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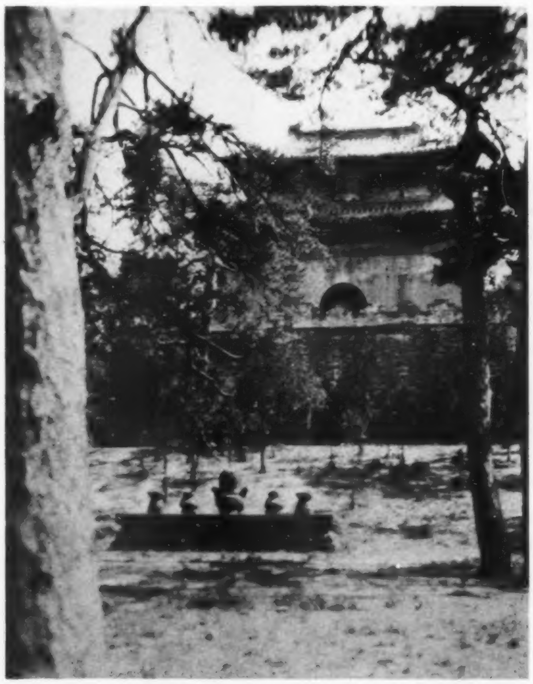
AN ARCHITECTURAL PILGRIMAGE IN CHINA

By WALTER A. TAYLOR

IN these times, when the word "China" seems to be almost synonymous with chaos and discord, it is a distinct pleasure to recall one place in that land where quiet peace reigns and where nature and architecture are combined to give the impression of inviolable security — the Tung Ling, or Eastern Tombs of the Manchu Emperors.

This pleasurable reminiscence is an inexhaustible compensation for a difficult walking trip at three days' distance from Peking through dust storms, across the loess plains and into the mountainous fringe of the Mongolian Plateau. Walking is preferred to the only other means of locomotion, riding small donkeys. One of these motheaten beasts is hired, with his driver, to carry the duffel. Even hardened and indifferent travelers must carry sufficient equipment to make habitable and bugproof the inns, which are unimaginably primitive and filthy and which have only concrete, flue-heated beds. After the nightly demonstration of cameras and leather shoes and other strange objects to half of the village population, and after the anatomy has been made to conform to the contours of the concrete, slumber is further sweetened by the arrival of camel caravans with attendant curses and odors, and by the violent, raucous brays with which the donkeys greet the moon while their drivers snore or gamble all night in the adjoining rooms. All of these circumstances seem to be designed to enhance the impression of ineffable quiet which is to be found at the end of the journey.

A pass, cut by a river through a low range, leads into the Valley of the Eastern Tombs, where the tombs are simply marked by a marble *pai-lo*, or memorial "arch," of five beamed openings, and a low, red-plastered, tile-capped brick wall of seemingly indefinite extent. Nothing else disturbs the spaciousness of the grassy valley. On the northern side wooded foothills lead to the



SOUL TOWER, TOMB OF MING EMPEROR YUNG LOH, CIRCA A. D. 1400. NEAR PEKING. THIS TOMB IS THE PROTOTYPE OF ALL LATER IMPERIAL MAUSOLEA. IN THIS EXAMPLE THE SOUL TOWER IS AT A SUFFICIENT DISTANCE FROM THE SPIRIT HALL, AND OF PROPORTIONS AND SCALE THAT MAKE IT A COMPLETE AND SATISFYING ENTITY.

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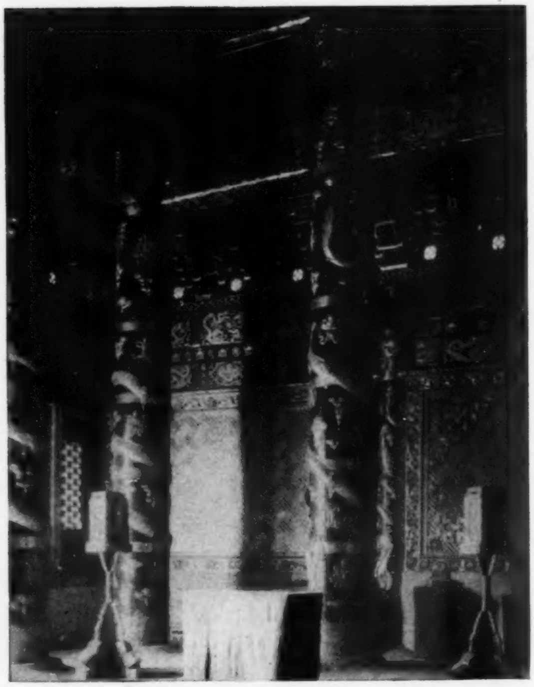

INTERIOR OF SPIRIT HALL, OR WORSHIP CHAMBER, TOMB OF THE EMPRESS DOWAGER—EASTERN TOMBS. THE TEAKWOOD COLUMNS ARE COVERED WITH DARK RED LACQUER. THE COLUMN DECORATIONS AND THE WALL PANELS ARE OF GOLD LACQUER. THE ORNAMENTATION OF THE BEAM SURFACES AND THE CEILING PANELS IS OF GOLD LACQUER RELIEF OVER FIELDS OF BLUE AND GREEN.

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mountains, across which the Great Wall throws itself so relentlessly and majestically. Here the Great Wall serves also as the northern boundary of the wooden tract of about two hundred square miles, bounded on three other sides by the low red wall.

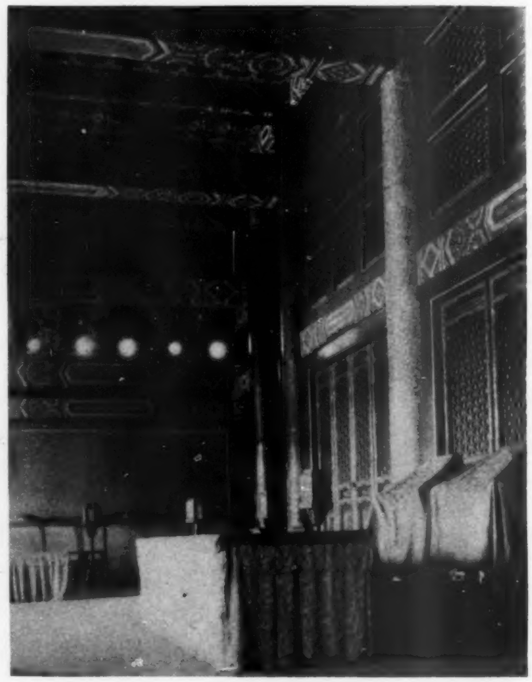
In this spacious park the remains and the monuments of six of the last rulers of Imperial China, including one of the world's really great rulers, two of the three greatest emperors of China's long history, and the greatest woman ruler of modern times. They share this space with twenty or more princes, wives and concubines.

