Pythagorean scale the "Pythagorean comma" would have been taken care of by a very narrow fifth, placed probably between G sharp and E flat, an interval which should be a fifth but falls short by a fraction. Many other Pythagorean tunings in pure fifths may have been tried; experience would have established that this is the most practical. With such a tuning the intervals of the third divide, surprisingly enough, in two groups of equal impure thirds. The wide thirds are all, using the modern measurement by *cents*, 22 cents wider than a pure third, and the narrow thirds are all 2 cents narrower than a pure third.

The result is that a Pythagorean tuning by this method will have all fifths perfect except one and in addition four thirds which are approximately pure. The wider (impure) thirds, being all wider than a pure interval by an equal margin, could be and probably were adjusted by the singer, when necessary, according to the accuracy of his ear, as well as on those instruments which permitted such adjustment. On instruments with fixed intervals, like the organ, the impure fifths would have been omitted wherever possible.

There is reason to believe that such a Pythagorean scale was used, in whole or in part, for all European music before the 15th century. Anyone who is interested in tuning such a scale on the piano, and it is not hard to do, will be amazed by the acoustical magnificence of this scale, the purity of the fifths accentuated by the occasional discordant third, which must have added appreciably to the quality of the early plainchant and polyphony. The Pythagorean is in my ears the most dramatically beautiful of the melodic scales. (By "melodic scale" I mean one which is used primarily for melody, allowing only slight modulation and subordinate vertical harmony.)

For practical experimentation on the piano, it is best to damp off two of the strings and tune only the third string. This method simplifies the tuning and gives a purer scale, though the damping must be very firm to reduce unwanted vibration by the two damped strings.

The elaboration of polyphonic music into many parts during the 15th century would have made difficult and oftentimes nearly impossible the attempt to continue adjusting by ear the wide thirds of the Pythagorean scale. For this reason attention was now turned to devising a new scale which would provide as many pure fifths and pure thirds as could be managed for the more commonly sung intervals. This scale of Just Intonation would have been conceived in many different approximations, according to the character of the music, requiring some adjustment of the unavoidable impure intervals.

To obtain a scale of Just Intonation in pure form, tune perfect fifths from C to G to D to A (upwards) and from C to F to B flat to E flat (downwards). Then tune perfect thirds from C to E, G to B, D to F sharp, D flat from F, A flat from C (or A flat from E flat, D flat from A flat).

The commonly accepted Just Intonation is the less perfect tuning achieved and recorded by Mersenne (1588-1648). (Other tunings as good or better were undoubtedly achieved but not recorded.)

Though more practical for voices in advanced polyphony than a Pythagorean scale, the seraphically mellow Just Intonation is no more practical for instruments. Neither tuning is practical beyond a single key for instruments with fixed pitches. The next solution was to devise a Tempered scale.

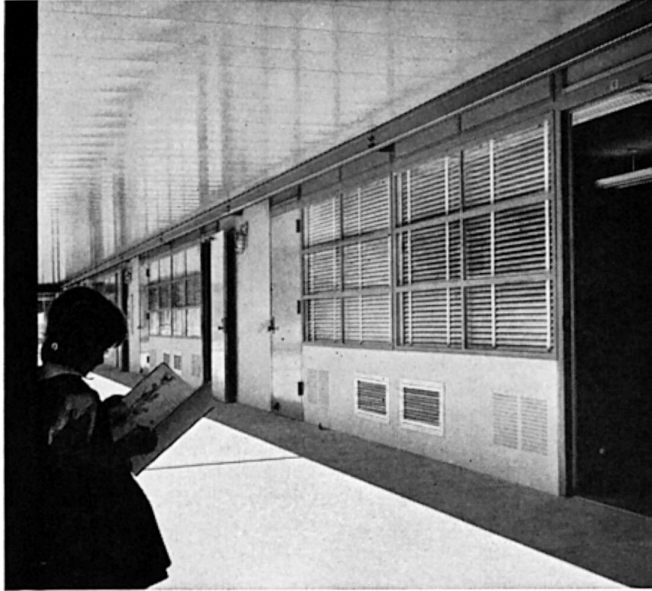
A Tempered scale is one in which certain of the intervals have been deliberately modified in tuning so that by an increase of slightly impure intervals and a corresponding reduction of grossly impure intervals a larger number of acoustically acceptable harmonic combinations are possible. Tuned to a tempered scale an instrument with fixed pitches is able to be played, by avoiding a few unacceptably discordant intervals, in more than one key. With a tempered scale, and only with a tempered scale, is a keyboard literature acoustically possible.

At various times efforts have been made to construct keyboard

(Continued on page 32)

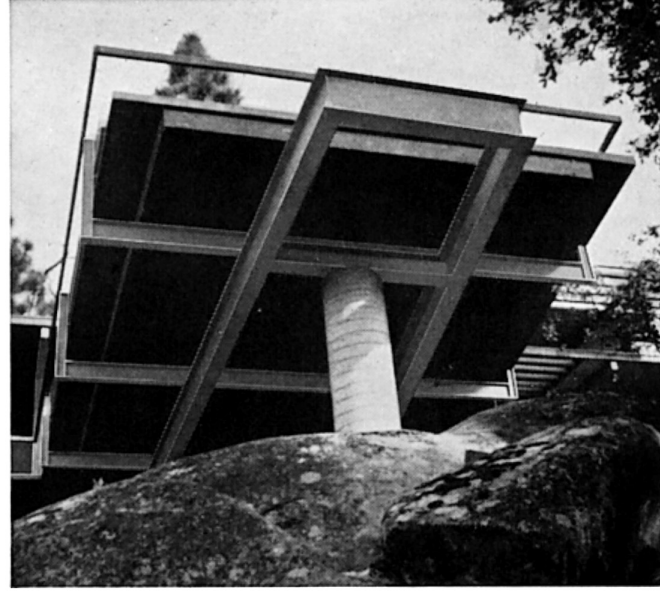
New Western ideas in steel

Architect: Roy Donley & Associates



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Contractor: Robert Jolly Construction Co.



Take to the Hills with Steel and make the most of a difficult site! Rigid frames of USS Structurals anchor this house and a *viewtiful* deck to an ageless foundation designed by nature. The architect, Thorne of Berkeley, planted the house in a cluster of boulders—but left them undisturbed in the wooded Sierra foothills. Steelwork, like this by Pittsburgh Des-Moines Steel Co., Fresno, Calif., goes up in a day!

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Architect: Donald Francis Haines & Associates



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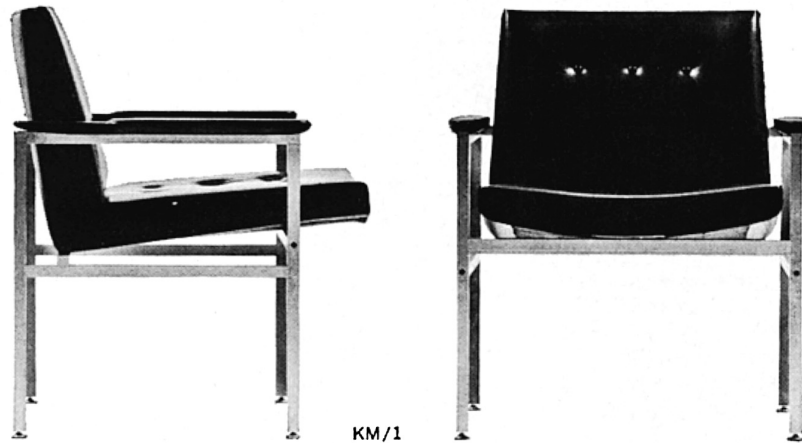
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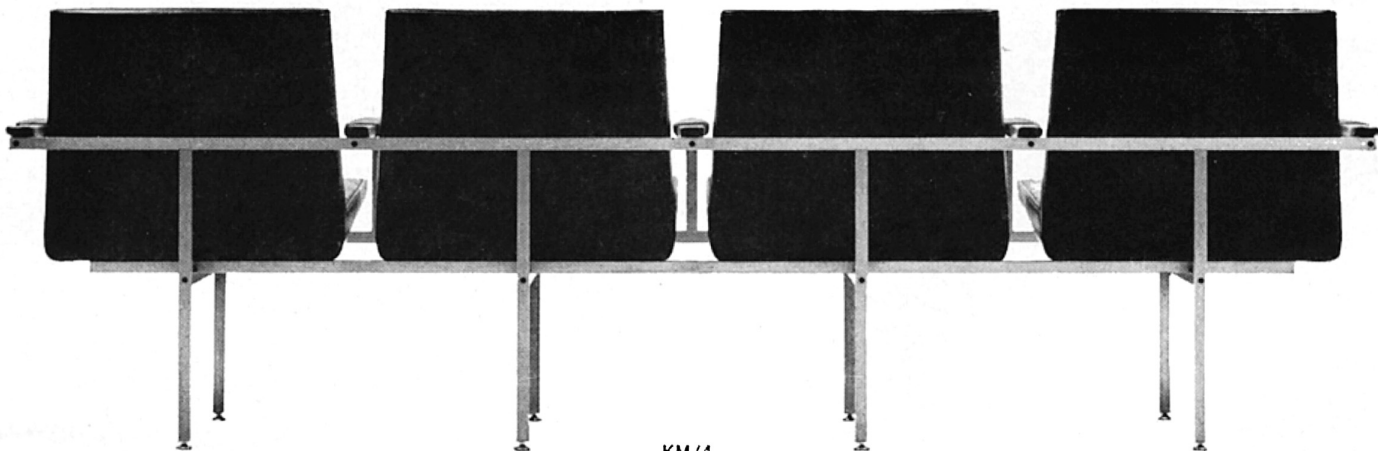
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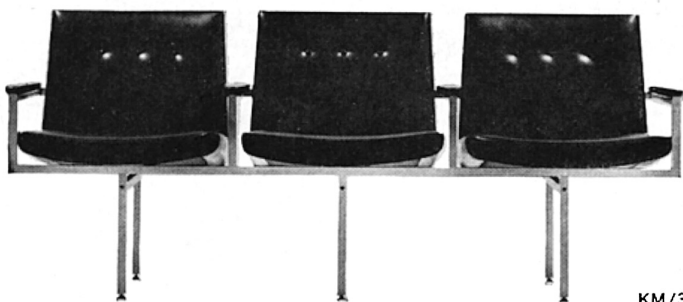


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Automation, atomic energy and other technological changes are dominating the labor and social scene in more and more of the older industrial countries and are a key factor in the development of the newly industrializing countries. They pose serious problems of economic and social adjustment for our industrial society and throw down a challenge to our whole civilization. True, many of the problems are not new. They arose in earlier stage of industrialization. Today, however, they seem to take on a more drastic form.

Today, every country is caught up in the relentless wheel of technological change. Each region and each nation is affected, directly and indirectly, and at an ever faster pace. There is no point in discussing here the desirability of this evolution. There is no question of turning back and little possibility even of regulating the speed of development. Our problem is to move forward in the social field fast enough to be able to ensure that technological progress is translated into social progress. We must give practical evidence of social growth if we are to profit from and even to control the mighty technological forces which we have liberated. If we do not grow to the extent required of us, our whole civilization will bend and may even break under the strain of change. If we do grow enough and fast enough, we open the way for creating a higher and richer civilization than man has yet known.

The concern is with the labor and social front, with what is happening to men and women at work, and with the problems confronting them today in consequence of the dynamics of technological change in our industrial society.

Despite substantial differences of opinion on many aspects of automation and atomic energy, no one would deny that they provide a powerful lever for economic growth. They make possible a vast increase in production and in productivity. They make possible the more rapid development required to keep pace with population growth and to raise living standards. Indeed, these and other forms of technological progress are essential if the world economy is to grow and produce more and better services and if it is to respond successfully to the challenge of rising populations and higher standards of living. This is the true perspective of the future—and one of which we should never lose sight.

Thus, the long-run outlook is good. But in the meantime many short-run problems have

to be met with imagination and vigor. Most of these relate to the labor and social aspects of technological change rather than to the technological aspects, and to our ability as a society to absorb change readily to the general benefit of the people.

Employers have continued their search for technical solutions to outstanding problems and have given increasing attention to the social aspects of technological changes. In many countries government services have taken steps to strengthen research and other facilities so as to be able to understand and anticipate the problems and to promote smooth adjustment to the accelerating pace of technological change. A great many national and international conferences have been held to discuss the impact of automation and atomic energy and to consider the more general problems of technological change. These questions have also been examined by a very large number of employers' and workers' organizations.

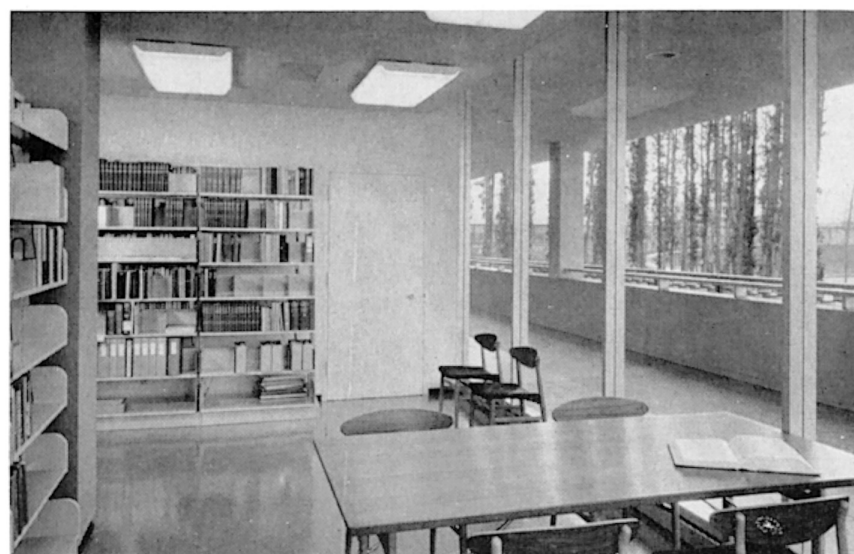
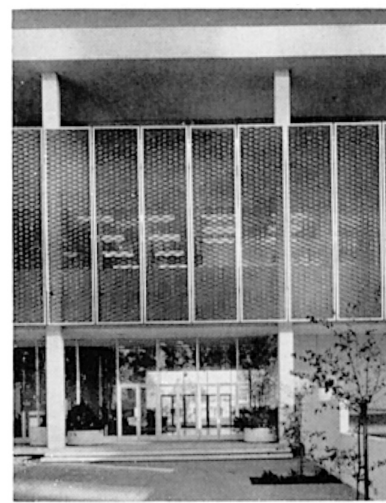
All these developments are symptomatic of a healthy concern with the problems facing us today and constitute reasonable and essential steps towards their solution. So far, we have only probed the surface. Much remains to be done to develop a sound basis for absorbing without unnecessary friction the vast changes which are taking place. We must adjust the pace of our social planning and action to the inexorable pace of the technological developments which are transforming the world economy. We have a heavy responsibility to develop and pursue policies which will facilitate the social growth now possible and necessary for world development.

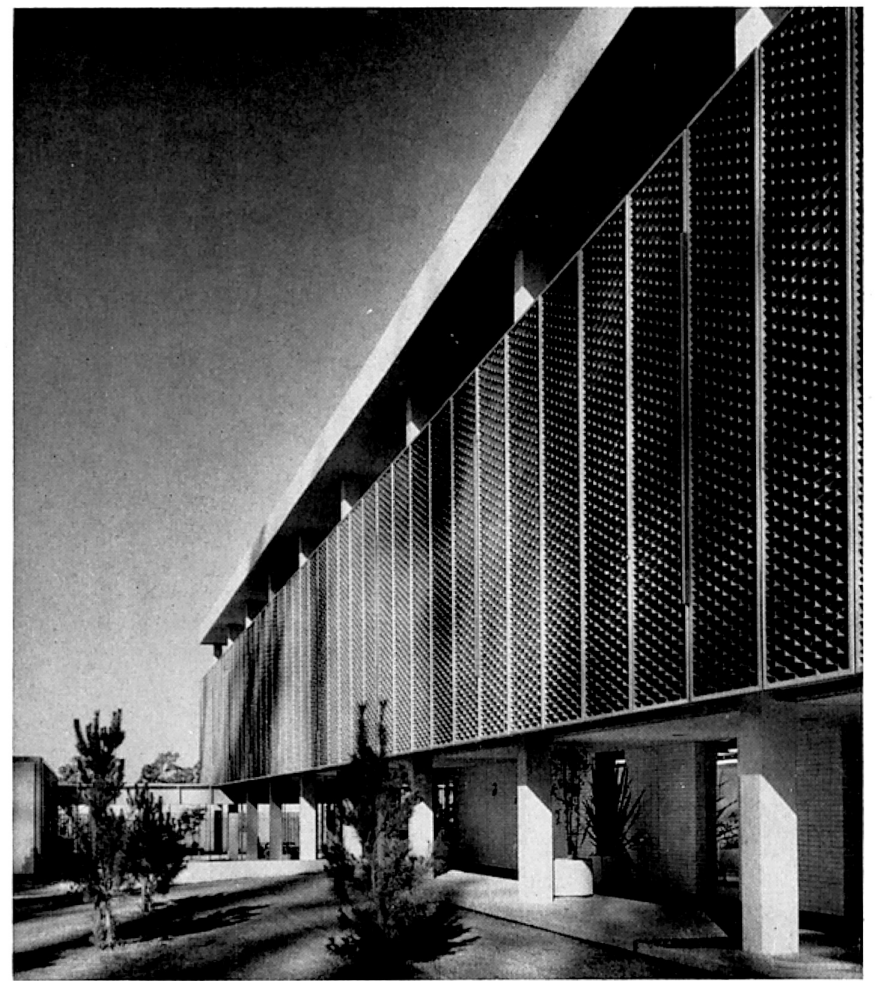
Despite many differences of opinion about automation, and especially about how fast it will come and how far it will go, there is a surprisingly wide area of general agreement about its impact on work and life.

The area of agreement can be summarized this way: Automation is rich with promise of higher productivity, of more goods and services, of higher living standards. It will have a deep impact on wages, hours, and working conditions, on labor-management relations. There is a need to prepare for change in all fields of labor and social policy.

The basic task is to ensure that the human problems of automation are not neglected. Put positively, its real job is to make sure that social goals triumph as the new technology makes its way into the world economy.

HEADQUARTERS BUILDING FOR THE CALIFORNIA TEACHERS ASSOCIATION BY WELTON BECKET AND ASSOCIATES



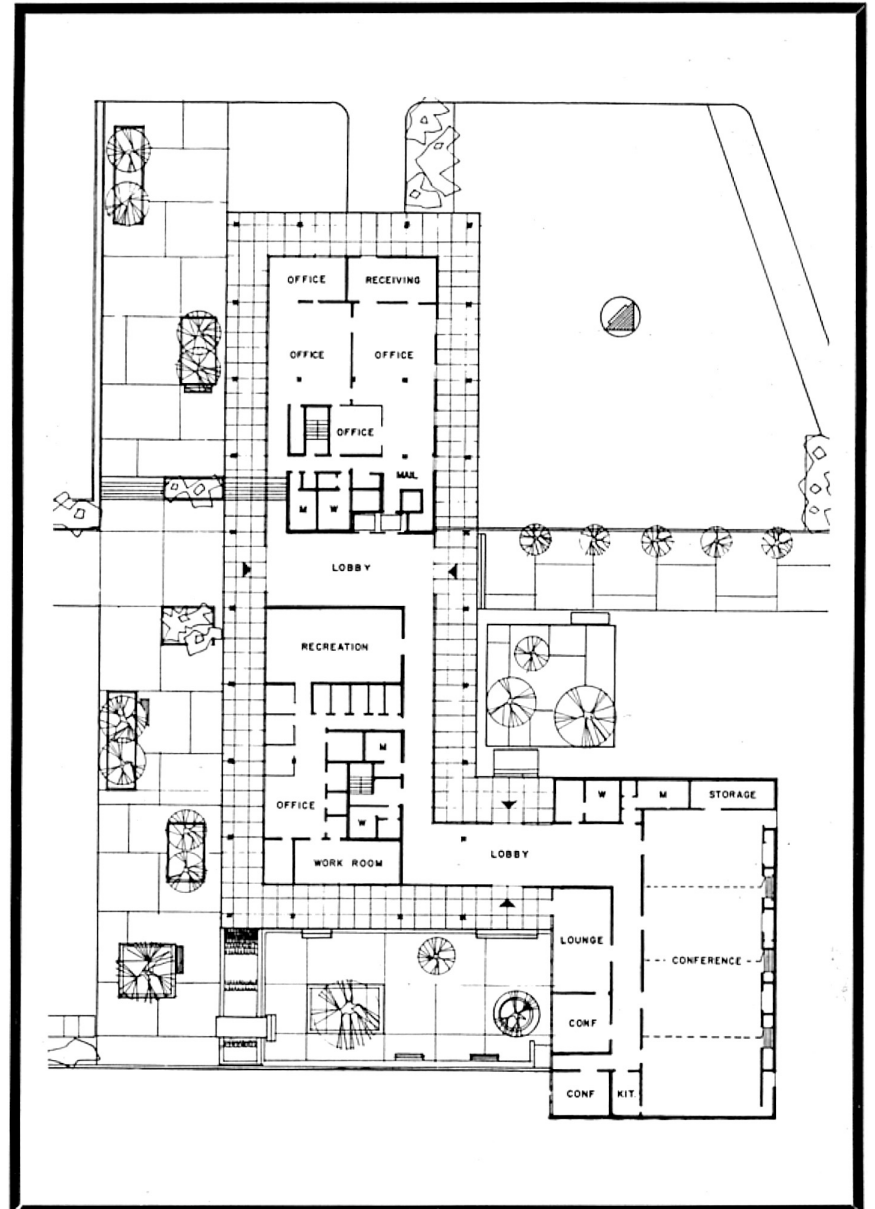


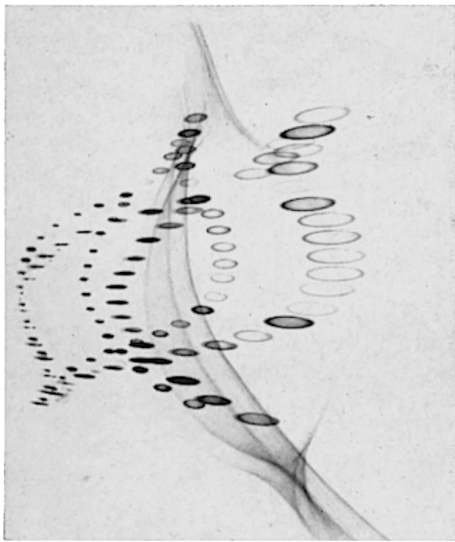
This new building designed to serve as a state center for educators and affiliated organizations is set in a park-like atmosphere with a gold sun-screen banding the white concrete building. Generous setbacks and large open areas with planting contribute to a feeling of unusual spaciousness.