What manner of monumental architecture would be adequate and fitting to commemorate and preserve such illustrious dead, who were the Sons of Heaven, whose titles are synonymous with fabulous wealth and splendour? The disclosure is decently discreet and gradual. Within the enclosure there are no signs or sounds of life save the dragonflies, and the magpies whose hoarse caws are the only funereal note in the whole effect. They seem to accentuate the silence as the solitary woodman or his inconspicuous hut suggests the apparently limitless extent of the woodland. There are neither tourists, nor charabancs, nor guide-books, nor souvenir peddlers, and the guide speaks only when spoken to! He is a venerable worthy who must be sought out in the official village of caretakers, two miles away, and who, after due formalities, shows the way with his basketful of ten-inch keys.

A grass covered, gradually curving roadway emerges from the woodland. A considerable distance along the road there may appear a pair of marble columns or obelisks carved with inscriptions or conventional ornament, and further along one or three parallel narrow marble bridges.

After a final turn of the road, the transition from the natural to the formal is accomplished by an avenue of monumental marble figures in pairs facing each other at twenty yards across the roadway, ranging from lion-like "Dogs of Fo" to camels and elephants, to warriors and scholars, all splendidly and massively sculptured.

These mark the approach to one of the Imperial Tombs and from this avenue there is to be



INTERIOR OF SPIRIT HALL, OR WORSHIP CHAMBER, TOMB OF EMPEROR K'ANG HSI—EASTERN TOMBS. TYPICAL CONSTRUCTION AND ORNAMENTATION CLEARLY SHOWN. CEILING PANELS AND BEAM ORNAMENT IN BLUE, GREEN AND WHITE. COLUMNS COVERED WITH GOLD LACQUER. GRILLED DOOR-WINDOWS OF WOOD, PAINTED DARK RED. FURNITURE COVERS OF IMPERIAL YELLOW.

Photograph copyright by W. A. Taylor

viewed a grand symmetrical ensemble; the Spirit Hall and the Soul Tower are still at a respectable distance beyond several walls and gates, but they present a superb picture. The sunlight on the golden yellow tiles picks out the massive roofs from the green and brown of the mountain valley in which they rest, flanked with dense woods, and the "wrinkled" blue mountains stretch on for many ranges.

The major tomb groups are all similar in parts and plan arrangement. We may choose as a good and typical example Ching Ling, the Tomb of K'ang Hsi.

In accordance with the two inviolable canons of Chinese monumental architecture, the whole group is arranged almost exactly symmetrically about a north and south axis, around a series of courts, with the principal buildings facing south. Before the first gate are two symmetrically placed tablet halls almost exactly alike, each one flanked by elaborately carved obelisks or marble pillars of conventionalized clouds.

The illiterate foreigner, unable to read the tablets, must learn from his history books that this man K'ang Hsi had come to the throne at the age of 8 (A.D. 1662) and had discharged his regents at the age of 13. He suppressed a serious rebellion and wrote a poem to commemorate it. He captured the Island of Formosa from the pirate chief who had captured it from the Dutch; he had a small frontier war with Russia; and in another campaign added large areas of Central Asia to the Chinese Empire, at the same time cultivating the personal friendship of Peter the Great. This grandson of the barbarian Tartars who invaded China and overcame the Chinese Ming Emperors was a patron of literature. He caused a huge dictionary of 5,026 volumes to be compiled, and himself wrote sixteen maxims of morality which served for many years as a "Ten Commandments." The reign of K'ang Hsi was surpassed in magnificence and accomplishment by that of his illustrious grandson, Chien Lung, the "Louis XIV of China." However, he is accorded a place as one of the Great Three of China's rulers. Being of an eminently practical race he saw to it, as is customary for Chinese potentates, that his tomb

MARBLE PAI-LO, OR MONUMENTAL GATEWAY, MARKING ENTRANCE TO EASTERN TOMBS. TYPICAL OF THIS WIDELY USED ELEMENT. LESS IMPORTANT ONES AT THE ENTRANCES OF PRIVATE CEMETERIES AND AT INTERSECTIONS OF PROMINENT STREETS ARE OF WOOD. THIS IS AN INTERESTING EXAMPLE OF THE EXECUTION IN STONE OF STRUCTURAL MOTIFS DERIVED FROM WOODEN PROTOTYPES.

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SOUL TOWER AND SPIRIT HALL, TOMB OF THE EMPRESS DOWAGER, TZE HSI. THE EMPRESS TOOK UNUSUAL PRIDE AND INTEREST IN THE BUILDING OF THIS TOMB, WHICH WAS THIRTY YEARS UNDER CONSTRUCTION. IN 1897, WHEN NEARLY COMPLETED, SHE ORDERED THE SPIRIT HALL REBUILT BECAUSE THE TEAKWOOD COLUMNS SEEMED TO HER NOT LARGE ENOUGH.

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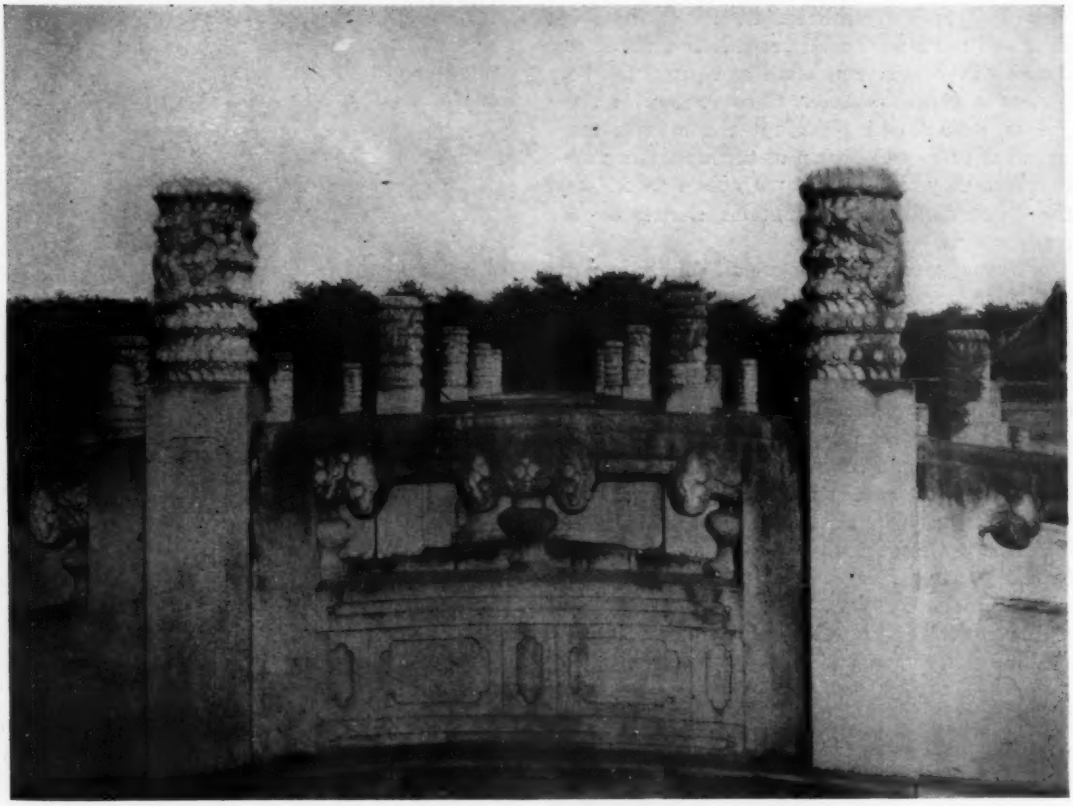


MARBLE BRIDGES OVER MOAT, EASTERN TOMBS
ADAPTATION OF TYPICAL TERRACE BALUSTRADE DETAILS
Photograph copyright by W. A. Taylor

was completed before his death. He died in 1723.

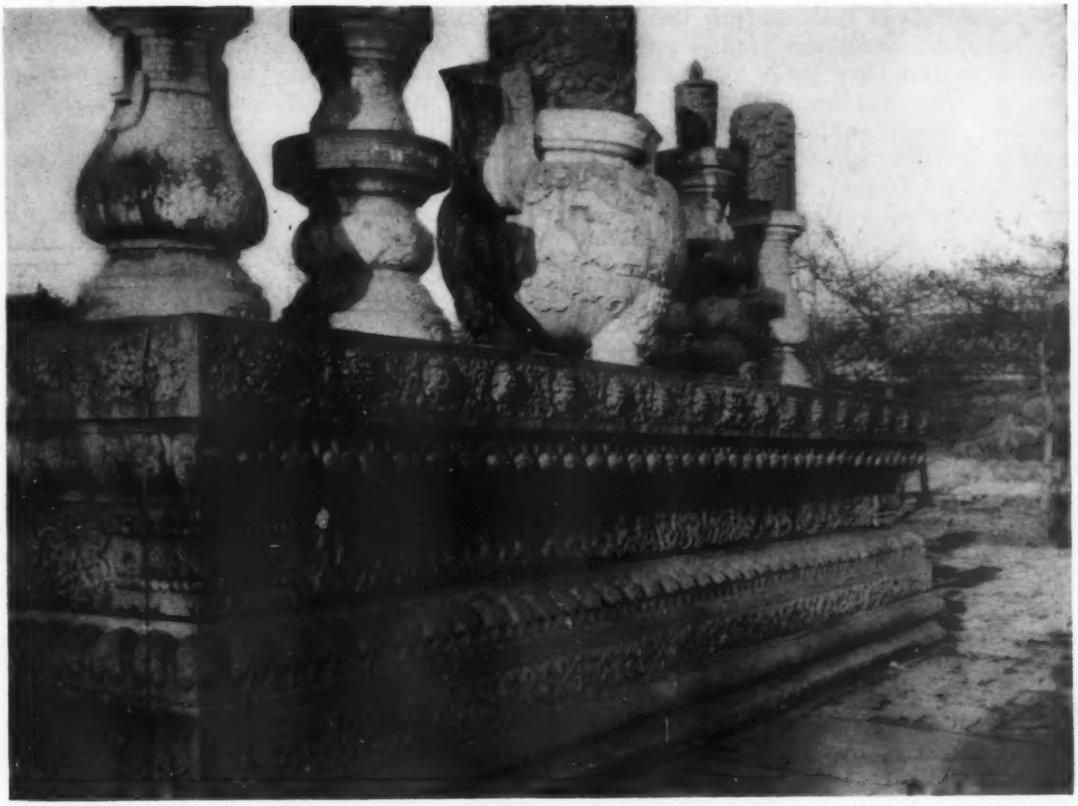
The arrangement of this tomb group shows a carefully studied transition from simple to elaborate. The first court is surrounded by minor buildings, the second by more elaborate lodgings for the Imperial family on pilgrimage, and with a few evergreen trees in symmetrical arrangement. A large pavilion with massive gate doors opens onto the impressive main court which is large enough to provide a setting for the Spirit Hall, or worship chamber, which is the real climax of the composition and to which are subordinated the marble altar, the terra cotta sacrifice ovens, and the elaborately roofed pavilions on paved terraces, all in formal arrangement.

Here are exhibited all of the characteristics and details of Chinese monumental architecture. Uniformity, the outstanding characteristic, is to be observed in every part. There are the dragon-embossed ends of the tiles, so formal in contrast to the haphazard abruptness of Spanish and Italian tiles. The bronze animals and incense urns, the blue and white eyes on the closely spaced show rafters, and the procession of little beasts riding the hips of the roofs vary but little from the same details of many other buildings.

The plan of even the most elaborate structure is a simple and symmetrical arrangement of rectangles, marked by wooden columns, which in turn terminate the sections of interior partitions and the exterior curtain walls of door-windows are of brick. The superstructure, supported entirely by the columns, in anticipation of our "modern" construction, is also of wood. The true truss is not known to the Chinese, and the width of bays is limited by the length of large timbers available for the bottom member of the "truss," above which are successively smaller beams on posts and brackets.

The ornament is either constructed ornament, or expresses the construction. In these late examples the intricate corbel and bracket systems are more decorative than structural.

The original color schemes were no doubt offensive to the occidental eye, but time and the elements, and the dust storms from the Gobi



MARBLE ALTAR

AN ALTAR OF THIS KIND IS IN THE MAIN COURT OF EACH TOMB, BETWEEN THE CENTRAL GATE AND THE SPIRIT HALL. THE DARK PORTIONS OF THE CONVENTIONALIZED SACRIFICIAL VESSELS AND CANDLES ARE OF BRONZE. THE PROFILE IS SUGGESTIVE OF EURÓPEAN CLASSIC OR RENAISSANCE, PARTICULARLY THE "EGG AND DART" OF LOTUS BLOSSOM ORIGIN.