The sunscreen is constructed of five-foot wide continuous panels, eight-inches deep and is projected by means of outriggers, three feet from the three-story portion of the building to eliminate glare from windows on the second floor. The windows of the first and top floors are set back and thus are protected from direct sun rays. All windows are fixed glass and the building is completely air-conditioned.

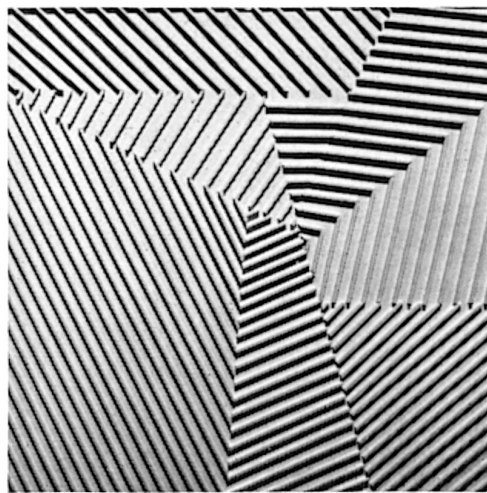
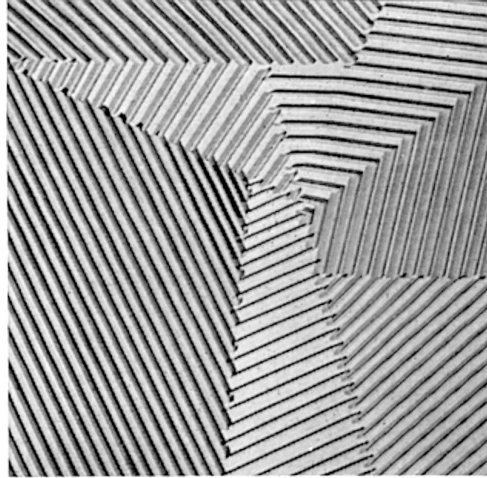
The main building is set on a platform which compensates for a sloping site and provides walkways of exposed aggregate finish around the perimeter of the building at the first floor. The exterior of the first floor is white brick and glass, while the second and third floors are plate glass with concrete. Both the office building and conference wing open upon a patio with a reflecting pool in green mosaic tile. The one-story wing is faced with Arkansas white clay and contains four spacious conference rooms, all of which can be opened into a single area seating up to 550. A large, glass-

(Continued on page 36)





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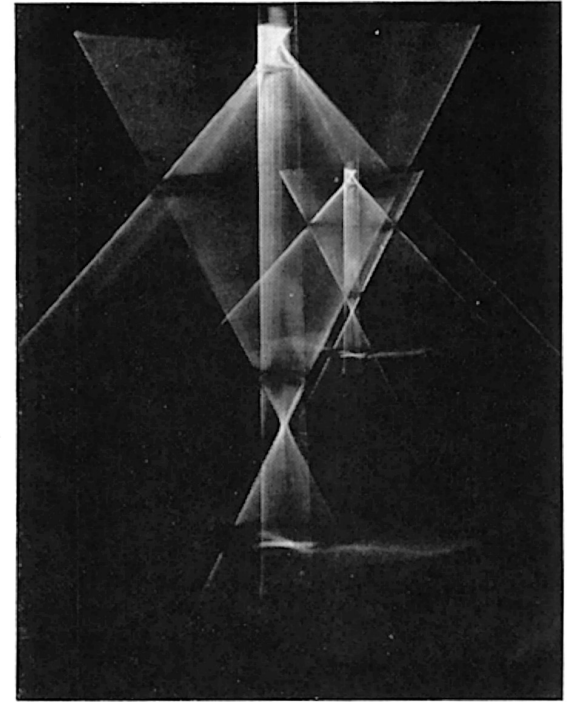


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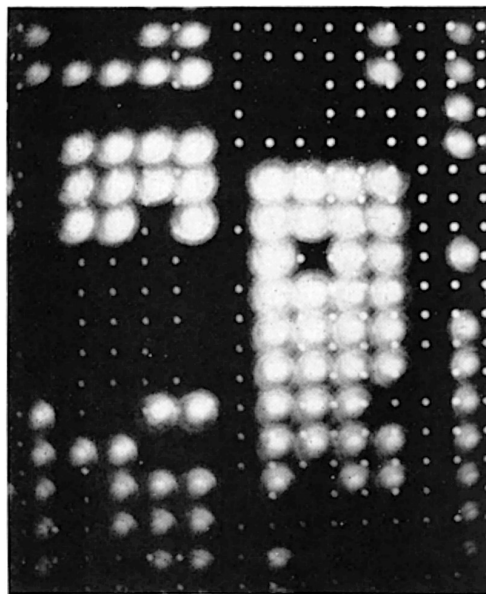
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VIRTUAL SPACE WITH PROJECTED LIGHT.

OPTICAL TEXTURE, PROJECTED LIGHT ON SURFACE.



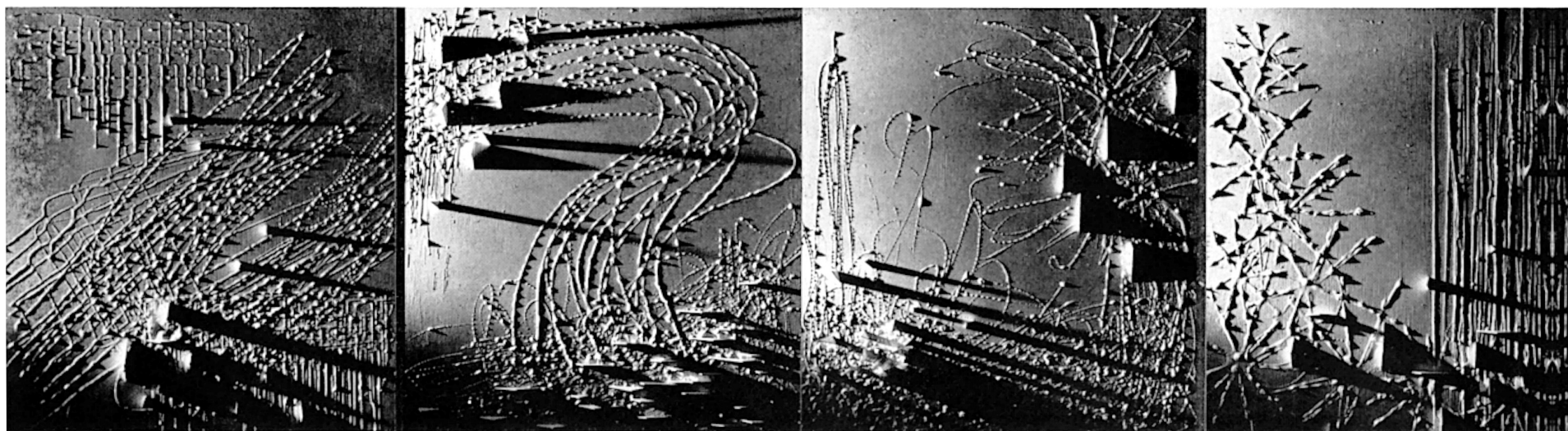
REG GRIFFITH

MATERIAL FROM AN EXHIBITION AT THE IBM GALLERY, IN NEW YORK, OF EXPERIMENTAL WORK DONE IN THE LIGHT AND COLOR COURSES AT THE SCHOOL OF ARCHITECTURE AT M.I.T.

LIGHT MODULATION WITH REFLECTING SURFACES.



JOHN SHAW



PETER B. BRANDT

The imaginative use of light has been until now a neglected area in design. In other areas, architects, planners, engineers and artists have established a basis for a physical environment that is authentic in its solution of twentieth-century needs, and promising in its enrichment of our life. There have been considerable technical advances in lighting, and designers with light have gained victories. Nevertheless, the creative use of light can be developed further in directions we have not even begun to explore, and an undreamed of wealth of esthetic experience still awaits us.

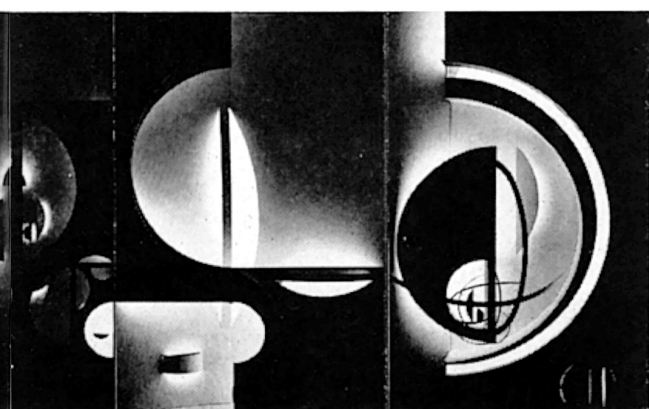
In large part, both the forms of contemporary architecture and the nature of present-day urban life derive from technical advances in illumina-

tion. The transmission of natural and artificial light through large sheets of glass has helped create a fresh sense of space as well as an augmented demand for light within structures. All twenty-four hours of the day may now be exploited, for the sharp differentiation in nature between night and day has fused in our cities into a single time scheme of day-and-night. Without the artificial lighting in our houses and streets, the circulation of people and goods would be reduced to a trickle. When evening comes and the lights are turned on, the city is transformed, however chaotic, blighted or ugly its daytime face. Points, lines, plane figures and volumes of lights, whether steady or winking, moving or still, white or colored, whether from windows, signs,

spectaculars, headlights, traffic lights or street lights—all these compose a fluid, luminous wonder, one of the grand sights of our age. Though this impressive display is produced almost by accident, a by-product of utility, its magnificence reminds us of the concentrated and ordered beauty of the great windows of thirteenth-century cathedrals. This accidental splendor contains the promise of a new art in the orchestration of light on either a limited or vast scale.

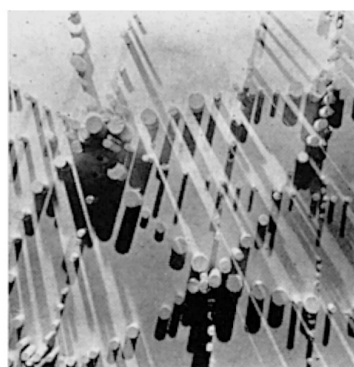
The use of light to clarify and inform architectural spaces and complex cityscapes is not yet a discipline. We do not yet command the principles. Such principles must be based on a thorough understanding of light and tools of lighting, as well as on a full awareness of the require-

(Continued on page 28)



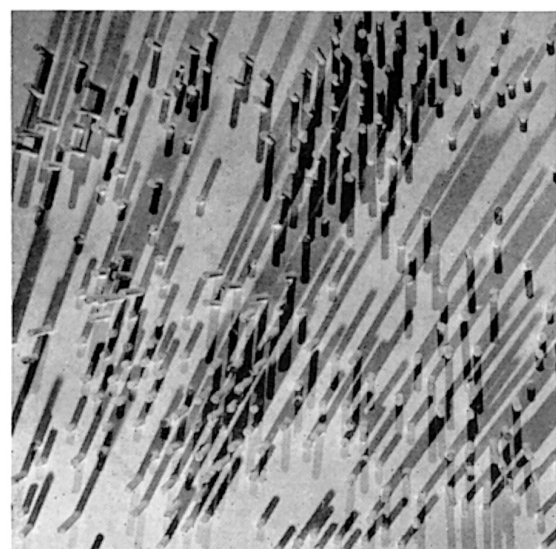
SPACE SEQUENCE WITH LIGHT MODULATION.

E. HALADAY



RICHARD LINDE

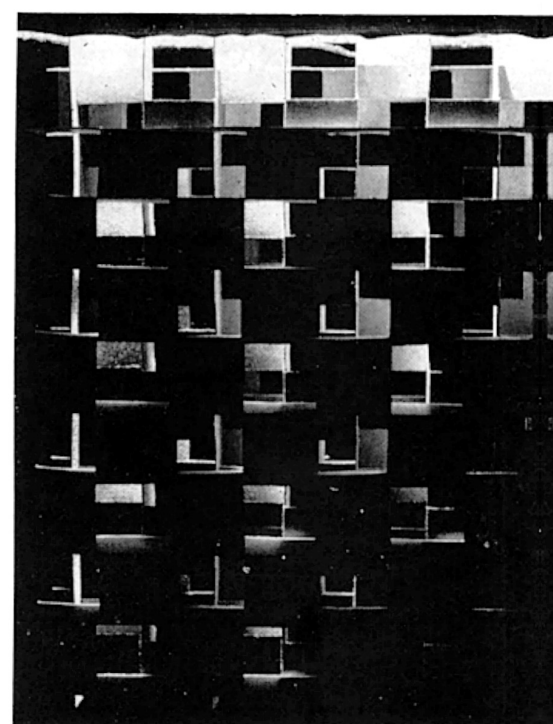
SURFACE MODULATION WITH SINGLE LIGHT SOURCE.



JACK KESTEN



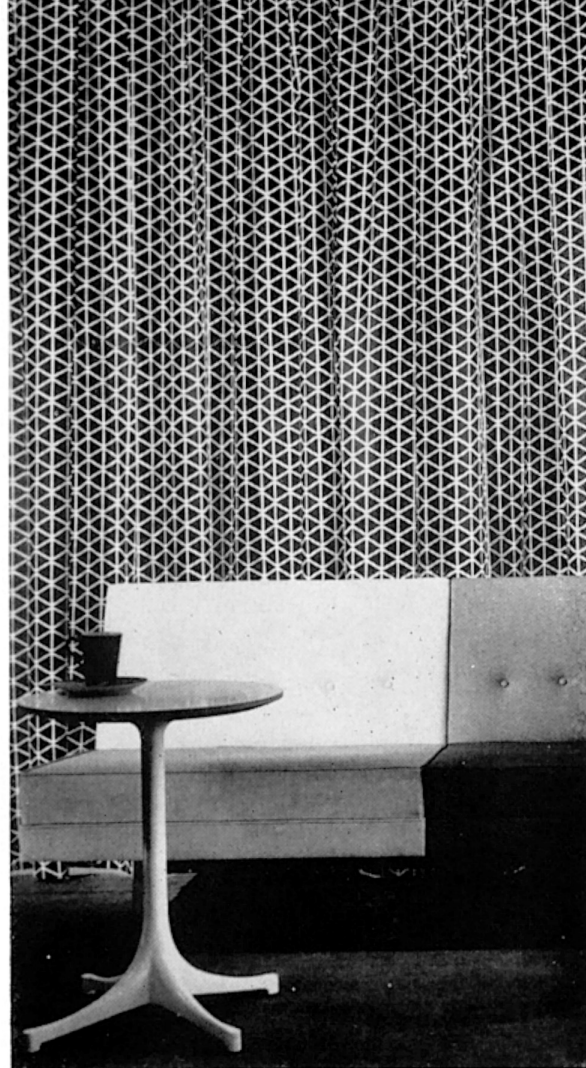
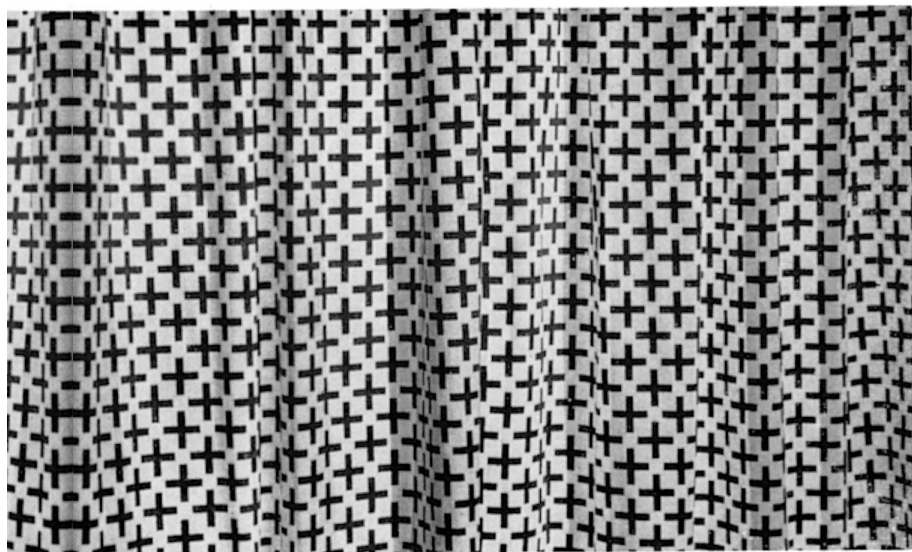
SURFACE MODULATION WITH DOUBLE LIGHT SOURCES.



RICHARD HOMER

LIGHT MODULATION WITH OPAQUE STRUCTURE.

NEW FABRICS

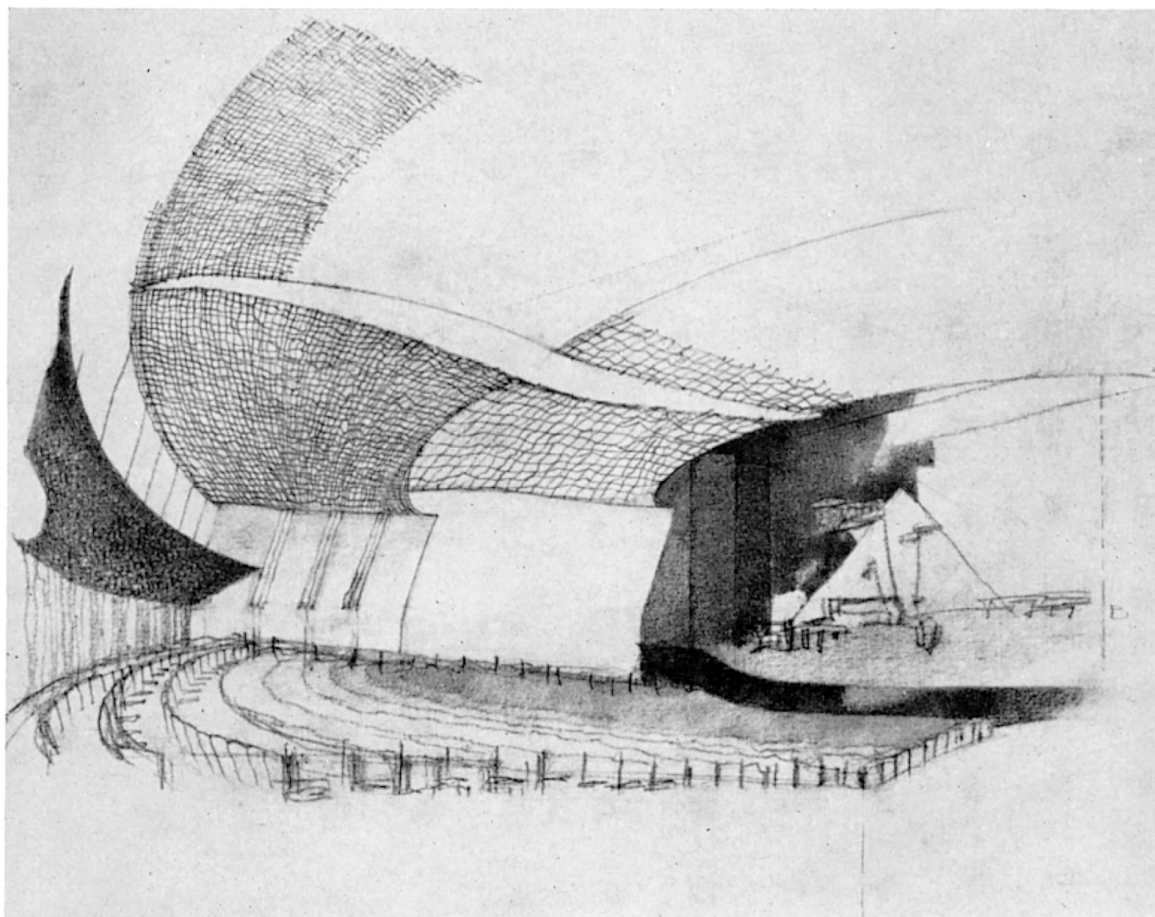


FOR HERMAN MILLER BY ALEXANDER GIRARD

Plus signs, triangles and ellipses in the hands of the architect Alexander Girard become colorful elements in a new collection of drapery fabrics for Herman Miller. Disarmingly simple because of their orderly symmetry these textiles are intriguing studies in design arrangement.

The rows of "plus signs" are seen as squares which appear to be created from interlacing of straight lines. "Small Triangles" is a print composed of equilateral triangles aligned to express themselves in horizontal rows. The little triangular shapes refuse to fit into the cliché of an even-sided hexagon and, instead, stand out as segments of hour-glass and diamond shapes. "Pumpkin Seeds" create a flow of elongated ovals which form a contrast against architectural shapes.

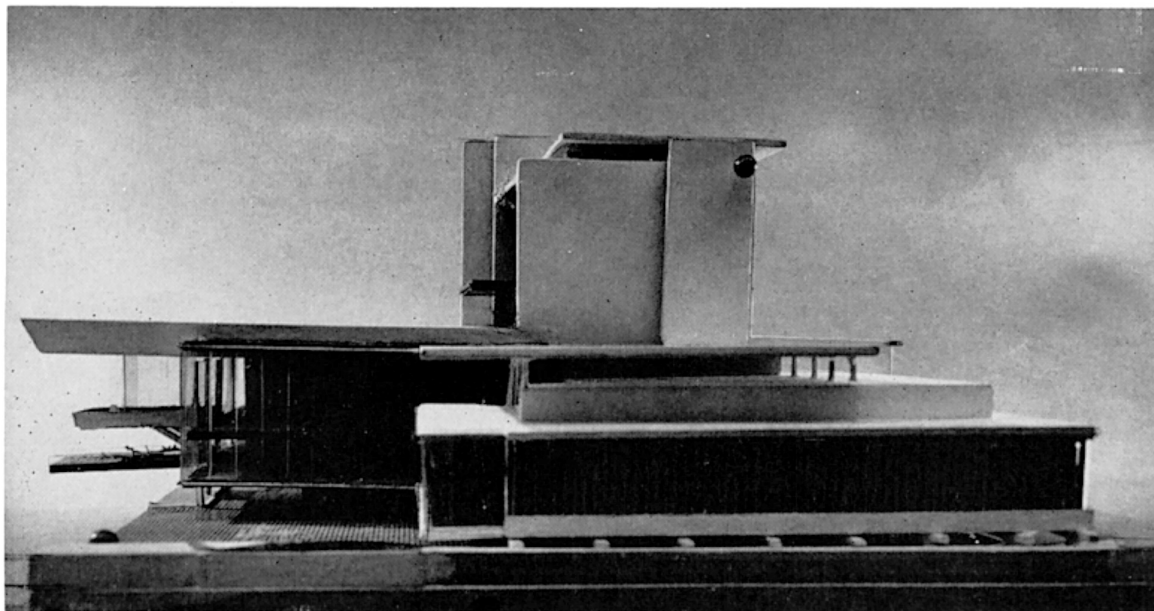
The selection of colors varies for each of the three patterns. All are printed with pigment dyes. The fabrics range from white cotton twill to Fortisan Bemberg and white linen.



A MODERN THEATER BY RICHARD NEUTRA, ARCHITECT

A PROJECT TO BE UNDERTAKEN IN DUSSELDORF, GERMANY

A FIRST HONOR AWARD IN THE INVITATIONAL COMPETITION FOR THE CITY THEATER OF DUSSELDORF



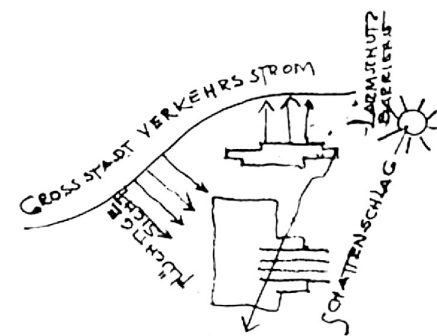
EXPERIENCE OF THE THEATER

ITS PHYSIOLOGY By Richard Neutra

Close by to the tallest, most distinguished office building in Europe, just finished for "Rheinrohr," a concern constructing fabulous pipelines in Arabia and Venezuela, is the site of one of the most prominent publicly maintained legitimate theaters of the whole Continent. It is a continent studded with theatrical culture.

The theater opens out on an ancient park of the 18th century and, due to its looming neighbor, the architect decided to distinguish it, not by a raised base, but by a sunken forecourt. It is the court of the original Three Muses. They stand there in an abstract sculptural chord; the fountain of the Hippocrene and a large mirror pool will enrich it. Over a bridge the visitors promenade onto a raised terrace during the intermission.

For Europe it is a very unusual matter to have a municipal monument like a theater



Metropolitan traffic gives a view onto this central civic structure. The skyscraper at its side casts on its variegated roofplanes an interesting shadow.

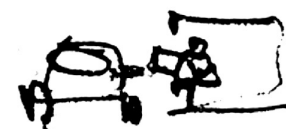
over-towered by a "glass slab," somewhat like the U.N. building, or seen and enjoyed from its roof terrace, something like 300 ft. above.

But, this theater is designed for an angel's view, rather than for frogs' perspective.

Shadows will be cast most interestingly by the tall neighbor over the two houses of the theater and the stage loft, on top of which one of the most honored functionaries of this rich German city holds his representative office—the "Superintendent," who will be visited by most important national guests, Heads of States and travelers from all continents.

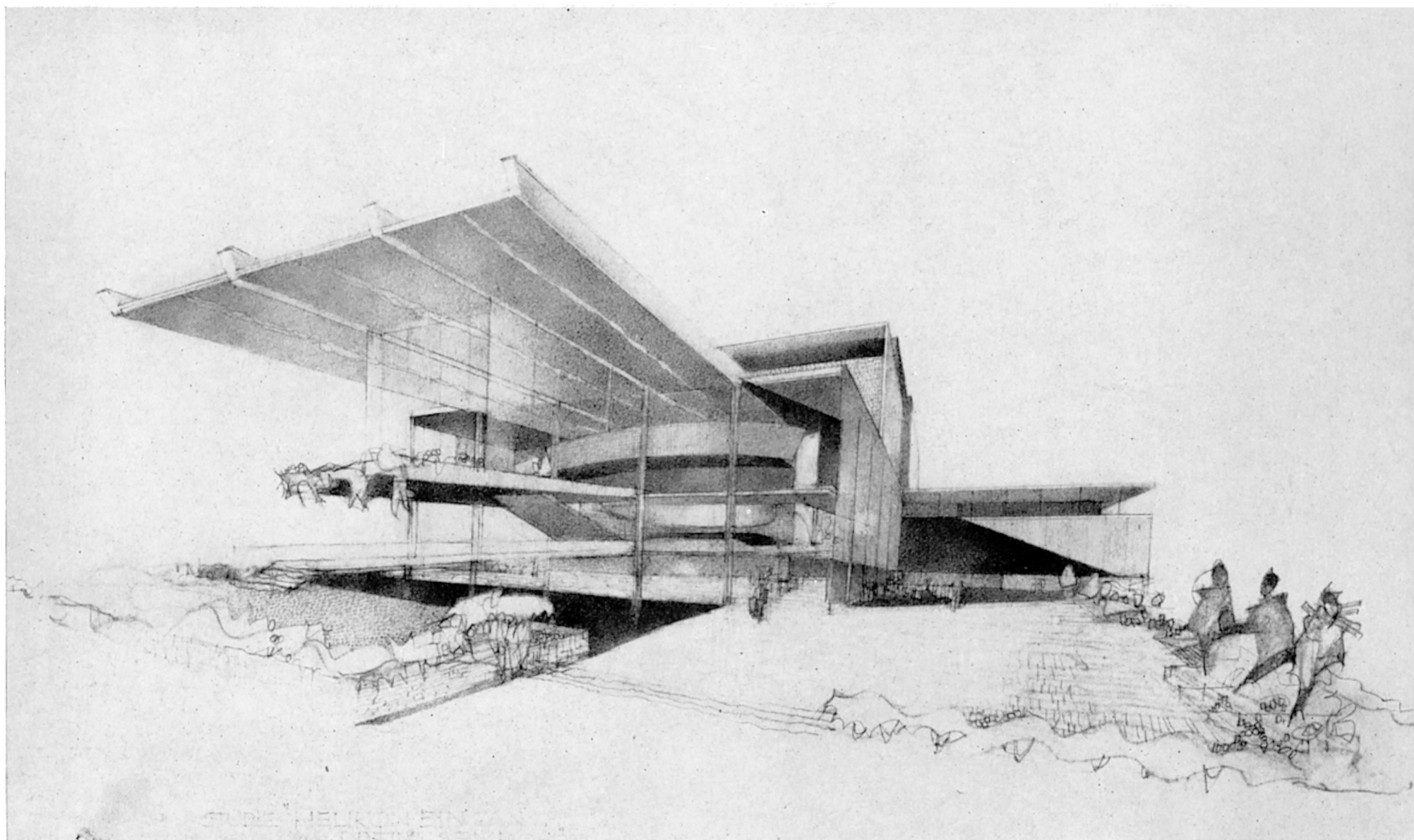
The whole building group and its surrounding terraces with garden areas and reflection pools will be a social center for many occasions and the pride of this city, which itself harbors few industries, but is the administrative center of the most far-flung, world-wide technological economies.

Every old tree has been preserved by the architect on this site, viewed from a dignified distance, by masses of people engaged in the stream of metropolitan traffic. Extensive park-



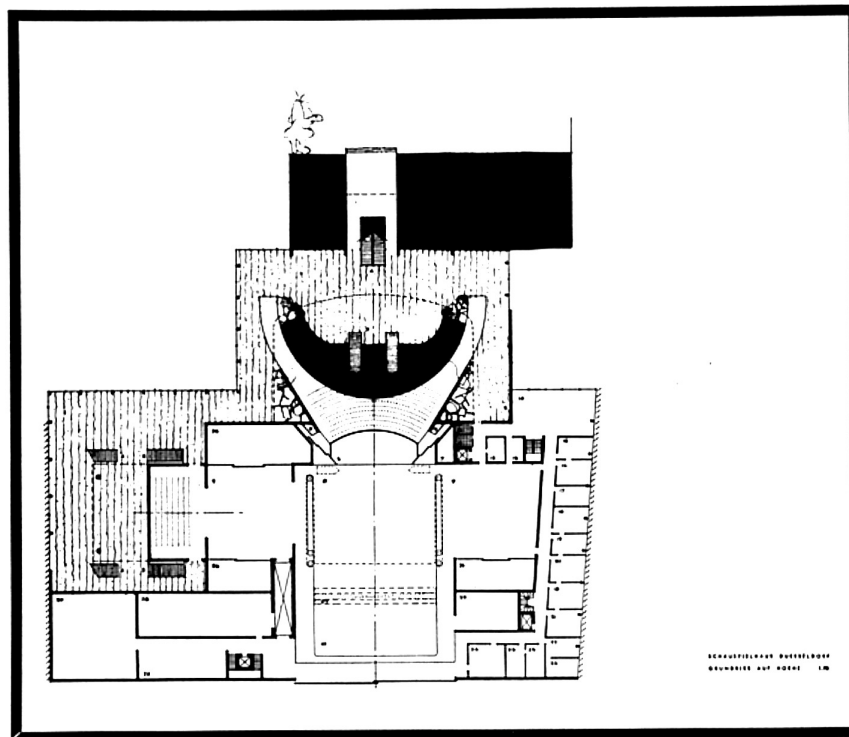
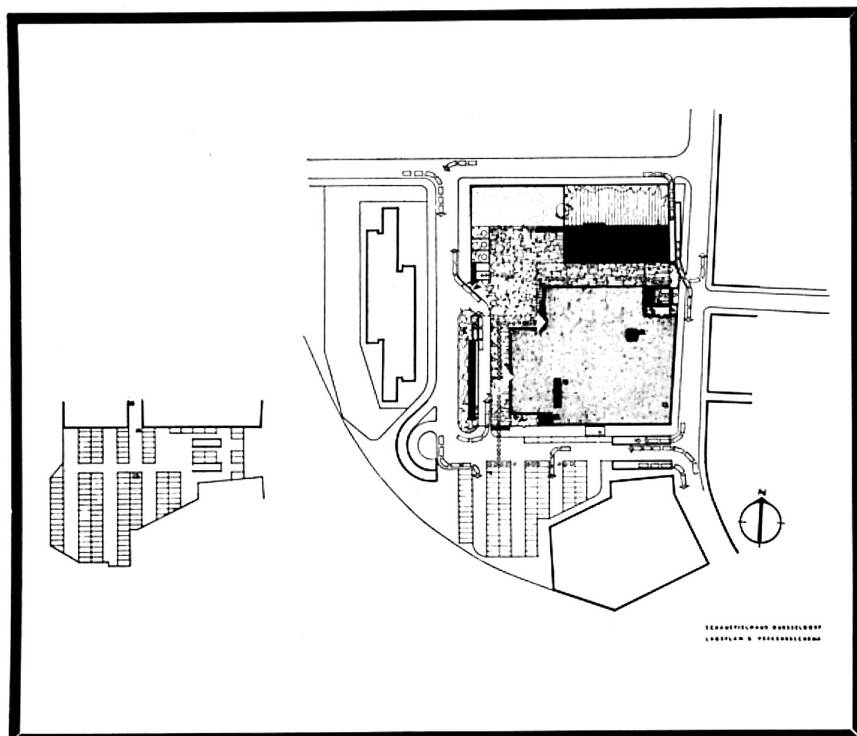
Ticket buying at day, right from the automobile, escalators up from underground parking garages are unusual features for a European theater.

ing spaces, especially under the building, are approached from the north and south and relayed by an underground concourse from which the theater guests reach, by escalators, the foyers of both houses and the ticket offices. An outer ticket office is operated by day for easy "drive-by" purchase.



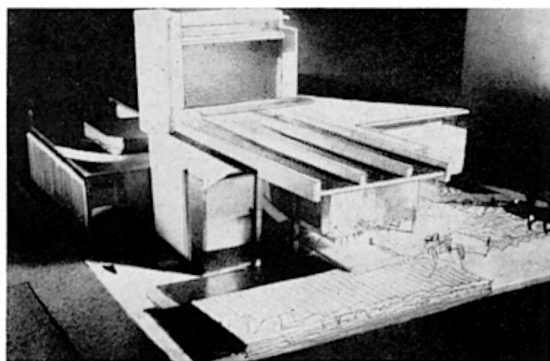
A MODERN THEATER BY RICHARD NEUTRA

The architect extends his gratitude for the aid given by collaborators, assistants and model makers, and particularly for the engineering advice by D. Sykes-Free and Eugene Birnbaum, and for the scientific information for which he is indebted to Dr. N. Ishlonsky and Dr. Karl Pribram. The other prize winners of the first three in the Dusseldorf competition were Bernhard Pfau, of Dusseldorf, and E. F. Brockmann, of Hanover.





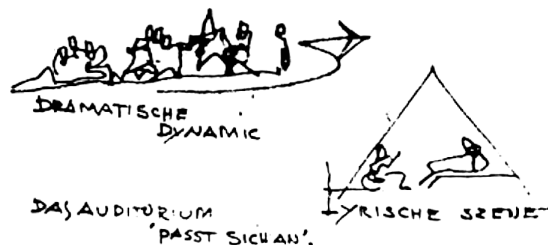
Sense perception is an ACTIVITY. But SEEING a drama is more active and directional. Hearing is much more relaxed.



All the up-to-date provisions of stage design and accommodation for the human and technical preparation of dramatic performances have been housed in what the architect hopes is a timeless, fashionably undated architectural body. The architect has devoted himself to a study of what man experiences when exposed to drama, spontaneously, intuitively and artfully composed.

The theater space, according to the Greek vocable "Theatron" is a seeing or viewing space, a "spectatorium," but is also an auditorium where things are being heard. Beyond this it is, way below the consciousness level of the theater goer, space, full of other sensorial offerings to millions of receptors. Because we live no longer in a time when architects catered to clients of just "five senses." The theater-goer finds himself also in a "thermal space" where the temperature starts rising after the curtain rises, with hundreds of human beings heating it, from act to act. He finds himself in a "space of humidity or dryness" while he watches the play.

He is enveloped in a breathing space with air movements, oxygen supplied and tiredness chemicals exhaled by himself and his fellows. He is in the midst of a space in which he turns and tilts his head with his acceleration sense in the inner ear stimulated, and so very cognizant of this space. All his inner senses, the



The stage can be drastically widened and narrowed, also asymmetrically.

intestinal and muscular senses, the "entero-reptives" and "proprioceptives" are activated, pleased or offended, while he sits through a performance, watches an illuminative color scheme, which might slightly irritate his stomach, or may exhilarate, and again depress, his organic entity as a whole, just as does the clarity or fuzziness of auditive reception, the low or high humidity, or the undersupply of breathing air. Even the slight smell of the

carpet padding in the aisles and, we hope, the controlled odor level, accruing where humanity is piled together, be it in Naples or New York, have their subconscious role. All the drama fan "knows" is that he is watching Hamlet in his despair, and actively follows with his whole body, in the last act the exciting sword play of the duelling scene. But there are many unconscious processes which the



The "social moment," which after the split of the dramatic event unites listener-spectators and the performers.

architect of the theater can stimulate or under-supply, which may blunt the effectiveness of even the most wonderful stage craft.

The drama starts with the dramatist's skillful exposition. Then, from the 1st, 2nd and 3rd acts, the curve rises to a climax and finally it sinks to a finish, never to be forgotten. On the other hand, the physiological receptivity of the theater audience could be shown by quite another graph to be highest at the beginning, and to fluctuate down to a minimum when the senses have been exposed for a long time. Still another graph could show various fatigue phenomena, first absent, but later beginning to creep up, rise and finally become too substantial for further intake.

All this is, as hinted, a physiological approach to the dramatic experience, and an approach to understanding how different and distinct the appeals are to our organic being, which comprises the most intricate, inter-linked brain, while we may believe that we are merely looking and listening. That is far from all, but if we only consider that what we are watching with our eyes is transmitted to us with a vast multiple of velocity, compared with what we listen to, it becomes at once clear that artificial provisions for visual and auditive reception, are by no means worked out, or cannot design-wise be combined automatically.

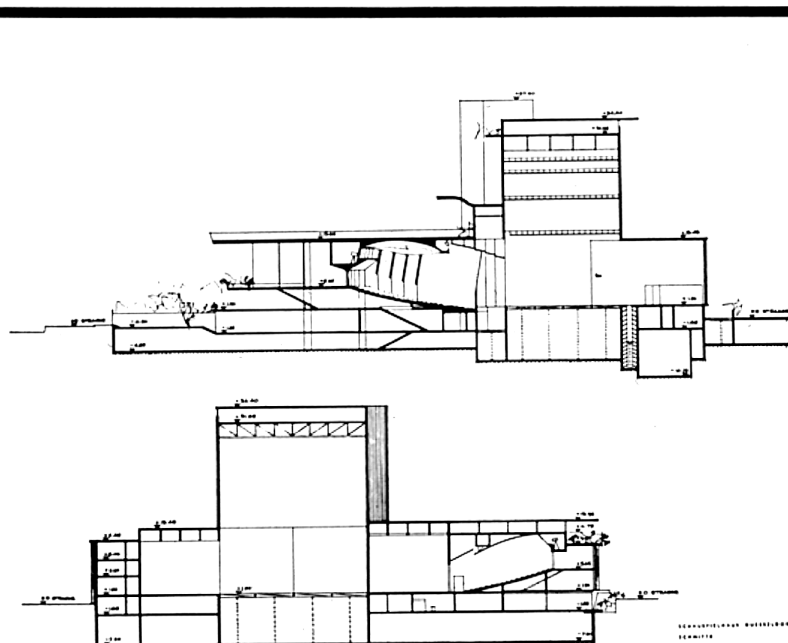
Neutra's theater in Dusseldorf does not make the assumption that what is acoustically desirable, also looks good, per se. We no more need think about acoustics when we enjoy visual form than we would care to take a glimpse into the boiler-room during the performance, to be sure that the temperature and moisture content of the hall is being taken care of. Nevertheless, the whole cluster of organic responses is simultaneously very alive in a human being, and in fact all sense intake is a lively, fused activity. It is not passivity by any means.

However, there can be no doubt that visual intake like, for example, watching a tennis match, with rolling of our eyes and turning of our heads, appears much more active than auditive intake where a listener to music may be, and look, very relaxed. Auditive intake is much less "directionally" marked. Our two stereophonic ears are less hectically and quickly turned than our two stereoscopic eyes.

Incidentally, more bodily participation of the looker-listener makes for intensified participation. It is psychosomatic.

The stage in Dusseldorf can be immensely broadened so that the onlooker is surrounded by the Battle of Philippi or, it can on other occasions be greatly narrowed, so that he finds himself, calmed down, in the tent of Brutus,

(Continued on page 28)



PROLOGUE

—Jean Tinguely is the man who mended Brancusi's machines.

Good Samaritan Jean Tinguely helps the bourgeoisie to help themselves. Let them do their own epater-ing. To aid them, he constructs clamoring machines that beat out your dance rhythms for you, paint your pictures for you, and pose prettily for that sober-citizen question: but is it art?

Acknowledged son of Dada (didn't Duchamp and Huelsenbeck take him to their bosoms?) T. has found a way to fill up time and confound movement. During his exhibition at the Staempfli Gallery, he spent much of his day repairing his obedient machines—machines that dutifully made his point: that they are, after all, the sums of imperfections, more human than machine.

Before New York, T. had already launched himself spectacularly in time and space. He had rented a small plane, flown over Dusseldorf and loosed torrents of manifestos. He told the Germans: Everything moves continuously. Im-mobility does not exist. Forget hours, seconds, minutes. Accept instability. Live in time. Resist the anxious fear to fix the instantaneous, to kill that which is living. Stop painting time. Stop evoking movement and gesture. You are movement and gesture.