Photograph copyright by W. A. Taylor

Desert, have wrought them into rich harmonies. The red plaster of the brick walls, said to be colored with ox-blood, has taken on several patinas of greens and browns with occasional pinks and grays of efflorescence. The lacquered wood columns have less variation in their burnt siennas or dirty reds, and the bold blues and greens in the geometrical ornament of the lintels and corbels have been subdued to harmonizing contrasts.

The more important buildings have the double roof, although none has a second story. Some examples have small round clerestory windows, not noticeable from without.

The most familiar characteristic, the upturned corners of the roof, has given rise to several fantastic explanations, such as "spears and tent corners," and "points to ward off evil spirits." The writer's opinion, apparently not supported by other investigators, is that this feature is a functional development. A wide projection of the roof has been found desirable because of intense sunlight and heavy rainfall, also because of the resulting dignity and massive composition. To carry this line horizontally to the corners would not only produce apparent sagging of the corners viewed diagonally, but it would also be difficult to construct at that level with diagonal cantilevers and corbels. The expedient of the turned-up corner was found to be practical as well as pleasing. It has been retained and elaborated, and it has brought about the unique achievement of a heavy roof that has at once repose and lightness, dignity and grace. It is a fact worthy of careful study that, in general, the farther south in China, the sharper the turn-up of the roof.

The guide uses a short ladder to reach the topmost of the three padlocks which he opens with his enormous push-keys and invites the foreign devils into the very worship chamber. This is a truly majestic interior, rich and massive, but reposeful and restrained. Many times the few available hours could be spent studying the details of this remarkable construction and ornamentation. This most exemplary guide seems to have an eternity of time, and seems not to mind the long exposures necessary in this dim interior.

After the satisfying size and unity of the Spirit Hall, the Soul Tower, above and in front of the actual tumulus, in another court and to the rear, seems somewhat of an anti-climax.

Artificial light being no doubt profane as well as dangerous in such a place, it is necessary to leave an hour before dark. A seemingly aimless path through the quiet woodlands, passing near to some of the other tombs, leads out to the open country and to the only sizeable village in the valley. Overlooking this village is a hilltop Buddhist monastery with its neat little fifty-foot pagoda. In contrast to the mountain village inns, this hostel is so clean and orderly that one is reminded of European refectories, wine cellars and dormitories. The genial hospitality of the well fed monks identifies them as the counterparts of our jolly fat friars; and the excellent variety of Chinese fare, with one's own pocket chopsticks, is especially delectable and satisfying.

After the luxury of a night on a bed of woven bamboo, one feels equal to any number of tombs. It would be interesting and profitable to visit each tomb of the group; but with limited time most of them, being quite similar at least in layout and general appearance, are passed by in favor of the most recent and perhaps the most interesting one, that of the Empress Dowager. It is awe-inspiring to stand before the tomb of this leading figure of the last powerful and lavish Oriental court that succumbed to the modern age. This Elizabeth, or Catherine de Medici, of China, affectionately called by some "Old Buddha," was the last real ruler of the Manchu House. With pride and cruelty and often in blind hatred, she resisted futilely the decay of the Manchu dynasty and the inevitable drawing of China into the affairs of the world. Among other things, she succeeded in turning the Boxer rebellion, originally against the Manchus, against the foreigners. By murder, kidnapping and adoption she manipulated the succession and kept herself the power behind the throne for over forty years. She died in 1908, a sad, proud figure, but with a name in all history as a great woman ruler. In 1911 began the revolution which brought to an ignoble end the rule of the House of Ching.

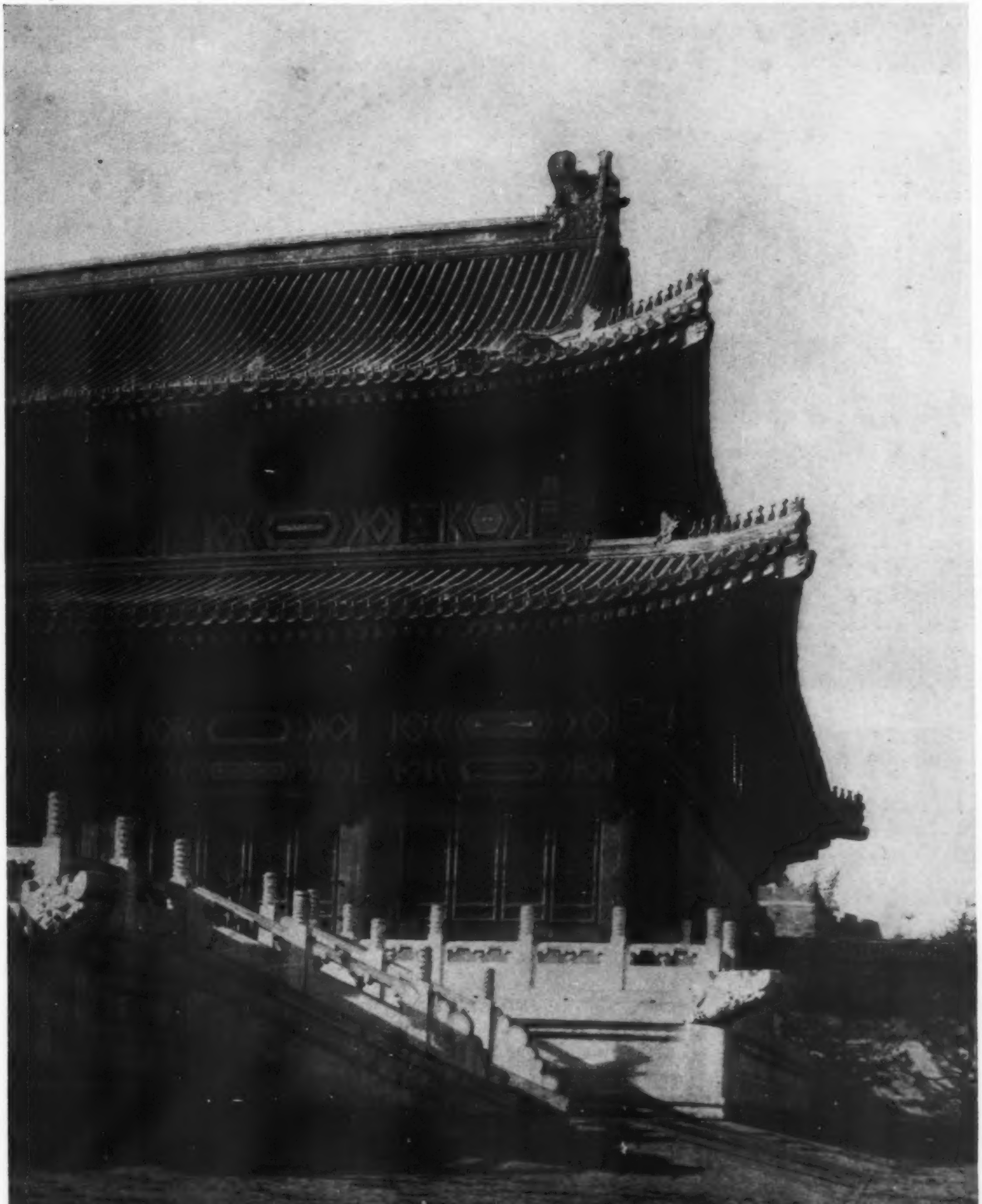
ONE OF TWO TABLET-HALLS MARKING APPROACH TO A TOMB. THE MASSIVE CORNER PIERS LEAVE THE INTERIOR A GREEK CROSS IN PLAN. WITHIN IS AN ENORMOUS TORTOISE OF WHITE MARBLE, THE TORTOISE BEING A SYMBOL OF LONGEVITY OR ETERNITY. FROM HIS BACK RISES A LARGE RECTANGULAR STELE ON WHICH CAREFULLY INCISED MANCHU AND CHINESE WORD-CHARACTERS IN APPROPRIATE PROFUSION TELL OF THE VIRTUES AND OF THE REIGN OF THE IMPERIAL INCUMBENT.