Did he exhort the Germans in seriousness? Ah, no. It was a gesture. "I am not persecuted by M. Tinguely" is all T. will say on the subject. In the gallery he pulled out a wad of papers—he had already planned on the boat to construct a machine that destroys itself: the beginning of the *Homage to New York*.

No parking-lot, garage or loft would do. "It has to be in the Museum of Modern Art—it has to wind up in the garbage cans of the Museum."

With halting language, an air of modest bewilderment, T. enlists one person after another in his cause. The project compounds itself. Rumors, Rumors. Disdain and danger. But T.'s spectacle is destined to take place because the bourgeoisie *needs* it (the way everything else takes place, even "art").

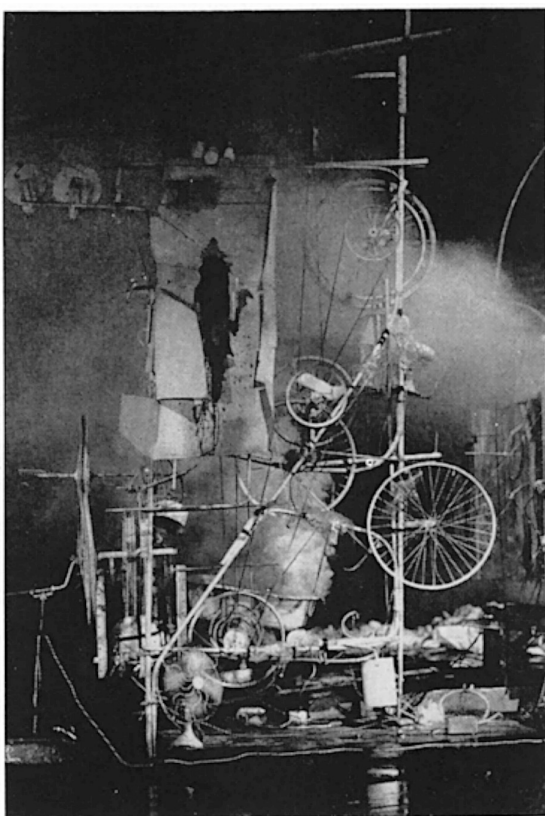
Digression

Spectacle. Remember Hokusai. He wanted to "paint on a scale that the world has not yet seen." A performance around 1805 described by a contemporary:

In the center of the northern court, protected by a fence, a specially manufactured sheet of paper, many times as thick as our raincoats, was unfolded. The size of the paper was 194 square meters. To keep it taut the ground was covered with a thick layer of rice straw and wooden blocks were placed as weights at short distances on it to prevent the wind from blowing the paper away. A scaffolding was mounted on the temple wall, provided with pulleys and ropes by which the picture could be hoisted. The top of the paper was fastened to a huge oak beam to which the ropes were attached. Brushes had been provided the smallest of which was the size of a broom. The ink had been prepared in large tubs and now stood ready in barrels. The preparations lasted the whole morning. People crowded the court from the early hours—noblemen and peasants, women and girls, old men and children. At noon, Hokusai, accompanied by his pupils, appeared attired in a strange semi-ceremonial dress, his legs and arms bare. The pupils filled the bronze vats with paint, carrying them to where the master worked. First Hokusai took a brush the size of a bunch of hay, dipped it in a vat of paint, and drew with it the right and left eye of the Daruma. After that he ran several steps and painted the mouth and ear. Thereafter came the neck, hair, beard. And with another brush he dipped into lighter paint, he drew other lines. His pupils then carried along a gigantic vat containing a brush of rice sacks bundled together. When they had placed the brush on the spot Hokusai indicated, the artist tied a rope around his neck and around the brush and running backwards with little steps and dragging the brush, drew the outlines of Daruma's dress. The red surfaces were colored with paint spooned out with a ladle from buckets. To prevent it from running several pupils followed behind mopping it up with damp cloths. By nightfall the gigantic Daruma picture was ready and hoisted by ropes over the pulleys, skirting the crowd who milled around it in buzz of excitement like ants round a piece of cake that had fallen on an anthill.

But that wasn't all. The acclaim Hokusai

(Continued on page 29)



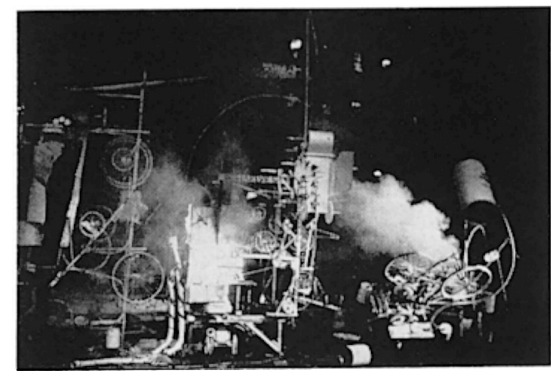
Early view



Jean Tinguely and Richard Huelsenbeck, father dada



The fireman

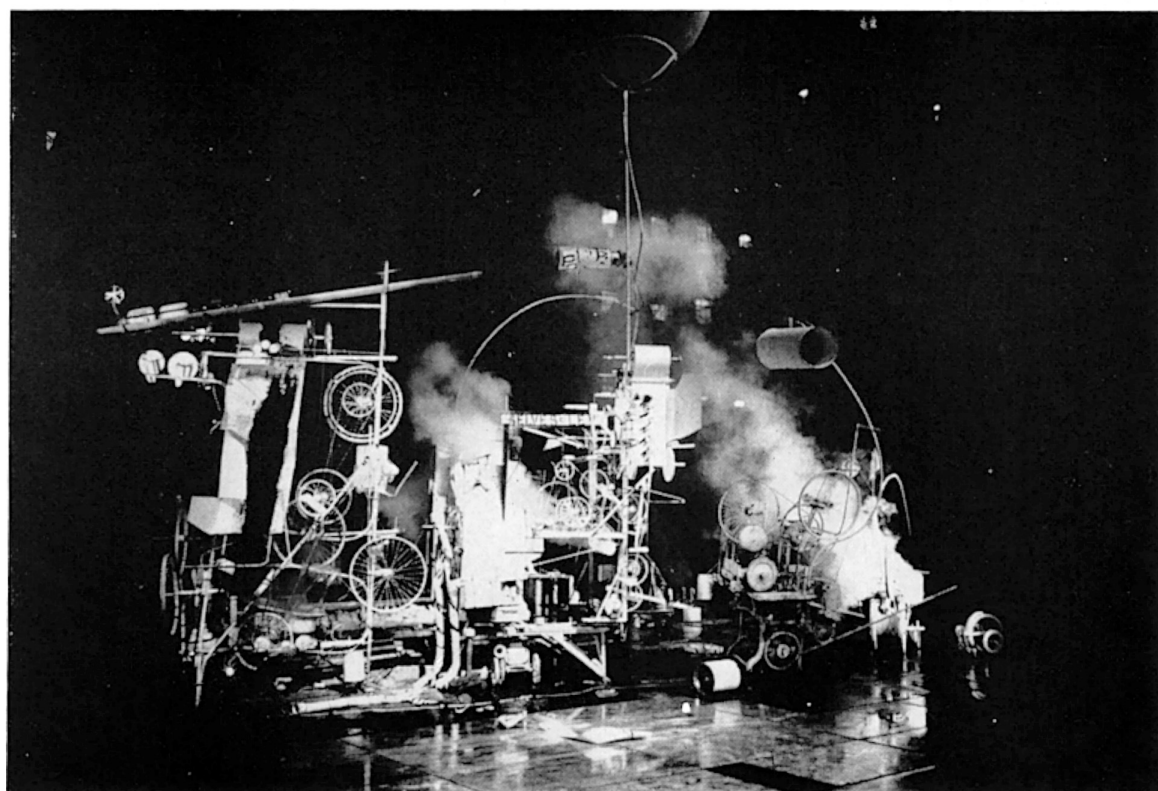


Piano machine in act of falling

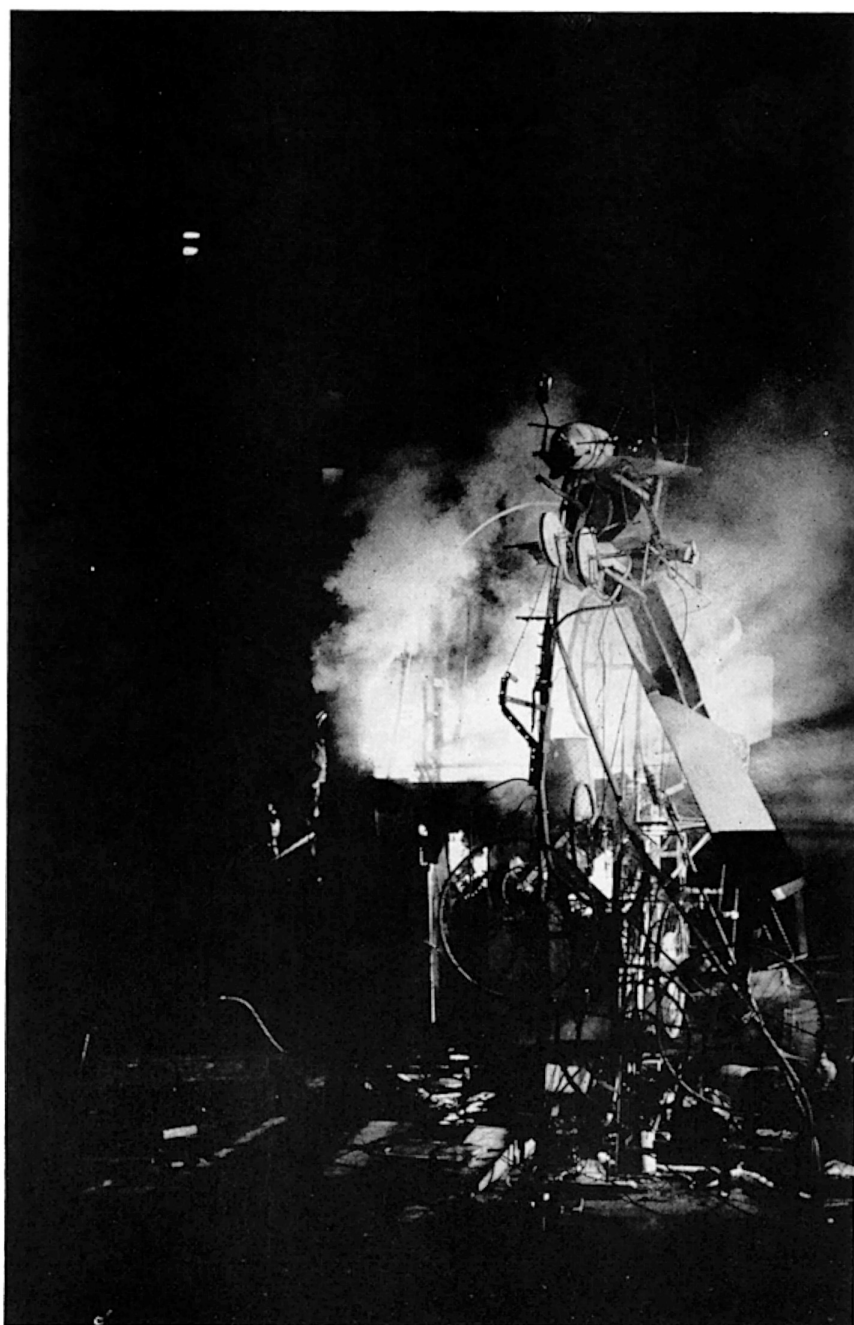
PROLOGUE AND LOG BY DORE ASHTON



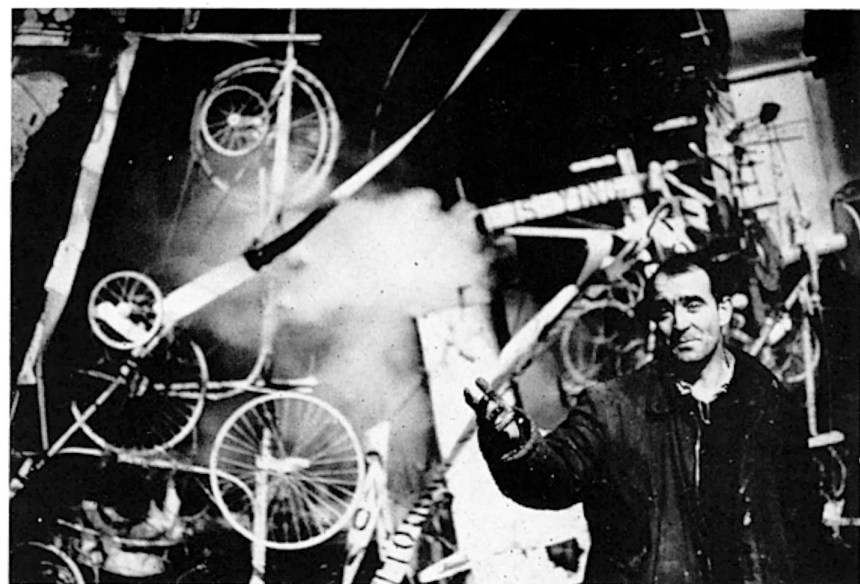
Jean Tinguely; behind: tachiste painting machine



Tinguely's machine at the mid-way point of the spectacle

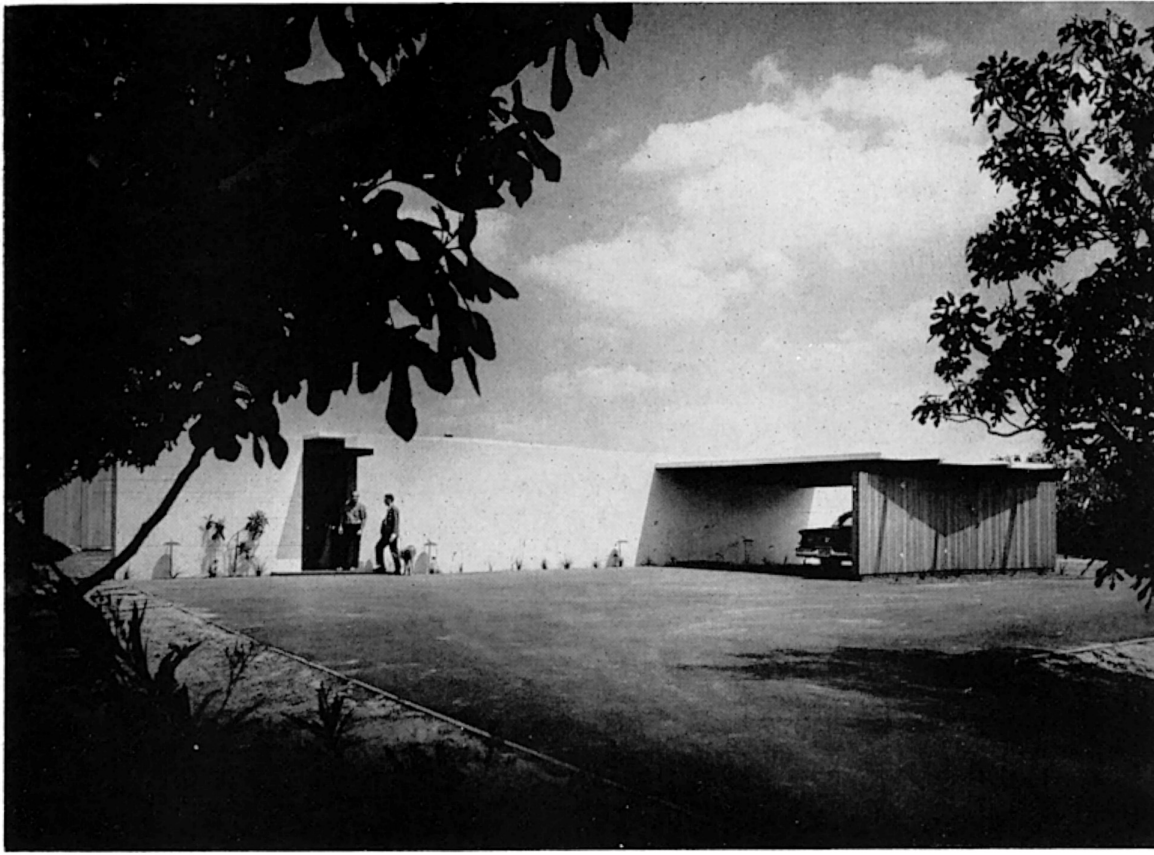


Finale



PHOTOGRAPHS BY DAVID GAHR

Left: Demise of flaming piano machine



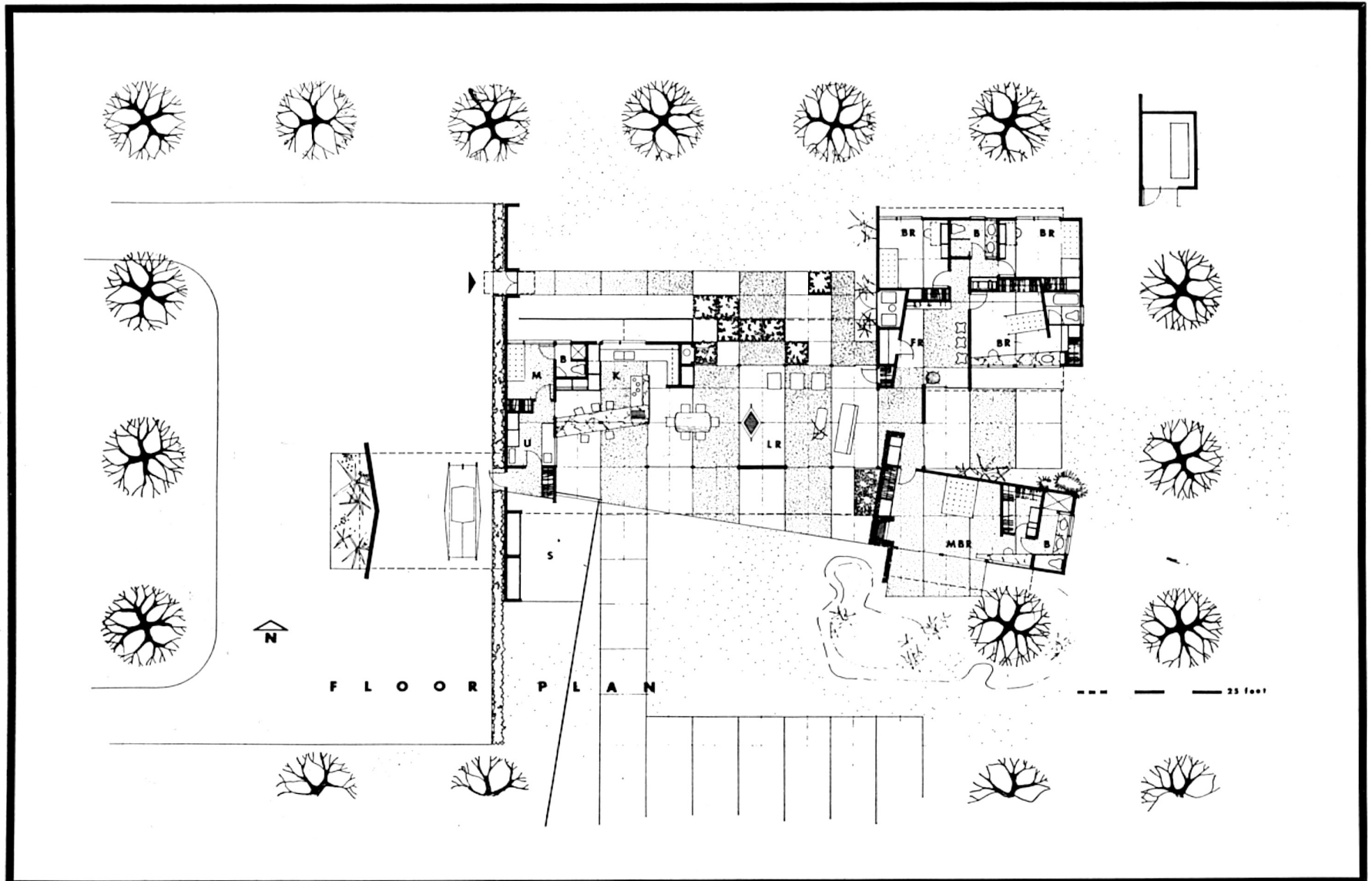
The client's requirements were to achieve an informal but elegant house for a family of five. There was a preference for wood as principal building material, therefore, the exterior and interior of the house is all redwood with the exception of a long, blank, plaster wall to the street. All floors through the house and terrace are terrazzo.