Photograph copyright by W. A. Taylor

The approaches and general layout of the Empress' Tomb are not unlike those of the other tombs, but the principal structures are somewhat smaller than in the Emperors' tombs, and the Spirit Hall is somewhat less dignified, perhaps more feminine. However, any scaling down is more than compensated for by the elaboration of ornament, particularly the interior of the Spirit Hall. The profusion of gold lacquer makes the dim interior seem almost brilliant and the design in its gorgeousness would certainly be called "rococo" if that were a correct term to apply to Chinese architecture.

Apart from any question of architectural merit, this tomb adds a final note of interest to this group of mausolea which constitute a significant chapter in the history of this style.

After a casual stroll through the village and another restful night at the monastery, the pilgrim starts with a new guide and a fresh donkey, through the Great Wall and north across three



SPIRIT HALL, OR WORSHIP CHAMBER, TOMB OF K'ANG HSI

TERRACES AND MARBLE BALUSTRADES, WHICH FORM THE BASE FOR MONUMENTAL BUILDINGS, ARE IMPORTANT ELEMENTS OF THE COMPOSITION AND ADD MUCH TO THE DECORATIVE EFFECT. THEY ARE USED WITH MUCH MORE FREEDOM THAN ARE ANY OTHER ELEMENTS OF CHINESE DESIGN, SHOWING GREAT VARIETY IN PLAN, HEIGHT, NUMBER OF STAGES, SCALE AND DETAIL.

Photograph copyright by W. A. Taylor

BASES OF FREE-STANDING SHAFTS OR OBELISKS, EASTERN TOMBS. THE FINELY CARVED ORNAMENT IS DISTINCTLY CHINESE, YET SOME OF THE MOTIFS AND THE GENERAL FEELING ARE NOT UNLIKE OUR MANUFACTURED "MODERN" ORNAMENT.

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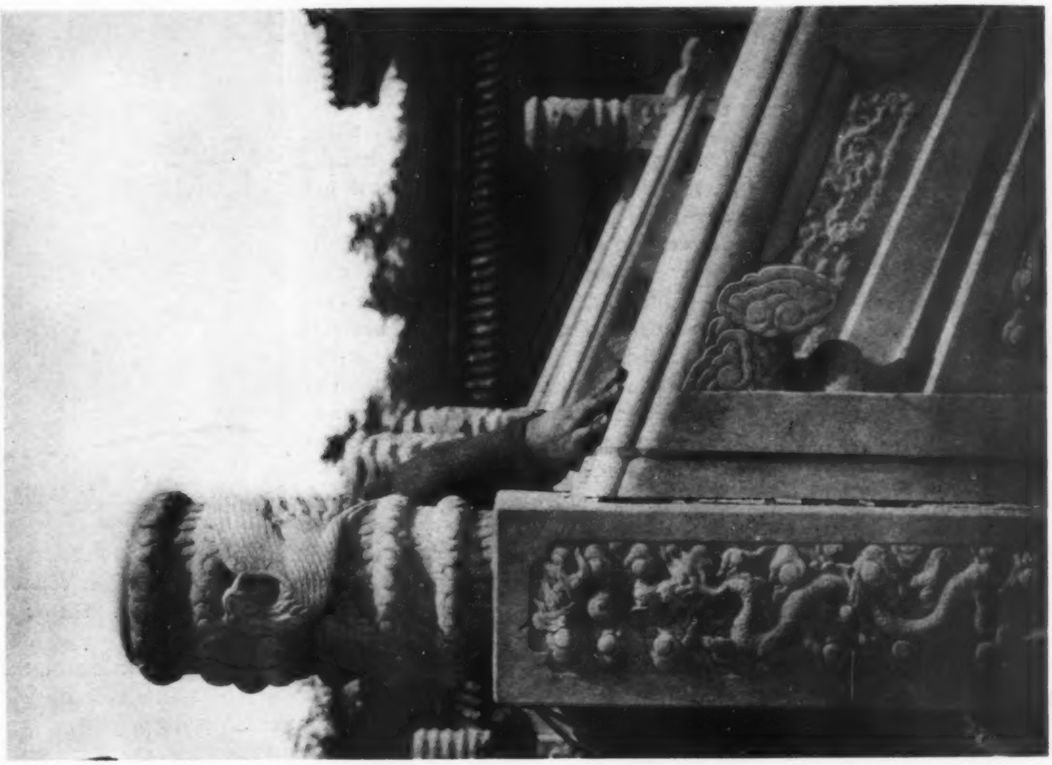


DETAIL OF BALUSTRADE, TOMB OF EMPRESS DOWAGER

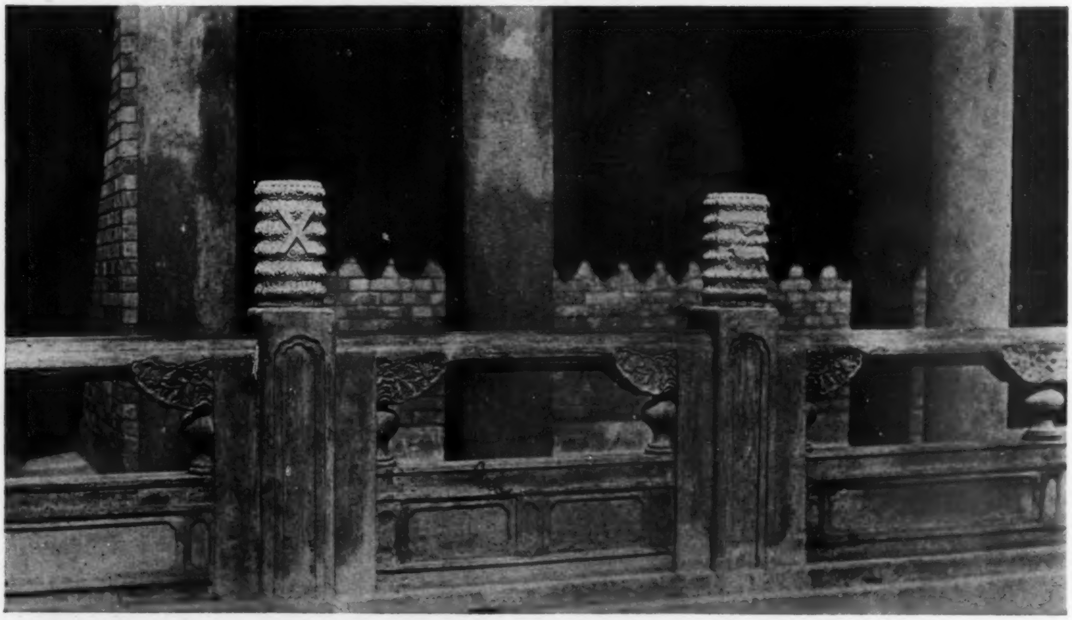
BASE OF FREE-STANDING SHAFT OR OBELISK, EASTERN TOMB

Photographs copyright by W. A. Taylor

ranges in quest of Chien Lung's Summer Palace and the great Lama Monastery at Jehol. During the three days of this journey there will be ample time to review and crystalize thoughts and impressions of Eastern tombs.

Here are the most recent, perhaps the last examples in China, of the only real and fully developed wooden architecture. They represent a closer adherence to precedent over a longer period of time than the architecture of any country or period since the temples of Egypt. Most of these larger buildings might easily be mistaken for similar buildings in the majestic groups of the Forbidden City, the heart of the City of Peking, which were built by the Great Ming Emperor Yung Loh in the early 15th Century. In practically all respects, excepting size, they are quite like the tombs of Yung Loh and the other Mings (1368 - 1644). But, more than this, these buildings and most of the Peking buildings would seem to the casual observer to be in exactly the same style as the Chion-In monastery in Kyoto and many other famous groups in Japan. These two styles, which are so much alike, yet really distinct, represent two streams of development which separated from their common source, the Chinese architecture of the Tang Dynasty, a thousand years ago.

It is to be hoped that the destruction of these buildings will not occur before they are again valuable in the eyes of the Chinese; or that, if they are not preserved from ruin, they may be otherwise recorded with as much care as that expended on historical European buildings.



ILLUSTRATIONS OF ST. ANDREW'S CHURCH, WU CHANG, CHINA—J. V. W. BERGAMINI, ARCHITECT

MODERN ADAPTATION OF CHINESE TEMPLE ARCHITECTURE FOR A CHRISTIAN CHURCH EDIFICE

Photographs copyright by W. A. Taylor

THE HOUSE OF

ELLERY S. JAMES

EAST HAMPTON, LONG ISLAND, N. Y.