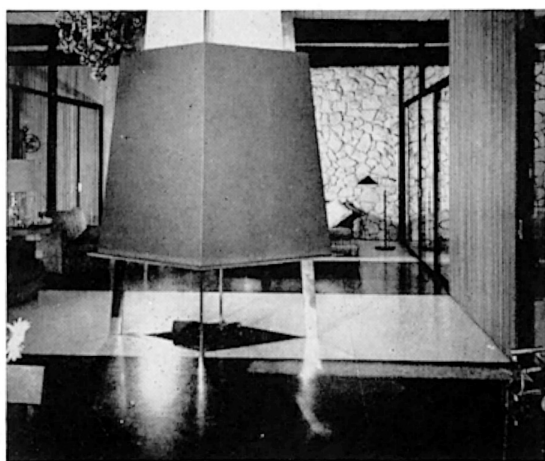
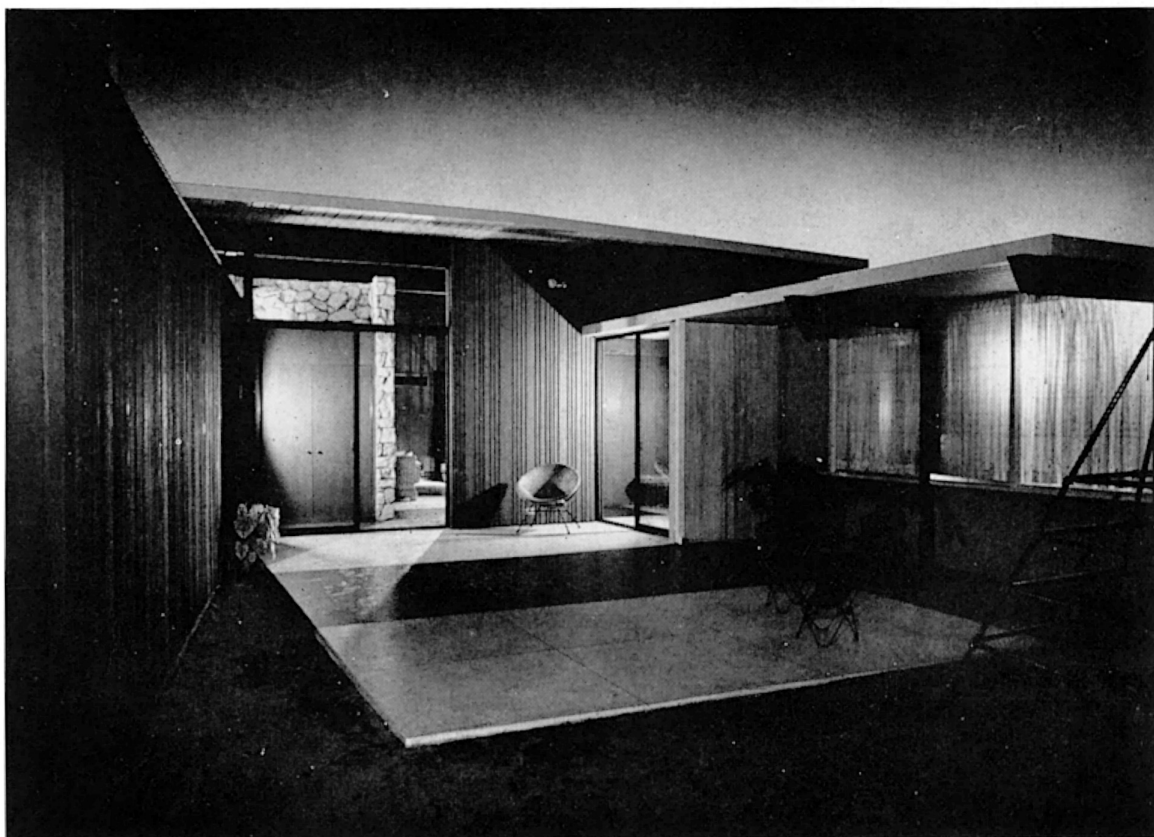
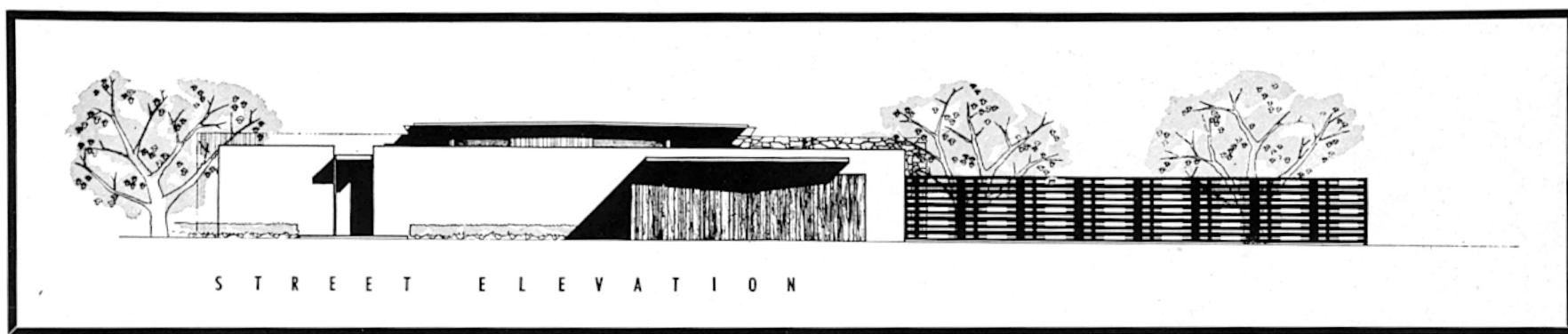
It was necessary to orient the house very carefully because of the intense summer heat in the area. The site is an old fig tree grove with all possible trees retained. The house is post and laminated beam construction rigidly held to a 10' module. It was desired that the house be able to accommodate an active social life and open up well for entertainment.

All color is by the architect and consists of a series of special stains in five colors: avocado and pumpkin yellow, matching paints, a black and a white and a brown stain.

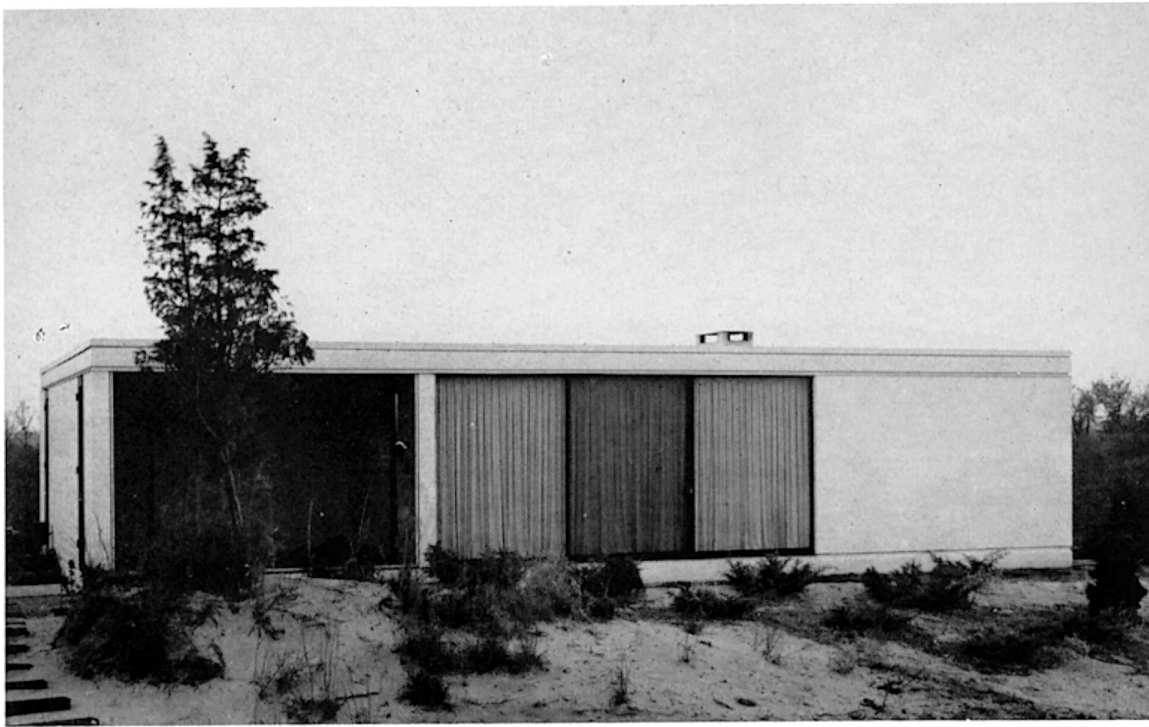
HOUSE BY WILLIAM SUTHERLAND BECKETT, ARCHITECT

BURR GARMAN, LANDSCAPE ARCHITECT

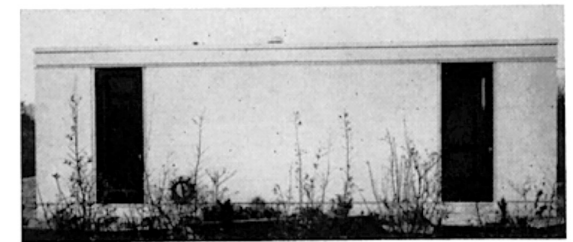
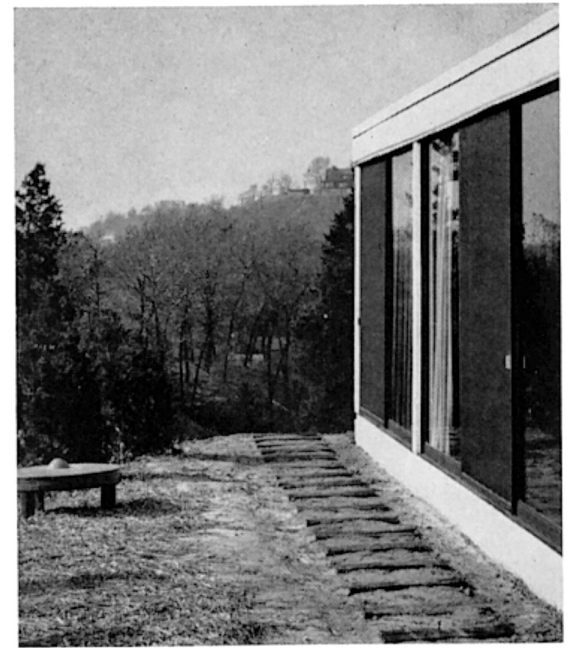
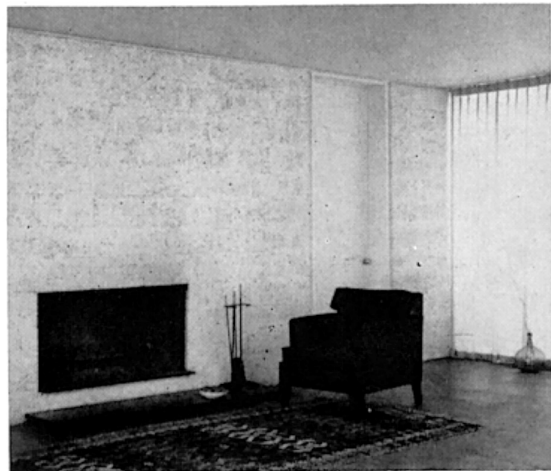




PHOTOGRAPHS BY JULIUS SHULMAN, GALEN LARSON



TWO SMALL HOUSES BY CROMBIE TAYLOR, ARCHITECT



This is a concrete block house built on a concrete slab. Used presently for weekends, it is also planned as a retirement house by the owners. Heat is from ducts beneath the slab and pouring hot air over the glass walls. Utilities are located in a room off the porch to separate any noise connection of furnace motors, etc. from the house.

Glass walls are faced to the south and to the north of the large living-dining room. This is done because the house looks over Lake Michigan to the north and inland for many miles to the south. A large dressing room with separate door to the outside is provided for the use of guests who may wish to go swimming. Interior partitions are of concrete block and in the living room are left exposed with a light coat of paint.

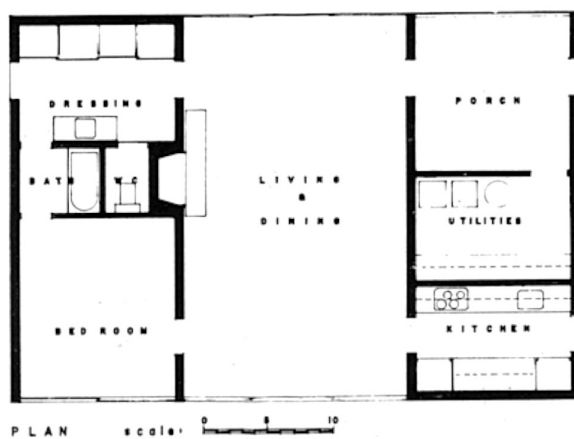
This house, simply executed, was conceived of as a platform for viewing the beauty of the dunes and the lake. In this respect it might be noted that it is intentionally modest, low and quiet, so that it need not intrude upon the natural beauty of the dunes.

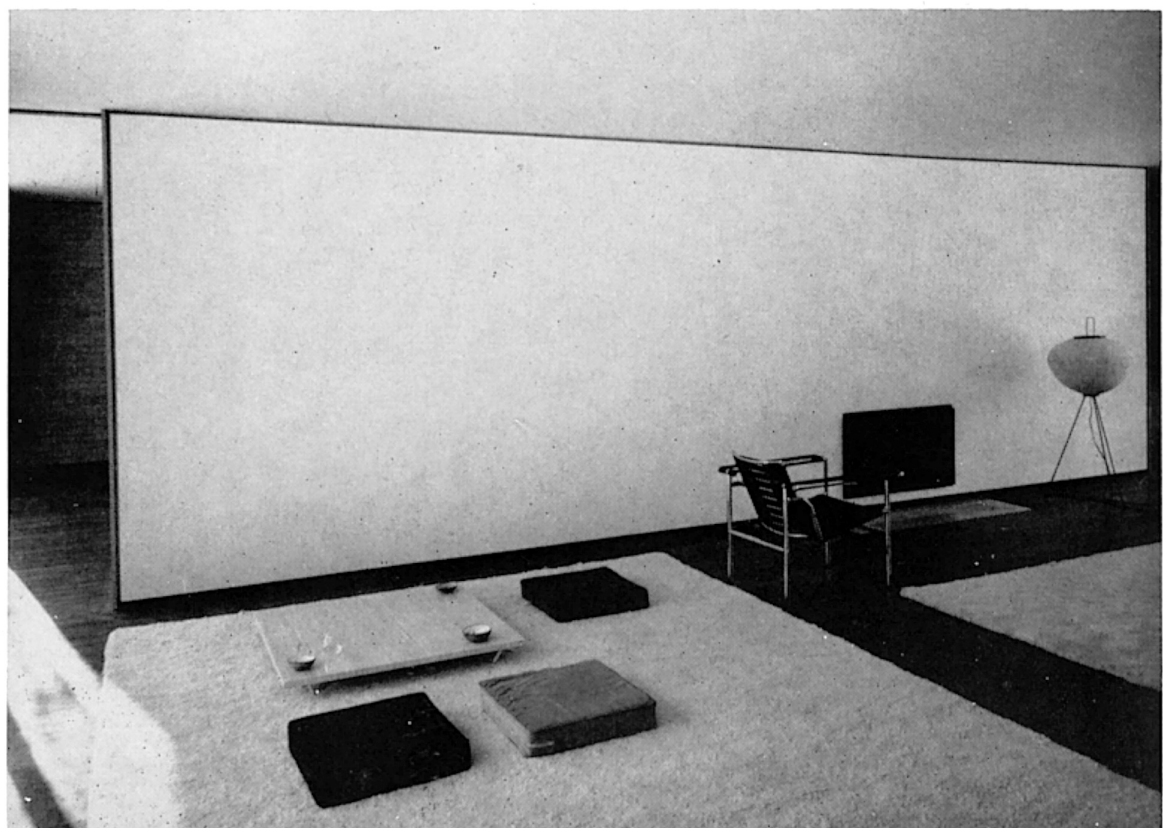
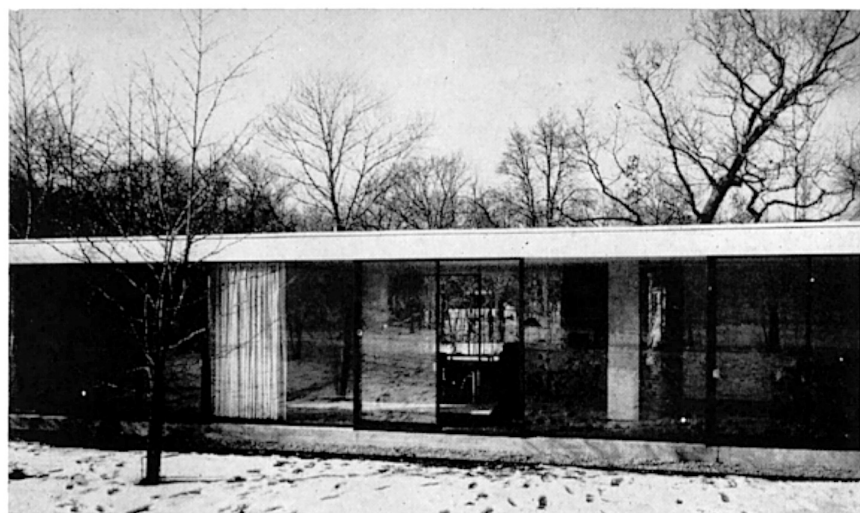
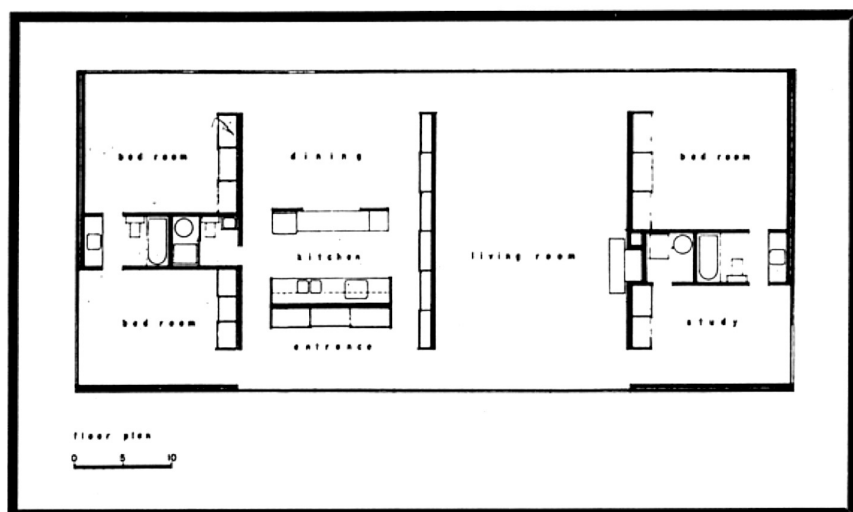
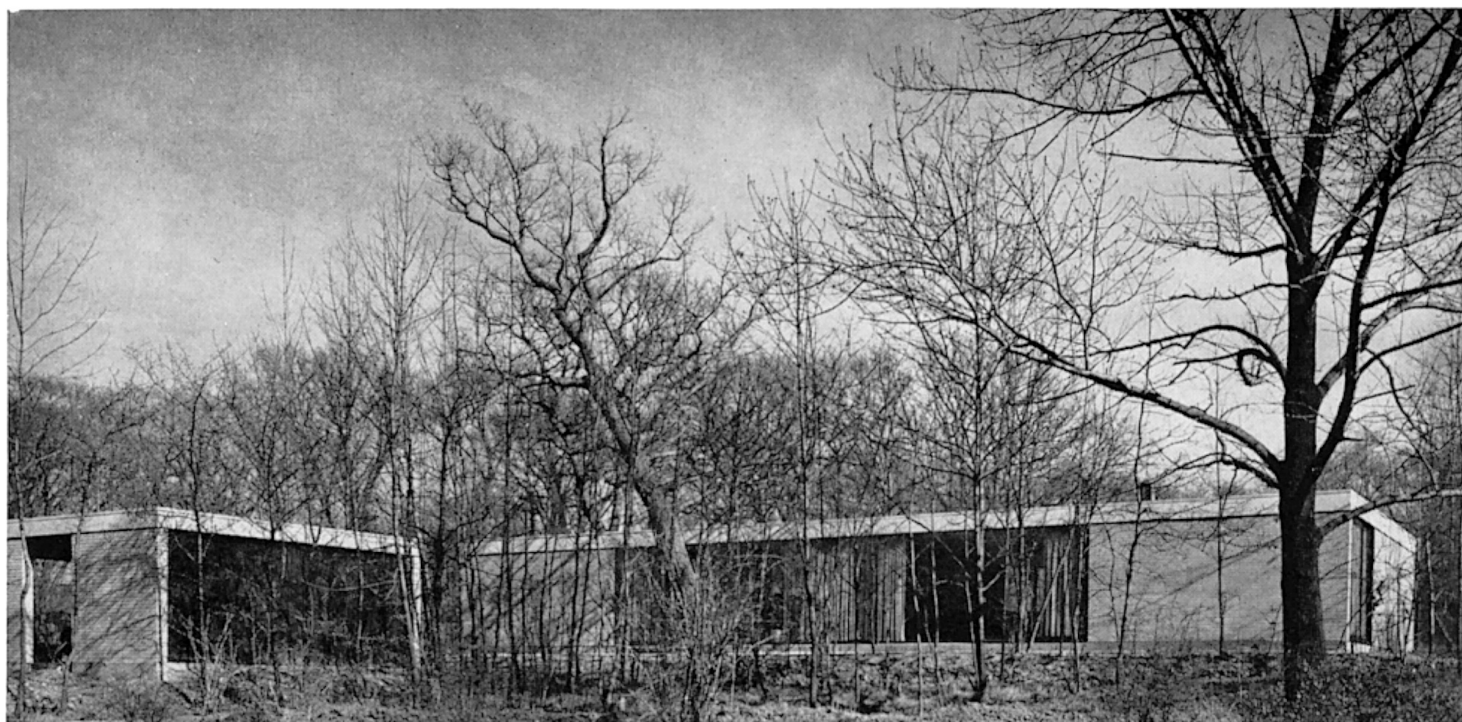
right page:

This house is built in the suburbs of Chicago for a family consisting of parents plus two children. Bedroom areas are separated: parents at one end, children at the other end of the house.