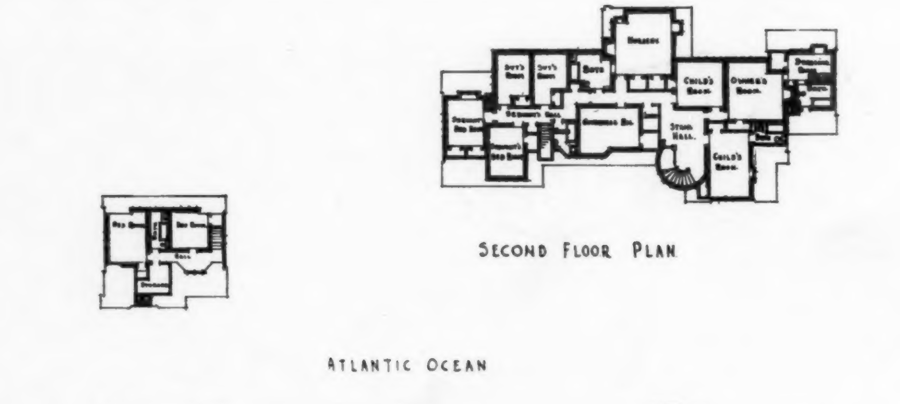
Roger H. Bullard, Architect

Photo by Van Anda

VIEW OF THE HOUSE FROM THE SOUTH

THE HOUSE IS LOCATED ON THE DUNES OF LONG ISLAND ON THE ATLANTIC COAST

THE ARCHITECT'S DRAWING



HOUSE OF ELLERY S. JAMES, EAST HAMPTON, LONG ISLAND, NEW YORK

ROGER H. BULLARD, ARCHITECT

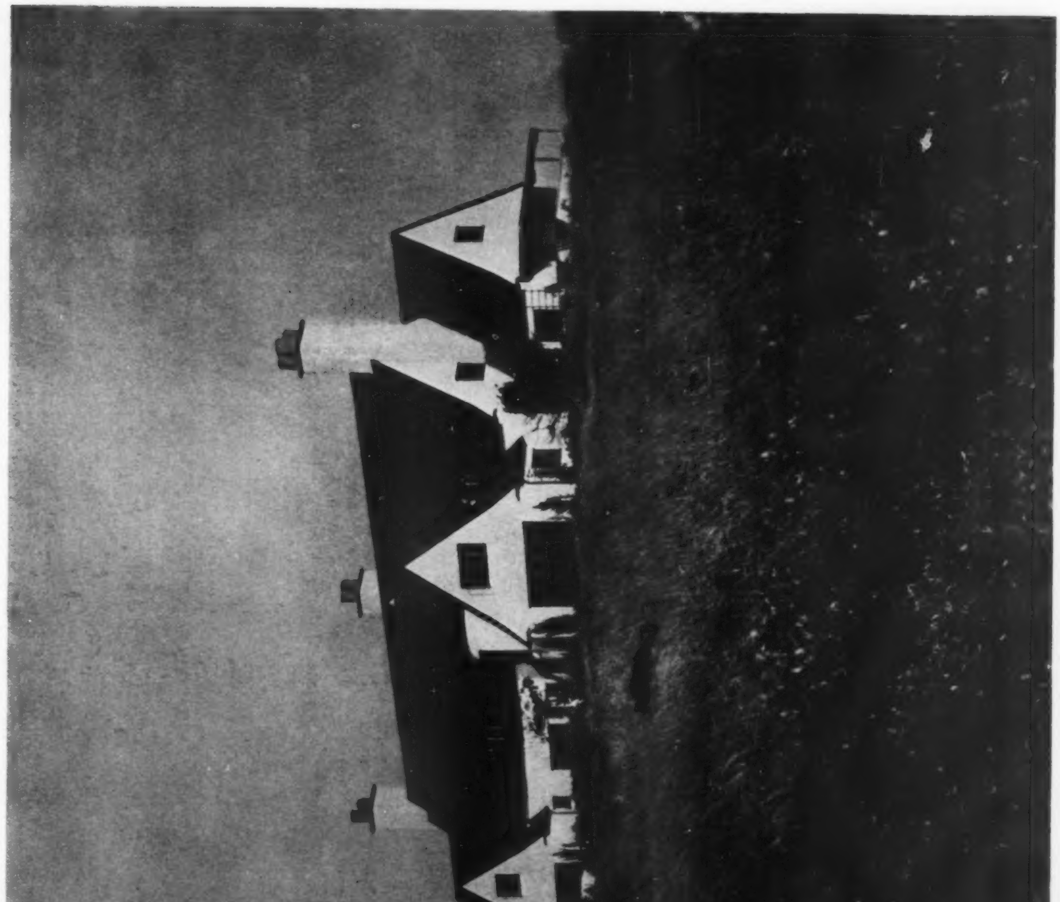


Photo by Van Anda

HOUSE AND GARAGE OF ELLERY S. JAMES, EAST HAMPTON, LONG ISLAND, N. Y., FROM THE NORTHWEST.—ROGER H. BULLARD, ARCHITECT

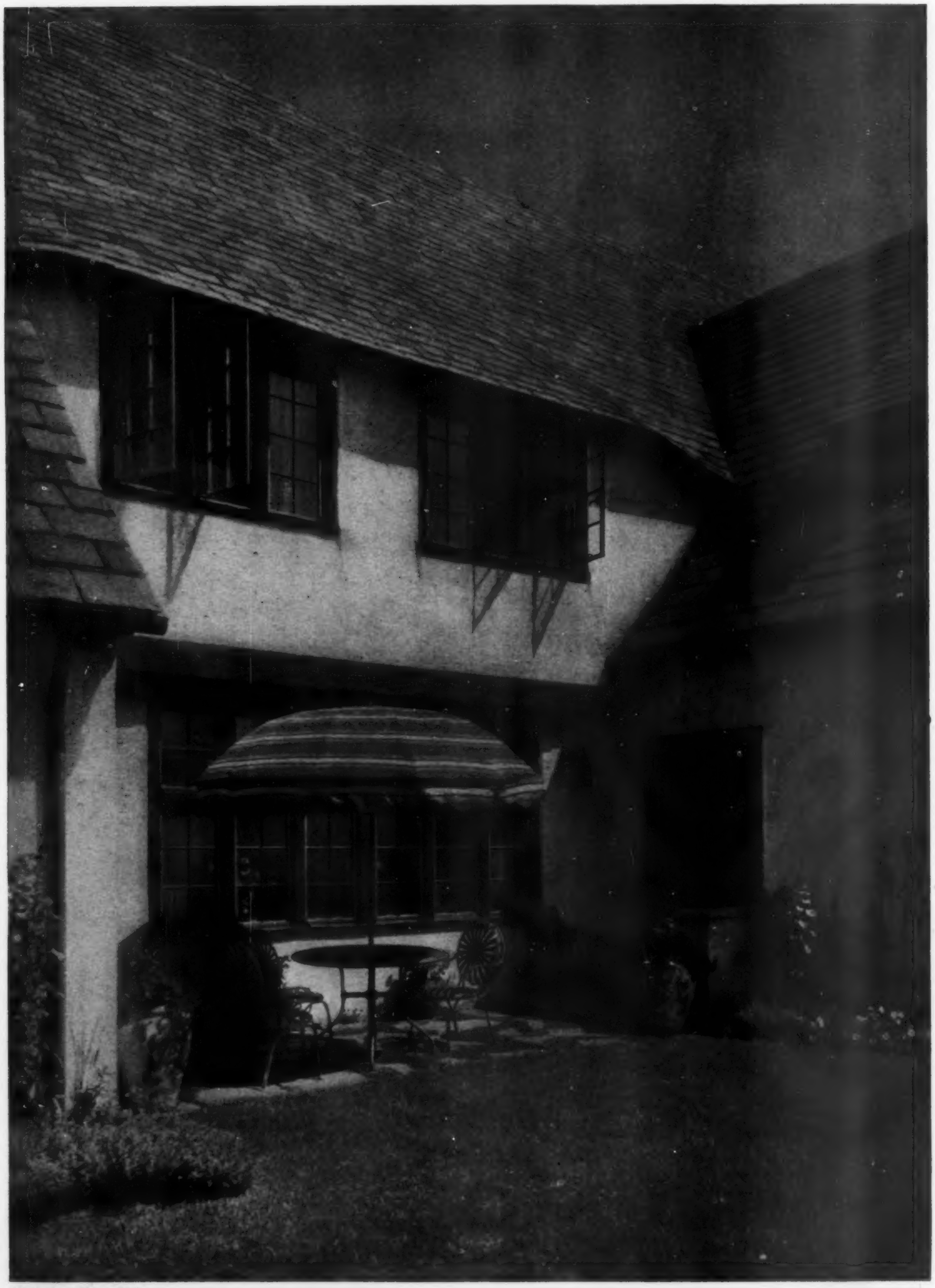


Photo by Van Anda

GRASS COURT, HOUSE OF ELLERY S. JAMES, EAST HAMPTON, LONG ISLAND, N. Y.
ROGER H. BULLARD, ARCHITECT

Photo by Van Anda

ENTRANCE DOORWAY, HOUSE OF ELLERY S. JAMES, EAST HAMPTON, LONG ISLAND, N. Y.