The house is placed in the center of an acre of land, and looks into woodland views in all directions. Walls are kept short of exterior walls, the roof cantilevering out. This peripheral circulation gives a fair degree of privacy in the various rooms without closing doors. Kitchen is separated from dining by sliding panels. Storage is provided in long screening walls as well as in a sizable room off the carport.

Construction is concrete slab on grade; brick exterior walls; wood and plaster interior partitions; standard wood joist construction in ceiling. Heating is by two separate furnaces which heat the two ends of the house. Baths and hot water heaters are also located by each bathroom. Floors of the house are 1 1/2" quarter sawn oak except for tile in bathrooms. Arcadia sliding steel sash is used alternated with fixed panels of glass. Area of house is 2400 square feet.







This house for a semi-retired couple consists of a living room, family room, containing an area for dining, with kitchen and utility room close to the family area, two bedrooms, and the outdoor activity area either on decks or on grade.

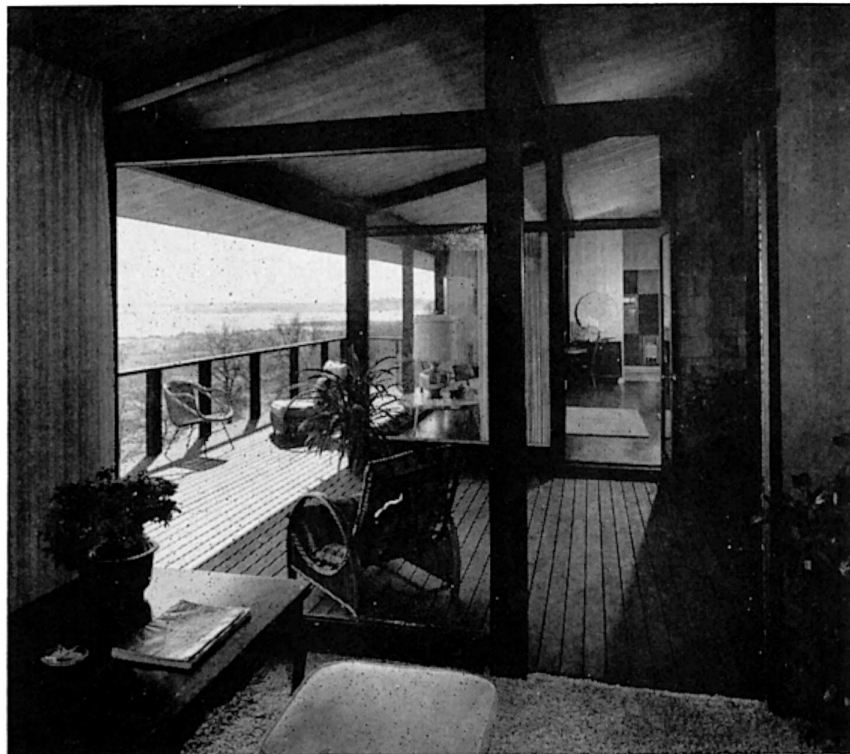
The site is an artificial lake created by a new dam. The slope of the property is nearly 25 degrees and steepest near the access street. The major view and outlook is toward the south.

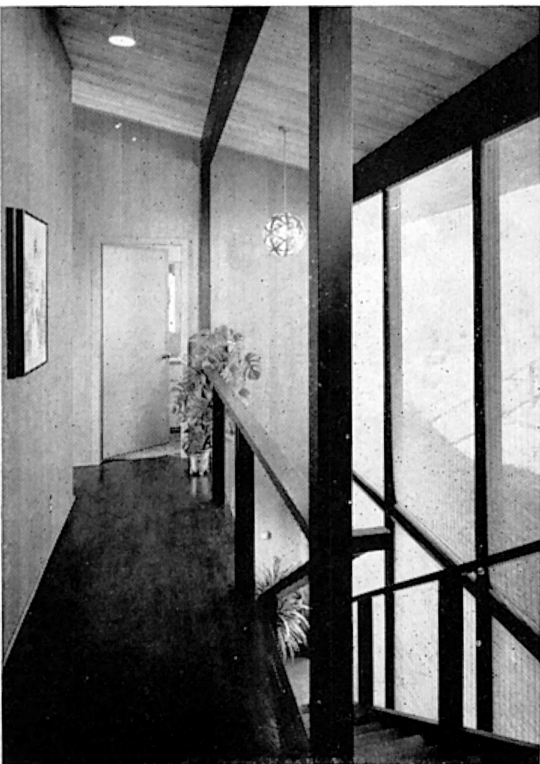
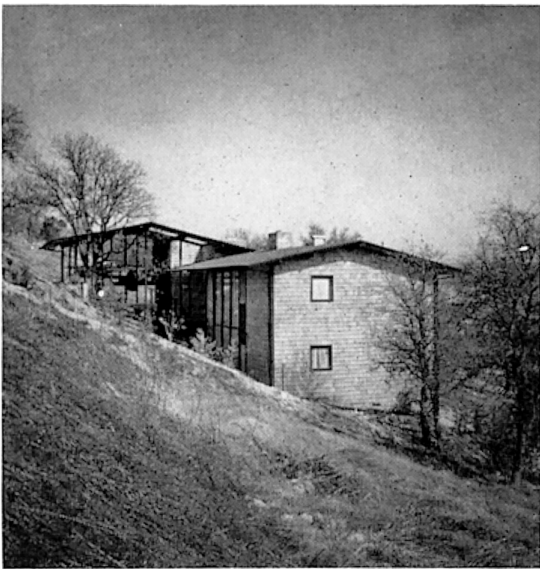
In general the solution is a three-story plan split nearly midway between the main living floor and the access street, the main floor level containing the living room, family room, kitchen and utility area with the decks toward the south and the main view. From the entry an open stairway goes to the bedroom floor below which contains two bedrooms, bathroom, and a small study area.

Most of the interiors are paneled in vertical grain Douglas fir. The kitchen cabinets have been done in mahogany; the main hall downstairs is paneled in vertical grain Douglas fir with the rest of the areas sheetrocked. Cedar shingles are used on all exterior walls to reduce maintenance with only trim and millwork being painted.

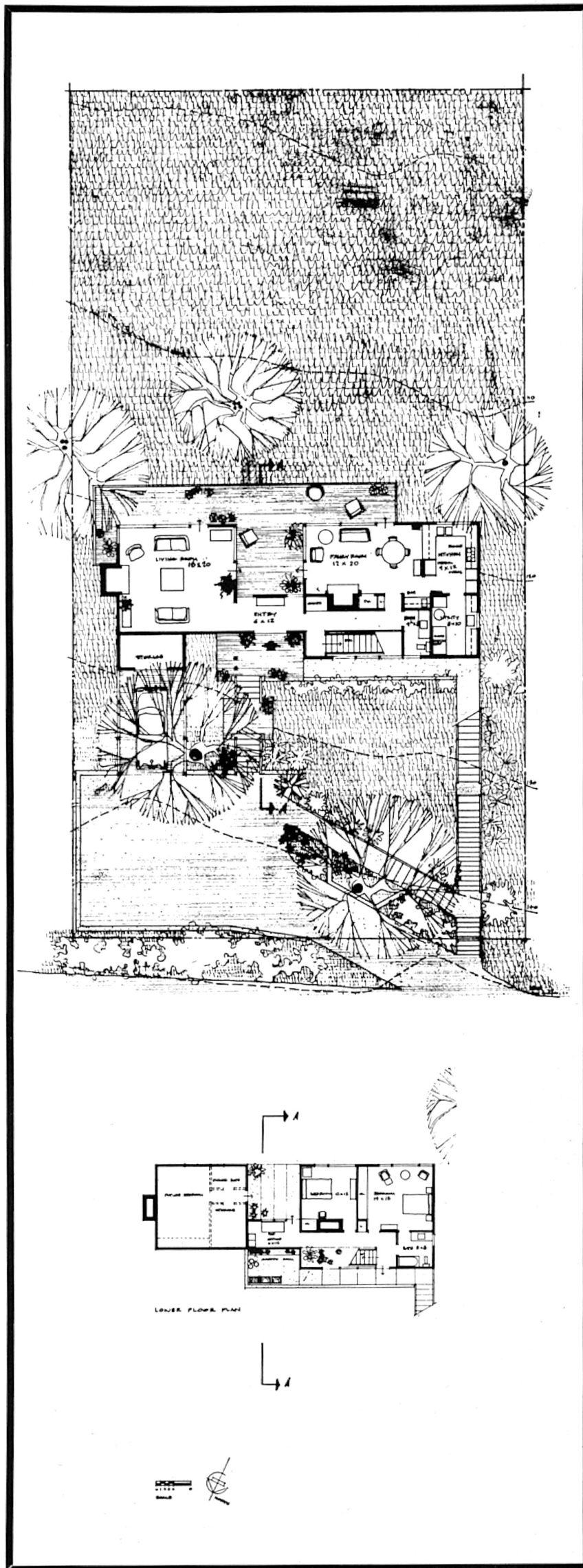
Landscaping was minimized for ease of maintenance and is terraced simply at the lowest point of the house and controlled with heavy ground cover.

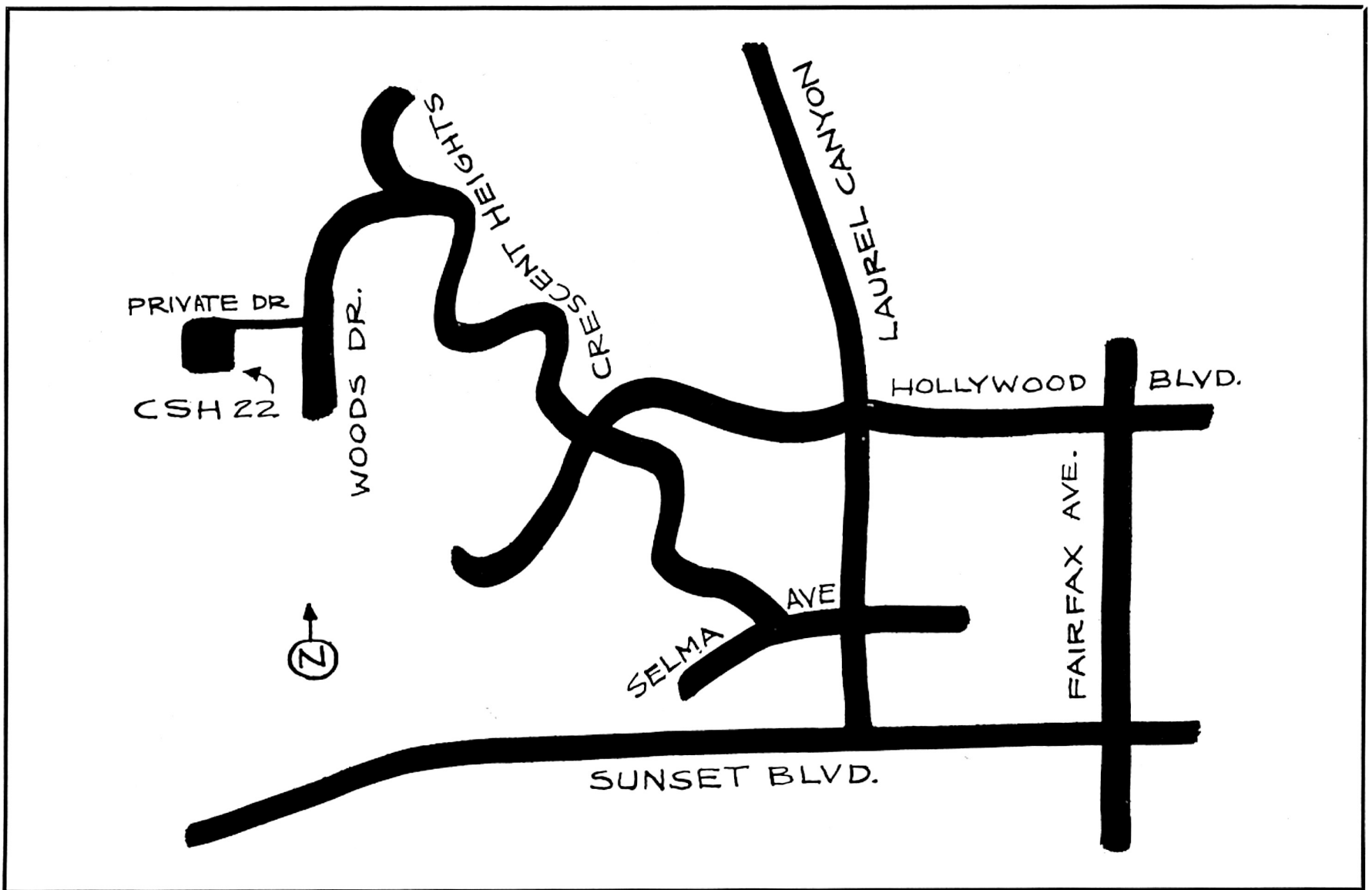
HOUSE BY CAMPBELL AND WONG





PHOTOGRAPHS BY MORLEY BAER





CASE STUDY HOUSE NO. 22 BY PIERRE KOENIG, A.I.A.

WILLIAM PORUSH, CONSULTING ENGINEER; ROBERT BRADY, GENERAL CONTRACTOR

The magazine, ARTS & ARCHITECTURE, wishes to announce the completion of its Case Study House No. 22 and takes pleasure in making it available for public showing for four weekends beginning May 7, 1960 through May 29, 1960, on Saturdays and Sundays, from 1 to 5 p.m.

The project is located at 1635 Woods Drive, Los Angeles

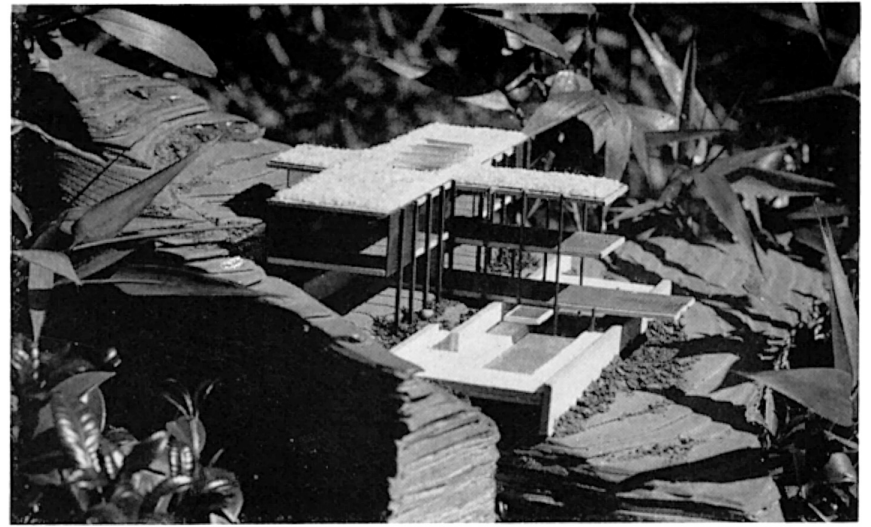
This house which has been on exhibition through all the phases of its building and shown in the magazine during the period of construction is the latest completed project in ARTS & ARCHITECTURE's continuing program to make available to the public the best examples of contemporary housing and to demonstrate the use of new materials and techniques that become a part of the growing vocabulary of the building industry. These houses, sponsored by ARTS & ARCHITECTURE, and undertaken with the assistance of cooperating manufacturers continue to be outstanding examples of the most advanced architectural design and have very successfully contributed to the development of domestic structures.

HILLSIDE HOUSE BY BERNARD ZIMMERMAN, ARCHITECT

The site is approached by a 10' easement from the main road leading to the 3½ acre site, which is just beyond a creek in the canyon. The placement of the house is at the meeting of two mountains forming an alluvial fill area and having a stream draining the upper portion of the canyon which flows past the house to the creek below.

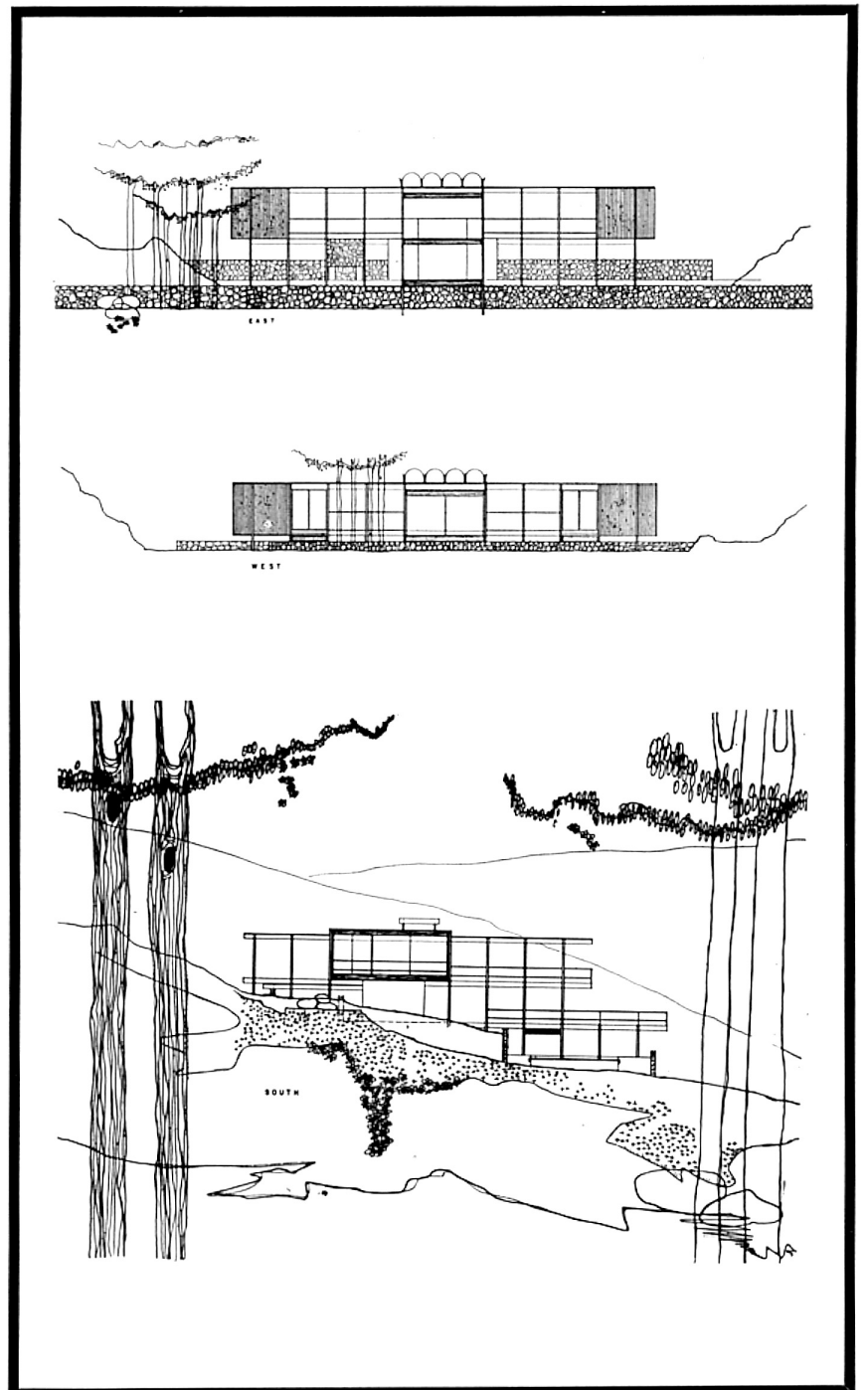
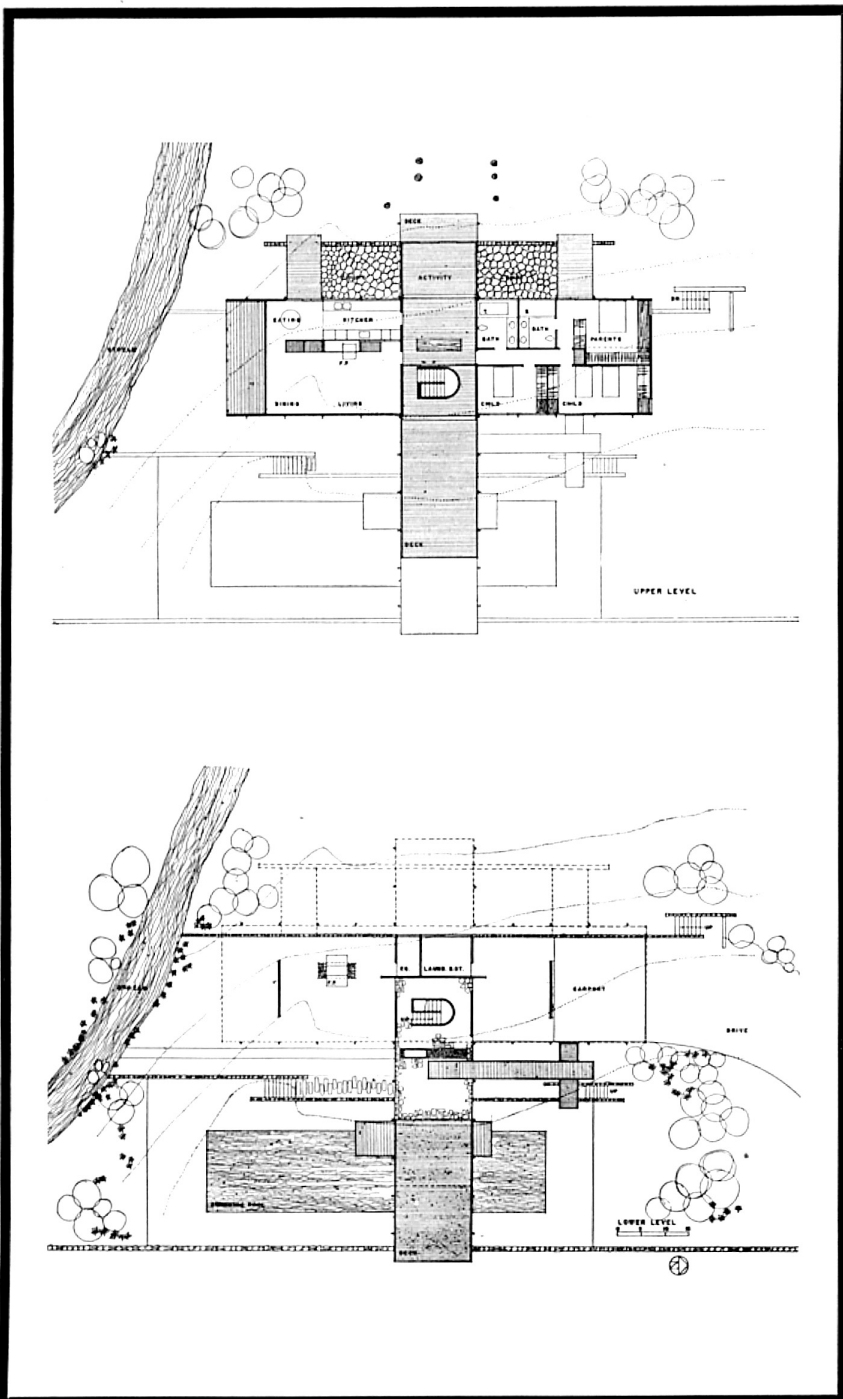
Because of the slope of the terrain and the program presented by the client, the house was developed with three levels. The upper, lower and swimming pool level. The upper level, which opens to the flattest area of the site contains, the living and dining room, kitchen, eating area, activity room, children's bedrooms, master bedrooms and two baths. Open decks are provided, leading to the upper portion of the canyon. The deck facing the lower portion of the canyon will be enclosed in the future to form a larger living room. The lower level is unfinished and left completely open except for the storage and laundry room. At present, it will function as a carport and outdoor play area. In the future the owners hope to develop an

(Continued on page 28)



MODEL BY STANTSAKAWA

ROBERT MARKS, STRUCTURAL ENGINEER



PHOTOGRAPH BY VLAD BALABANOV

PRODUCTS



merit specified

For Case Study House No. 22

Designed by Pierre Koenig, architect

For dates of public showing see page 26

The following are specifications developed by the architect for Case Study House No. 22 and represent a selection of products on the basis of quality and general usefulness that have been chosen as being best suited to the purposes of the project and are, within the meaning of the Case Study House Program, "Merit Specified."

STRUCTURAL

Structural Steel—Bethlehem Steel Corporation, 6000 South Boyle Avenue, Los Angeles
Roof Deck—T-Steel Corporation, Kirkland, Washington
Structural-Steel Fabricator—Raymond Equipment & Welding, 6633 San Fernando Road, Glendale, California
Deck Erection—H. H. Robertson Company, 2330 West Third Street, Los Angeles
Waterproofing & Corrosion Preventive Materials—The Lee Potter Company, 915 Los Angeles Street, Glendale, California
Insulation—Owens-Corning Fiberglas Corporation, 3445 West Eighth Street, Los Angeles 5

FINISHES

Bath Ceramic Tile—The Mosaic Tile Company, Zanesville, Ohio; 131 North Robertson Boulevard, Beverly Hills, California
Concrete Finish and Hardner—Watco-Dennis Corporation, 1640 Twentieth Street, Santa Monica, California
Stone—Palos Verdes Stone Corporation

FIXTURES

Plumbing Fixtures—American Standard Company, 1151 South Broadway, Los Angeles
Fans—Emerson-Pryne Company, 526 East Twelfth Street, Los Angeles
Stainless Steel Kitchen Sinks—Lyoncraft, 1052 West Sixth Street, Los Angeles 17

LIGHTING

Flush Lighting—Emerson-Pryne Company
Hanging Lights—Prescolite, 923 East Third Street, Los Angeles
Surface Lights—Litecraft Company, 545 Rodier Street, Glendale, California

APPLIANCES

General Electric Company—2957 East 46th Street, Los Angeles
Waste Disposal—Waste Champ by Harvill Corporation, 6251 West Century Boulevard, Los Angeles

ELECTRICAL

Stainless Steel Cover Plates—Arrow Hart, 120 South Anderson Street, Los Angeles 33
Tap Action Switches—Arrow Hart

DOORS & WINDOWS

Sliding Doors—Bellevue Metal Products, 1314 East First Street, Los Angeles
Sliding Windows—Bellevue Metal Products
Wardrobe Doors—Glide-All Sliding Doors; Woodall Industries, Inc., 801 West Valley Boulevard, El Monte, California

CABINETS

Kitchen Cabinets—Arcware Frames, Architectural Hardware Corporation, 2132 Pacific Avenue, Tacoma 2, Washington

FURNISHINGS

Van Keppel-Green—116 South Lasky Drive, Beverly Hills, California
Carpets—Carpets of Distinction, 8923 Sunset Boulevard, Los Angeles 46

SWIMMING POOL

Catalina Pool Company—18446 Hart Street, Reseda, California

GARDEN POTS

Architectural Pottery—1107 Kings Road, Los Angeles 46

LIGHT & FORM—GYORGY KEPES

(Continued from page 13)

ments for raising the art of using light to a high level. Certain preliminary steps must be taken. For example, we know how to make illumination both sufficient and comfortable. This has been the goal of illumination engineers, who have learned all that physiology and physics can teach them, both in natural and artificial lighting.

But architects and planners demand more than comfort and amplitude in lighting. They realize the immense opportunities in designing with light. Stainless steel, reinforced concrete, and the new structural systems naturally collaborate with the tools of lighting. Together, they suggest a whole new range of light qualities for architectural surfaces and spaces. However, how to take full advantage of these opportunities has not yet been realized. Such knowledge will slowly grow in any case. It is possible, on the other hand, that a breakthrough can be brought about by an effort directed at exploring light itself as a field for the creative imagination, not merely as an adjunct of architecture and planning.

HILLSIDE HOUSE—BERNARD ZIMMERMAN

(Continued from page 27)

enclosed play area, bath and three more bedrooms for the future growth of the family.

The house contains approximately 2,300 square feet of enclosed area; 1,600 square feet of open deck and 2,300 square feet of future area which is now left open.

The structural system is composed of 4" WF 13 columns supporting 4" x 14" beams running perpendicular to the columns and supported by a clip angle. The columns are spaced 8' on center in one direction and 24' in the opposite direction. Thus, making the house free from bearing partitions and giving the greatest amount of flexibility for future expansion.

The stair is semi-circular leading from the lower level to the uppermost level with an opening at the top covered by vaulted plastic skylights. The fireplace which is cantilevered at the ends, runs two stories and provides an outdoor fireplace at the lower level and a fireplace for the living room at the upper level.

The materials used in the composition of the house are steel, Douglas fir wood siding, 2 x 4 Douglas fir wood decking and glass.

A MODERN THEATER—RICHARD NEUTRA

(Continued from page 17)

listening to the lyrical notes of a harp, played just when, with lights faded, the ghost of Caesar is to descend into the confined space of an anxious soul before the decisive battle.

But a theater play does not consist only of scenes on a stage and five acts full of action, or contemplative thought content. It consists also of four intermissions and inter-act experiences. As a matter of fact, the spectatorium, the theater hall to be seen, becomes visible only when the lights go on, upon the falling of the curtain. Now the spectatorium glories, visible in all its effectiveness, but the appeal of the auditorium goes to pieces right then. Everyone gets up and starts talking, while pushing his way out to get refreshments.

What may be the hidden role of the inter-act in the play as a whole? Is it just an interruption and a disturbance? An interruption only, or also in another sense, a link? Does it have any additive significance, augmenting, intensifying the experience of drama intake?

If people watched a play or a ritual, say, in the woods, looking past and between trees accidentally standing around, each spectator would have a different visual experience, and thus take home an entirely different memory picture. To a certain extent it may be similar to the "theater in the round," which got its American start with the Penthouse Players on the University Campus in Seattle. "In a theater like that," Mr. Neutra says, "I watched a love scene on a couch, before and below me, from which I had just taken my own feet, to give room for this dramatic action, while another spectator, diagonally opposite, obviously saw something entirely different and probably could identify the same girl only by the color of her petticoat, when we afterwards discussed the play."

The Dusseldorf regisseurs and play directors have an idea at variance with this. Their playhouse is a unifying "monothatron." The director arranges everything for an ideal homogeneous reception equalized for everybody in the spectatorship. Directionalism is a tremendous aid and condition to make the composition of such a dramatic offering consistent.

Now, from the experiences of the stage, while we sit in the dark, we take all our reverberations into the intermission. But, from the intermission our seeing brains inevitably return into the dramatic vision at the open scene to recapture us to that other world. We see the theater room in the light, and we take the visual impressiveness of it again into the next audience-darkened act.

A sea anemone, when stimulated for ten seconds, reverberates for two hours. A human being can reverberate for days, months, years, a lifetime. He does so from the impression time of the theater room into that of the scenic experience. The visible spectacle of the intermission periods in a well axially designed theater room can give us a direction we never could have received in that forest with its haphazard surroundings. Even the old baroque and the Victorian theater tried to give such a relaxation time direction, during the overture and the inter-acts, by painting Apollo and the Muses on the fire-curtain. Everyone

was made to know and to understand that, *there*, right there in front, drama was to unfold and to roll on. Theaters in which you did not know where things were going to happen have never, until recently, existed in Asia or in Helas, or in Basutoland, but of course, in Helas, and in black Africa, theater was "day-theater" and there were no dark intermissions at all.

In Dusseldorf an impressive serpent of luminosity centrally waves toward the middle of the stage from the middle point of a broadly sweeping illumination balcony in the rear of the spectator. The interestingly warped ceiling of several tiers is irradiated, with increasing or dying down rapture of forward looking, or still reverberating, souls, when the lights rheostatically go on, or are dimmed off, to mark the beginning or the end of the inter-act. But this visual ceiling is not a solid ceiling. It is a mesh-work, completely independent of the auditive ceiling which is calculated to guide an optimum of reverberations to every seat, at the side or in the middle, front or back. The rear portions of the side wall consist of batteries of parallelepipeds with triangular cross-sections, and with each of their three faces different in absorption and reverberation characteristics. Just as push buttons change the illuminative mood during a scene, so, and similarly, this auditive coloring can be regulated and acoustical illumination can be heightened while that battle scene reaches its height, or while that ghost speaks his last lines. There is no reason why room acoustics should be static during drama, and only visual illumination dynamic.

Many features of the American theater have been transplanted into Dusseldorf. For example, Neutra believes that a Green Room, for meeting with the players, will also delight German theater goers.

Germans greet their famous play directors with deference, they applaud their best players and ensembles often up to a dozen curtain calls. But, they also have spent, and are spending more love and funds on theaters—as if they were temples. They call them so. A temple can be venerable, but should have a vista into a future of ever-deepening insight into human nature.

PROLOGUE AND LOG—DORE ASHTON

(Continued from page 18)

received reached the Royal Court. The Emperor called him. "Hokusai lifted the paper door of the temple from its hinges and placed it on the floor of the hall. Taking indigo paint with his hands he threw it on the paper then brushed it with his hands. He then took a cock from a basket, daubed his claws with red stamp dye and let it run over the paper." Contemporary commentary: "The Shogun Iyehara was pleased and Hokusai was wildly feted."

End of Digression

Before February 13th, when the Staempfli show was dismantled, the Emperor called. It was agreed that T. would bring off his "event" at the Museum in the garden. The Machine that is the super-machine begins laboring. Publicity. Rumors. Anger. Publicity.

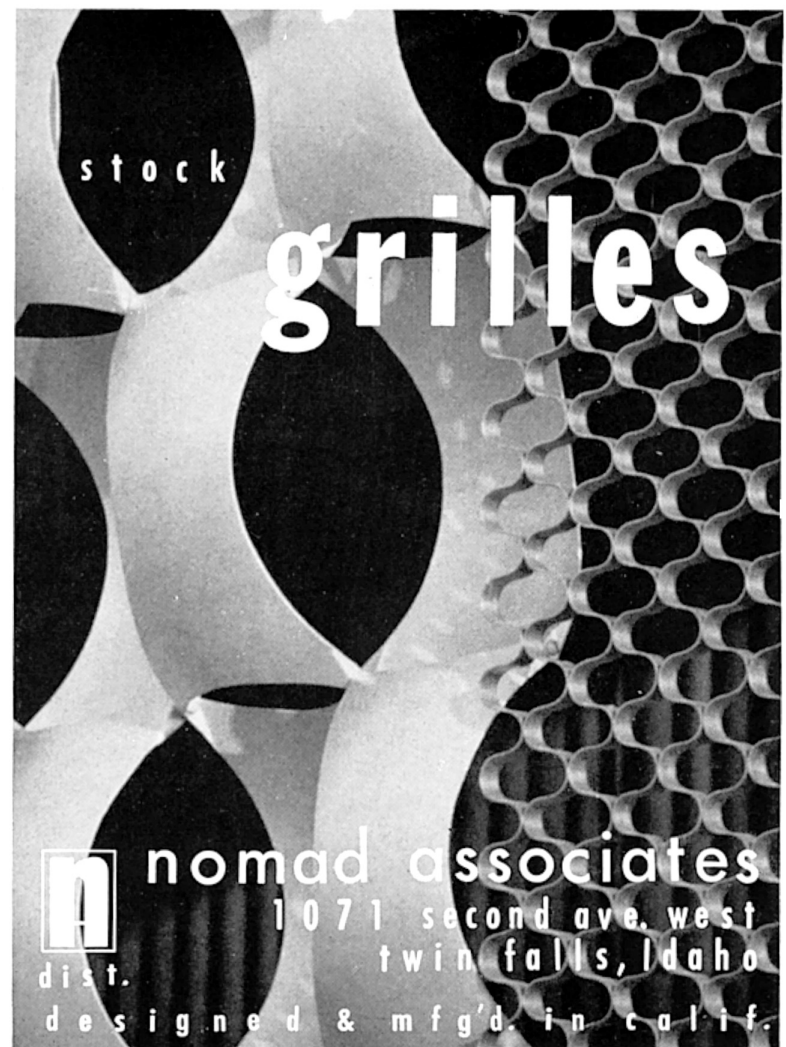
They give T. the plastic dome—Buckminster Fuller fulfilled. He begins his quest for junk. Over to the Jersey dumps, returning with: 80 bicycle wheels and wheel-chair wheels, a child's wagon, a baby's bath and other cosmopolitan detritus.

A great snow storm. The garden is like Austerlitz. Balzac has snow on his eyebrows and his lapels need dusting. St. John points his accursed finger, tipped with an icicle.

Back in the dome . . . freezing. T. surveys a scatter of machine parts, wrenches, oil cans and one half of a piano. His cheeks are blue. We have to skirt the center of the dome to talk or our words triple-echo. Obvious question: what a lot of trouble for an incident that will take less than a half hour. T.: But what about the Egyptians who carved statues and painted pictures that were only to be sealed up immediately and never seen by human eyes?

We are, of course, no longer cryptic as Malraux says. The Tinguely machine may perish on March 17th, but the super-machine works on. Photographers are documenting progress. Arrangements are made for a movie. Television and weekly picture magazines are informed. The alert goes out: only two hundred people will be privileged to witness the event.

Meanwhile, back at the dome. The weather holds. It is cold



but clear. The snow, except for tracks to and from the dome, and a few black holes in the pools, remains a neutral sea isolating T. in his dome from the world. T. shows me a machine that ratta-tat-tats itself. The piano is struck in a sequence of what seems to me three repeated notes (although I must be mistaken; T.'s "mea-machines" never repeat themselves he says). A radio with a saw suspended over it. Little ampules attached to largest structure. "They had to be specially made for me by scientists." *Enfin*, he says, an artist can't *really* make something that destroys itself. It takes a scientist to do that.

Outside the walled garden, gossip swells—I hear that the balloon will explode, that there will be a sound track with T.'s voice explaining in bad English while a shrill female voice corrects him; that the machine will ambulate and clatter its way into the pool.

The museum prepares. Plans are made for a broadside. The Dada dadas and a few others place their bets. Philosophic points duly raised and mooted. Duchamp creates a counter-machine, a machinery of words, a wise saw: "Si la scie scie la scie et si la scie qui scie la scie est la scie que scie la scie il y a un suisse métallique."

LOG, MARCH 17, 1960

10:00 A.M. A bitter rain, but event scheduled anyway.

3:00 P.M. I call S. He says they are having a hell of a time. The men assisting T. to install the machines—there are now about five separate units, with fifteen motors and a control box and scientific assistants standing by—think it is junk and treat it accordingly.

4:15. Still cold, raining. The garden is gray and slushy. Two museum *fonctionnaires* stand under umbrellas forlornly watching a frantic sawing. At the last minute, the museum worried about its marble flag-stones. Blocks of wood must be placed under the machines. The Emperor not in sight yet.

Balzac rain-slicked and lowering.

4:30. Rain stops. Camera men aimless. They look like they are covering the war in Korea. Begins to look like movie set. Gaping

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CLAIRE FALKENSTEIN

faces in cafeteria. T. tinkering with the worried expression of an airplane mechanic making the last check-up on the Emperor's plane that is taking the Emperor behind the iron curtain where if everything doesn't go right, what a responsibility.

4:40. Rain again. They mount the weather balloon sagging like a mariner's flag in the doldrums. In the glass hall in front of the cafeteria three black-cloaked gentlemen look gravely into the garden. They are disapproving artists.

5:00. S. tells me Mathias Goeritz is distributing leaflets against the demonstration. He is talking about God and morality. They say he is serious.

5:30. Photographers on roof; on first, on second, on third floors; and in the Whitney. Shouting up and shouting down. David Sylvester, British art critic, very soberly prepares to leave: "Don't like tuxedo dada."

6:00. The fourth machine installed and T. goes up ladder to put a huge roll of paper on the large drawing machine. An actress next to me says T. is cute. Remarks "This thing is certainly hung up with the press."

Yells. Cameramen. Huelsenbeck stands in a puddle. Finally gets a discarded piece of lumber to put under his feet. Someone near T. is reading instructions and examining the control board. T. mounts ladder and oils or inks the sponge that will draw.

6:20. Nothing happens, nothing at all.

6:30. Actress chats with Kenneth Tynan. "I've seen plays like this, self-destroying" says he. Someone puts a canvas bag with airline's insignia on Maillol's lady. St. John has a klieg-light at his feet.

6:45. T. puts some plastic tape near the paper roll. Without plastic tape what could be done in this world? Who's paying for this says an irate voice to my left.

6:48. Test piano briefly. Rustle in crowd. Suspense, suspense, suspense.

6:50. Raining again. T. comes from dome with baby machine cradled in his arms. It has wheels and a long claxon.

6:51. Sawing. T. puts large bottles in the gutter running above the largest machine. They are supposed to roll down and break. Rauschenburg with a Florida tan hands T. more junk.

6:56. Yellow smoke! T. runs back. From the wings the leading actor appears: a blue-capped, blue-garbed, blue-eyed Fireman. The Fireman is suffering. A look of consternation never leaves his face. Like the Fireman in the *Bald Soprano*, he doesn't know why he is there.

7:10. The flaccid balloon writhes, struggling to catch its breath. A cameraman perched on a ladder looks trepidantly at bottles poised to explode. Suspense.

Supposing T. really is an anarchist and plans to blow us all up. He is an anarchist. It says so in the broadside. Voice: "I'll tell my wife I missed the commuter's train because I watched a machine destroy itself. She's never heard that one before."

7:12. Voice: "Pity General De Gaulle isn't here."

7:13. The roustabouts take away excess lumber. A kewpie-doll child appears silhouetted in a high window opposite.

7:15. Inquiring reporter with his own little machine with its own plastic tape helps the super-machine. Mr. Tynan, he asks, what is your impression. Er. Well. I'd say it was the end of civilization as we know it. Perhaps the entire thing is a hoax. Across the street there may be eighteen machine guns waiting.

7:18. "You been to one of these things before?"

"I've seen the coronation in London."

7:20. The balloon lumbers bumpily on, the machines are in *situ*, jet plane overhead, everyone cold and damp, a bottle of cognac lasts only five minutes.

7:30. Like all drama critics, Tynan leaves before the third act.

7:32. Piano plunks. A small flame appears. The Fireman waits. The fan starts whirring, the paper, . . . the paper rolls itself up the wrong way. Crowd laughs then groans. They still think the machines are intended to function. Smoke billows, we can see nothing for three minutes. But the piano clunks out its three notes. A string breaks, a wheel falls off. The crowd is disturbed. T. goes to controls and consults with worried collaborator. The museum *fonctionnaires* move in. Something is wrong.

7:37. I can't read the text. All I see is the word "hope." They say it ended with the word penis. It then wound itself back up. The toy wagon attached to a wheel bobs up and down like an oil drill.

7:38. I catch 4 words of text: Now is the foe. Fire eats with relish. More flames. The drumming machine doesn't seem to work. The flapping paper flirts with the flames reaching avidly for it. Next machine. Orange smoke, wheels turning, a bell, ding. Two more cans fall.

7:50. Piano really burning now. Two boys with fire extinguishers appear. T. seen arguing with Fireman. Crowd thinks *fonctionnaires* interferes. They loathe his silver buttons. No, no, no, they call, booing the Fireman. Ding. T.'s assistant goes over to machine, leaps back, electric-shocked.

7:55. Drawing machine making Chinese mountains. The hoses turned on full blast. Flags wave madly. A baby machine in flames skitters toward the audience. Screams. Someone grabs its torso and sends it flaming back toward T. Ding. Ding.

8:00. Fireman disputes. Runs into the museum. Returns trundling a giant fire extinguisher. A look of iron determination on his face. Boos. Meanwhile, the second-largest machine with the piano is overturned and lies smoldering. The crowd still feels betrayed. Something is wrong. Voice: "This is like an unfinished nightmare."

8:05. T. assists one of the smaller machine to limp off-stage. Smokes belches intermittently. Cameras, cameras, and suddenly, in the confusion, the thing seems to be at an end. Milling. Finally T., smiling, faces cameras. Cheers, bravos. What has happened or not happened no one can be sure. T. says he instructed them to put out one part of the fire. The Museum says it never knew there would be a fire. The *fonctionnaire*, whines: "I dunno if I done the right thing."

(Continued on page 32)

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PROLOGUE AND LOG—DORE ASHTON

(Continued from page 30)

EPILOGUE

They say that one of the machines threw out silver dollars. They say two of the machines never worked at all. T. says it was a success. Museum worried. Did Fireman call a general alarm? Bad publicity . . .

But B., the Times photographer, tells me the Fireman threatened the Museum. If you don't let me extinguish this, I'll pull the general alarm. Says he pulled only the house alarm. B. heard him call the firehouse (where he couldn't reach his chief!) He said: "There are these machines, see, and one of them on fire, see, but they tell me it's a work of art, see, then this guy tells me himself to put it out see, and the crowd yells no, see . . ."

And the Machine was pleased and T. was wildly feted.

Post Script: The parts, after all, wound up in the Jersey dumps from whence they came.

MUSIC

(Continued from page 6)

instruments with multiple keyboards to preserve the more important of the pure acoustical relationships within a harmonic system. Such instruments were never practical, and no one has succeeded in solving the problem of pure keyboard harmony by such means.

Two distinct types of tempered scale may be presumed to have appeared, the one well documented, the other to be arrived at only by historical probability. The usefulness of these scales is to be judged by their effect, though to unaccustomed ears either will at first seem out of tune in comparison with our own Equal Temperament.

I should explain that Equal Temperament has been known from very early times as a possible alternative to other temperaments, but though it has had its advocates the objections to it outweighed its merits. Equal Temperament is not, as some believe, a modern improvement.

Until approximately 1600, the beginning date of the era of Modern Music, the voice was the principal means of musical expression, and for voices the pure acoustical intervals are the most natural and by far the easiest to sing. Even today, as the composer Lou Harrison has discovered by experiment, the change from the artificially tempered intervals of Equal Temperament to the acoustically pure intervals of Just Intonation can be managed by singers and players of adjustable instruments in a few minutes with little trouble. The greater trouble is to change back.

For this reason a musical art governed by the voice would strongly resist in practical use any type of tempered scale, however much individual musicians might agree theoretically to the argument for an equal temperament. The need to make adjustments to avoid occasional discordant intervals, even the presence of a few discordant intervals, would seem to them more desirable and would certainly be easier to sing than a temperament which was all acoustically out of tune. The tuning of instruments would seem, because of the nature of the music, a minor consideration.

By 1600 the instrumentalists had struck out on their own; the

solo keyboard was demanding a wider range of harmonic possibility than could be achieved within the purely melodic scales of Pythagorean or Just Intonation. The era of the voice was being replaced by the era of the instrument.

The first tempered scales were probably a modified Pythagorean. Leaving the pure fifths C-G, G-D, A-E, E-B, the tempered fifths would have been B-F sharp, F sharp-C sharp, C sharp-G sharp, F-B flat, B flat-E flat. C-F may have been tempered or left pure. The enharmonic intervals, E flat-D sharp, D flat-C sharp, A flat-G sharp, B flat-A sharp, G flat-F sharp, may have been adjusted according to the harmonies desired. Other adjusted variants of the tempered Pythagorean tuning would have been tried.

This tempered Pythagorean tuning is very effective for the playing of the earliest keyboard music and for the Elizabethan keyboard music. It solves the problem of the modulations in the famous Hexachord by John Bull, which is usually taken, though with reservations, to be an early experiment in Equal Temperament, and solves it so much more effectively that on the example of this piece alone the use of tempered Pythagorean for the English music of this period seems probable. For the English keyboard music generally either a pure or a tempered Just Intonation (Meantone) are too bland, and Equal Temperament is characterless. In attempting to resolve the reason for this, one discovers that the Elizabethan keyboard music is figured more often around the interval of the fifth, whereas keyboard music using a tempered Just Intonation (Meantone) is figured more often around the interval of the third.

If it may be asked why no documentation of this tuning for the Elizabethan keyboard music has survived, I would point out that there is also no documentation for the playing of the two commonest types of Elizabethan ornament, the single and the double line through the note stem. If these embellishments must be played by guess, according to the character of the music throughout which they appear in profusion, a good guess as to the character of the tuning preferred by these composers goes no farther afield in speculation. Apparently the Elizabethan composers took so much for granted the two common elements of tuning and embellishment they felt and foresaw no need to document them. As their music was played, so would it always be played. We who take our classical harmony for granted make the same assumption, not realizing that in our lifetime the very foundations of harmony are again being changed, if indeed, in music of the near future, any harmony as we have known it will remain.

Tempered Just Intonation is called Meantone; it is extensively documented in a variety of tunings. Nearly the direct opposite of Pythagorean, it requires pure major thirds and modified fifths. The pure third is divided into two equal whole steps: this is the source of the name Meantone. This tuning varies more markedly than tempered Pythagorean in the character of the individual keys, no two of which are alike. From these disparate characteristics of the eight keys that were considered practical for performance in any Meantone tuning arose in part the doctrine of the Affections.

For the true Amateur, a single-strung spinet, tuned to Meantone, is the best means by which to learn the advantages of this

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arts & architecture

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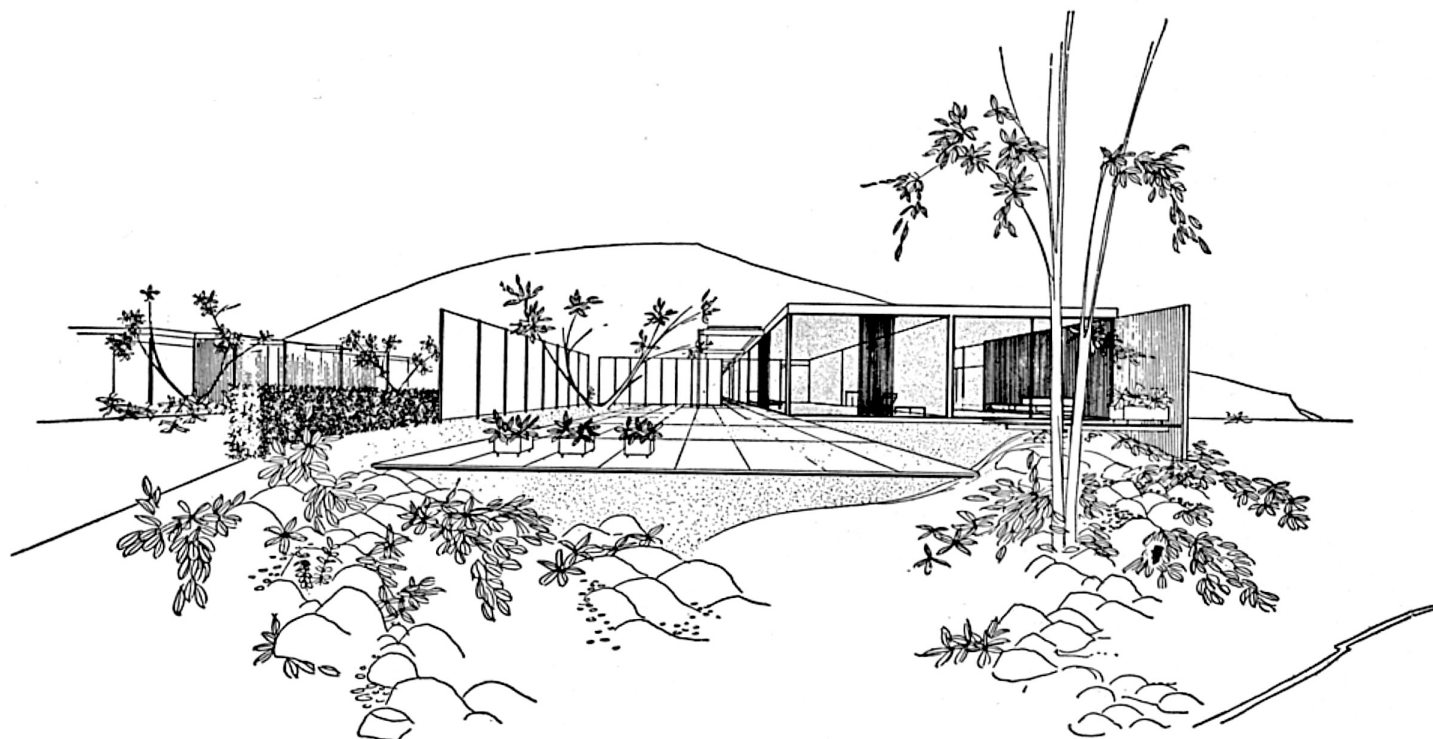
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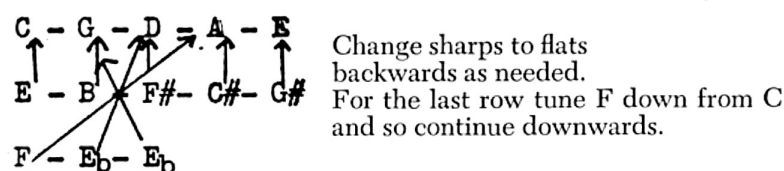
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tuning. As an instrumental tuning it is not less important than Equal Temperament, since it applies to nearly all music composed during the 17th and 18th centuries, except that written to exploit the advantages of a special type of Meantone that Sebastian Bach called Well-tempered.

Not least of the advantages of Meantone is the ease with which it can be tuned by ear. The first cycle of fifths will be the hardest to get right. The old formula was, narrow the fifth as much as the ear will bear. The Equal Temperament fifth is nearly pure, while the third is brilliantly discordant; in this respect Equal Temperament approximates Pythagorean. The Meantone fifth is narrower (will beat more rapidly) than the fifth in Equal Temperament.

Here is a diagram for the tuning of Meantone for flat keys up to three flats. For the sharp keys, up to three sharps, raise G sharp to A flat, making a pure major third with the C above. This change alters the principal *Wolf* tone. (The *Wolf* is that tone which contributes to the most discordant intervals.)



A little practice in adjusting the interval C-E will enable one to come out with a third that is absolutely beatless (acoustically pure). Each cycle can be "proved" by the pure third between its end and its beginning. Each of the thirds connected vertically by arrows in the diagram should be pure and beatless. Thus Meantone can be tuned by fifths and checked by thirds for accuracy at each interval. No other tuning can be so accurately verified by an ear with little training, though it is necessary to learn to hear beats and to recognize when an interval is beatless.

Apart from the distinct coloration of each key, the pure third in Meantone gives a wonderful sense of the expansion and contraction of the melodic line, which cannot be matched in Equal Temperament.

Meantone tuning permits a restricted amount of key modulation and playing in chords, if the occasional dissonant or *Wolf* tones are avoided, left out or displaced by an embellishment. Any Meantone system of tuning provides some eight harmonically practicable keys; by adjusting intervals, as indicated in the diagram, the range of possible Meantone scales can be altered to give a choice of additional keys, though never more than eight for any one tuning. With these a composer could project mood or idea; listeners learned to recognize the mood or Affection as an esthetic adjunct of the key. Beyond this range the dissonant relationships became too extreme for ordinary acceptance. The standard Meantone keys were those up to three sharps or three flats, although F sharp minor was for special reasons thought to be acceptable.

It is likely that the vogue of "double" instruments (with separate keyboard, strings, and soundboard) originated in the need to provide for variant tunings. The second instrument was often inserted like a drawer in the larger instrument.

Composers of the later Meantone period did not hesitate to dramatize certain dissonant aspects of false relationships to enhance the pathos of a single voice or intensify a passage, sometimes an entire movement, for example the "dangers of foreign lands" in the second movement of Bach's *Capriccio for the Departure of a Beloved Brother*, when played in the common flat tuning suitable to the key. Knowing how to use these dramatic or pathetic effects of Meantone can greatly enhance the interest of 17th and 18th century keyboard music.

In those days the Pathos of drama was valued more highly than the contrast Tragedy-Affirmation we have been brought up to think esthetically normal. A few minutes listening to a 17th or 18th century composition in C minor played in Meantone will teach the listener what the musical intelligence at that time understood by Pathos. The hint of false relationship within the key can be no less moving than the more recent dramatic use of outright dissonance.

Many tuning compromises within Meantone were tried in hope of finding a "Well-tempered" tuning that would preserve in

some degree the distinctions among keys, while permitting full harmony in both hands. The best known and possibly the most successful of these Well-tempered tunings was achieved by Sebastian Bach. Well-tempered tuning is not Equal Temperament, as musicologists usually assert, but a modified Meantone tuned by ear and taste. When well ordered it is perhaps the most satisfying and practical keyboard tuning European musicianship has produced.

Well-tempered should be tuned forward (first cycle) and backward (second cycle) from C. The Pythagorean comma is gradually absorbed by increasing the degree of tempering the fifth, starting with a pure fifth in each cycle. It is capable of considerable variation.

Such a tuning, achieved by ear by Wesley Kuhnle, was tested by stroboscon at the request of J. Murray Barbour, the authority on tuning theory, and accorded throughout within a very slight mathematical deviation to a theoretical Well-tempered which Mr. Barbour himself had derived by mathematical calculation. It is not likely that such a tuning by ear would ever accord exactly with its mathematical prototype or that it would be quite the same in successive tunings. This, and not Equal Temperament, may be presumed to be the tuning used by Bach.

Mr. Barbour's study terminates at 1750, the year of the death of Bach. After that time the problem grows more complicated, and it is even less well documented. Between 1750 and at least 1795, Meantone and Well-tempered tunings of various adjustments and Equal Temperament move along side by side, Meantone slowly losing provenance within the widening range of harmony, though it survived on English pianos until 1850; some type of Well-tempered tuning persisting until towards the middle life of Beethoven; and Equal Temperament coming at last to full acceptance in the music of Schubert, Chopin, and Liszt.

The significance and importance of tuning lie under all considerations of harmony, yet careful examination of this basic fundamental of music has been put aside and at best hesitantly pursued by scholars. When I proposed to an eminent musicologist, a specialist in 17th and 18th century musical studies, that he

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should have accessible to his students a spinet harpsichord tuned to Meantone, he replied that this was unnecessary, because no one would detect the difference. I had always assumed one purpose of education to be learning how to make distinctions of which the student would not otherwise be aware.

A melodic or harmonic system exists only in relation to its mode of tuning. Melody and harmony in Meantone are practically quite distinct from the same notated relationships in Equal Temperament. If this were not perceptibly so, composers during 200 years would not have debated the alternatives. They would not have resisted, as Rameau did, the advantages of Equal Temperament.

With Equal Temperament the distinction between keys lost any acoustical reality or emotional significance and survived as no more than a convenience, a refract of notation.

In Equal Temperament the vertical relationship predominates, and melody becomes an adjunct of the chord. Although some musicians even today interpret the meaning of key harmonies in terms of the Affections, the characteristic emotions and ideas expressed by modulation within the limited scales available to Meantone tuning have been lost. Harmony, dynamics, instrumental pairing, and contrast replace this lost inherent expressiveness; the structural development of music is emphasized. The importance of the key has dwindled to a notational convenience. The degeneration of harmony, which had begun in the conversion of tuning to Equal Temperament, was completed when Schoenberg announced and demonstrated the Emancipation of the Dissonance.

The Emancipation of the Dissonance did not do away with the rules of harmony. The entire 12 notes of the scale in Equal Temperament became the only surviving system to which the individual notes and intervals can be related. Harmony in Equal Temperament had been stretched too far beyond the rules to be governed any longer by its consonant relationships.

No one who reads this article should judge by the emphasis I have given to the values of other modes of temperament that I do not thoroughly appreciate the beauty, practicality, and expressiveness of Equal Temperament for music written to be played with this tuning. Meantone, for example, contains no enharmonic relationships, around which Beethoven conceived in his later music his most unexpected modulations. It is in fact the exploitation of discordance that gave rise to the great structural developments of music during the period between Sebastian Bach and Schoenberg. My effort has been in some degree to break through the exclusive attachment to this one tuning held by musicians who have tried no other and by theorists who have not accustomed themselves to hearing naturally music in another tuning.

I am grateful to my eldest son, Peter Barheidt Yates, for the use of his school paper, *The Influence of Tuning on Twentieth Century Music*, in the preparation of this article.

I owe a great debt to my friend Wesley Kuhnle, whose long experiments in realizing these several historic temperaments by working out their tuning orders and tuning them for me taught me the full meaning of this subject. In one glorious afternoon he tuned them all for me on a group of instruments, making possible the comparisons I have included here.

HEADQUARTERS BUILDING—WELTON BECKET

(Continued from page 11)

enclosed corridor connects the conference wing to the main building, and can be used in conjunction with other space for receptions.

The first floor of the main building contains the public areas, including rooms for teacher interviewing and placement. The second floor houses the offices of the various teaching associations, and the top floor includes the executive suites, and library. The facilities for publication and report duplicating activities are located in the basement for maximum noise control. The offices are laid out on a modular principle for maximum flexibility, with movable partitions so that office sizes can be easily adjusted.

The interior design employs earth color accents in shades of gold, burnt orange, and bronze-green against a foil of warm whites. Generous use of teak and oak woods was made throughout the building's interior. Lighting is largely fluorescent with some incandescent fixtures and special chandeliers.

CURRENTLY AVAILABLE PRODUCT LITERATURE AND INFORMATION

Editor's Note: This is a classified review of currently available manufacturers' literature and product information. To obtain a copy of any piece of literature or information regarding any product, list the number which precedes it on the coupon which appears below, giving your name, address, and occupation. Return the coupon to Arts & Architecture and your requests will be filled as rapidly as possible. Listings preceded by a check (✓) include products which have been merit specified for the Case Study Houses 18, 20, 21, The Triad.

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FURNITURE

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SURFACE TREATMENTS

✓(326a) Construction Plywood: A new fir plywood catalog for 1958 has been announced by the Douglas Fir Plywood Association. Indexed for A.I.A. filing systems, the three-part, 20-page catalog presents basic information on fir plywood standard grades and specialty products for architects, engineers, builders, product design engineers, and building code officials. Sample copies may be obtained without charge from: Douglas Fir Plywood Association, Tacoma 2, Washington.

✓(354a) Western architect and tile contractors in a hurry find a new full color booklet put out by The Mosaic Tile Company a big help on rush jobs. The Mosaic Tile Pacific Coast Service Plan for 1959, (form No. 239) shows the tile types, sizes, and colors available in all their Pacific Coast warehouses. The in-stock for fast service items shown, all manufactured or stocked locally, include glazed wall patterns, Jordan-Carlyle quarry tile, all-tile accessories and trim shapes. Mosaic offers another full color folder on Carlyle Quarry Tile (form No. 216) showing the eight colors of quarry tile manufactured from California clays by The Mosaic Tile Company's plant at Corona, California. Write to: The Mosaic Tile Company, 131 North Robertson Boulevard, Beverly Hills, California.

(348a) New Technical Bulletin on Protective Coatings Offered: A new 8-page Technical Bulletin on "Protective Coatings for Exterior Surfaces of Concrete Block Walls" is now available free of charge to qualified building professionals. Prepared at the direction of Quality Block Producers, an association of leading concrete block manufacturers in Southern California, the Bulletin is the first of its type offered. Actual research, editing and writing was performed by Raymond S. Wright, AIA, & Associates, and the Paint & Coating Committee of the Construction Specifications Institute. No brand names are mentioned and recommendations for various coatings are notably unbiased and objective. The last page, Brief Specification Data, is perforated for easy removal and extra copies may be obtained without charge. Copies of this Technical Bulletin have already been mailed to a select list of building professionals. Readers not included in this mailing, or those desiring an extra copy, may obtain one by telephoning or writing: Quality Block Producers, Attn: Mr. Peter Vogel, 856 So. Hoover Street, Los Angeles 5, California. DU 8-0251.

✓(346a) Triangle Tile by Hermosa, 6" equilateral glazed ceramic triangles available in all Hermosa colors, in bright glaze, satin glaze, and Dura-Glaze. Triangle Tile brochure shows unlimited possibilities of this medium for light duty floors, walls, wainscots or entryways in any room. Excellent for bold design effects or abstract murals. Triangle Tile has all durable features of Hermosa glazed ceramic tile and has spacers for accurate setting. Write for complete brochure to Gladding, McBean & Co., 2901 Los Feliz Boulevard, Los Angeles 39, California.

(175a) Etchwood and Etchwall: textured wood paneling for homes, furniture, offices, doors, etc. Etchwood is plywood; Etchwall is redwood lumber T & G preassembled for fast, easy installation; difficult to describe, easy to appreciate.—Davidson Plywood & Lumber Company, 3136 East Washington Boulevard, Los Angeles, California.

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