ROGER H. BULLARD, ARCHITECT

Photo by Van Anda

STAIR HALL, HOUSE OF ELLERY S. JAMES, EAST HAMPTON, LONG ISLAND, N. Y.—ROGER H. BULLARD, ARCHITECT

Photo by Van Anda

LIVING ROOM FIREPLACE, HOUSE OF ELLERY S. JAMES, EAST HAMPTON, LONG ISLAND, N. Y.—ROGER H. BULLARD, ARCHITECT

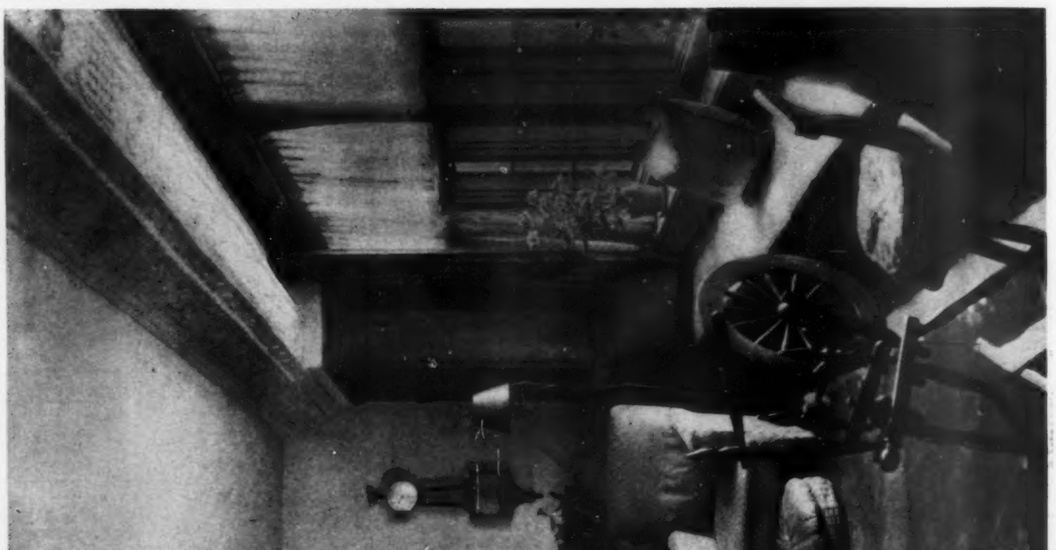
Photo by Van Anda

DINING ROOM CUPBOARD DETAIL, HOUSE OF ELLERY S. JAMES, EAST HAMPTON, LONG ISLAND, N. Y.
ROGER H. BULLARD, ARCHITECT

Photo by Van Anda

DINING ROOM FIREPLACE, HOUSE OF ELLERY S. JAMES, EAST HAMPTON, LONG ISLAND, N. Y.

ROGER H. BULLARD, ARCHITECT



LIVING ROOM BAY

HALL LOOKING INTO LIVING ROOM

HOUSE OF ELLERY S. JAMES, EAST HAMPTON, LONG ISLAND, NEW YORK—ROGER H. BULLARD, ARCHITECT

Photos by Van Anda

INTERIOR ARCHITECTURE

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A TAVERN ROOM

Developed from Old English Ideas

Incorporating in Its Design

Original Old Woodwork, Furniture and Accessories

Photo by Gillies

LOOKING INTO THE ROOM FROM THE PASSAGE

TODHUNTER, INC., DESIGNERS

Photo by Gillies

TAVERN ROOM DESIGNED BY TODHUNTER, INC.

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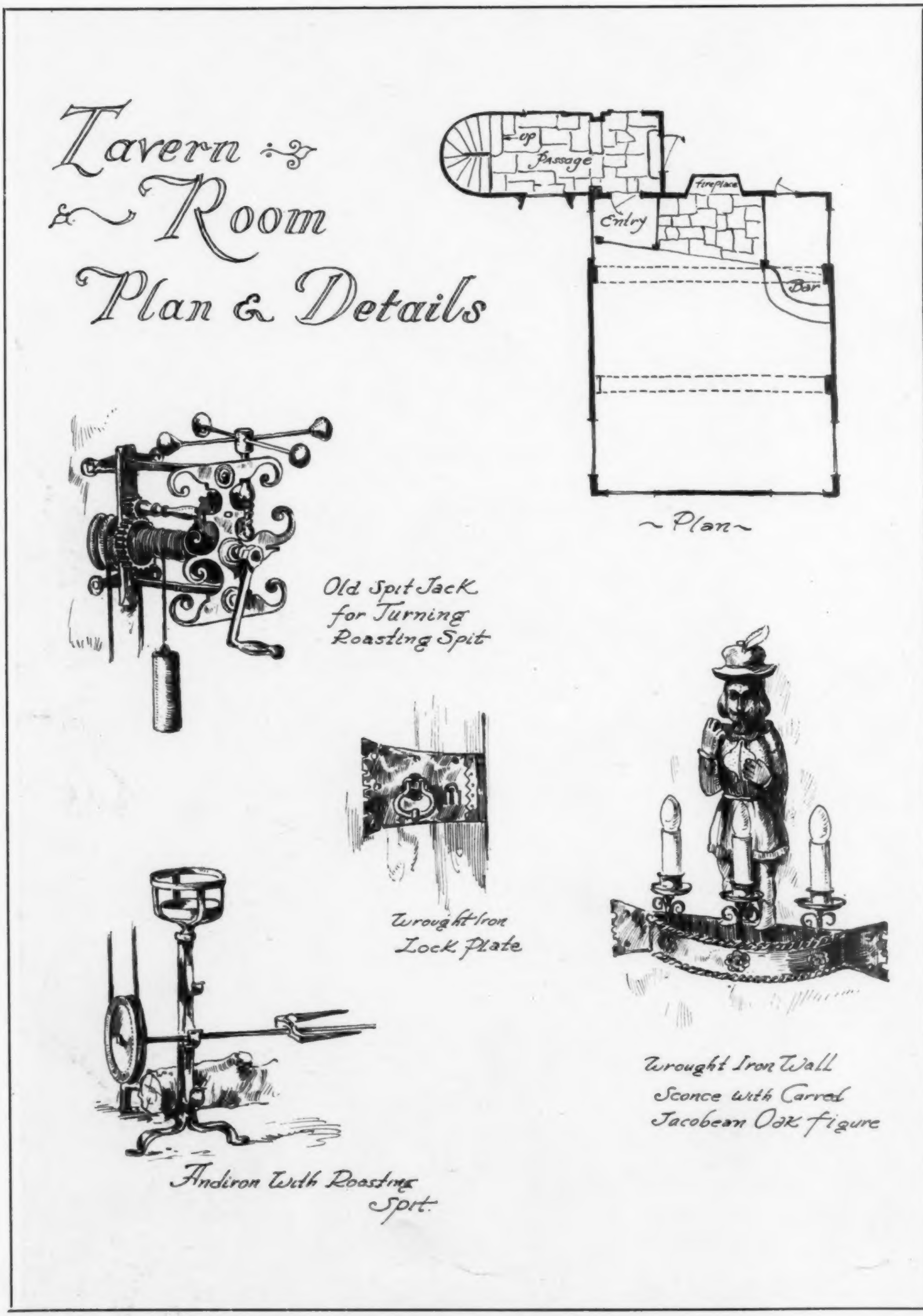
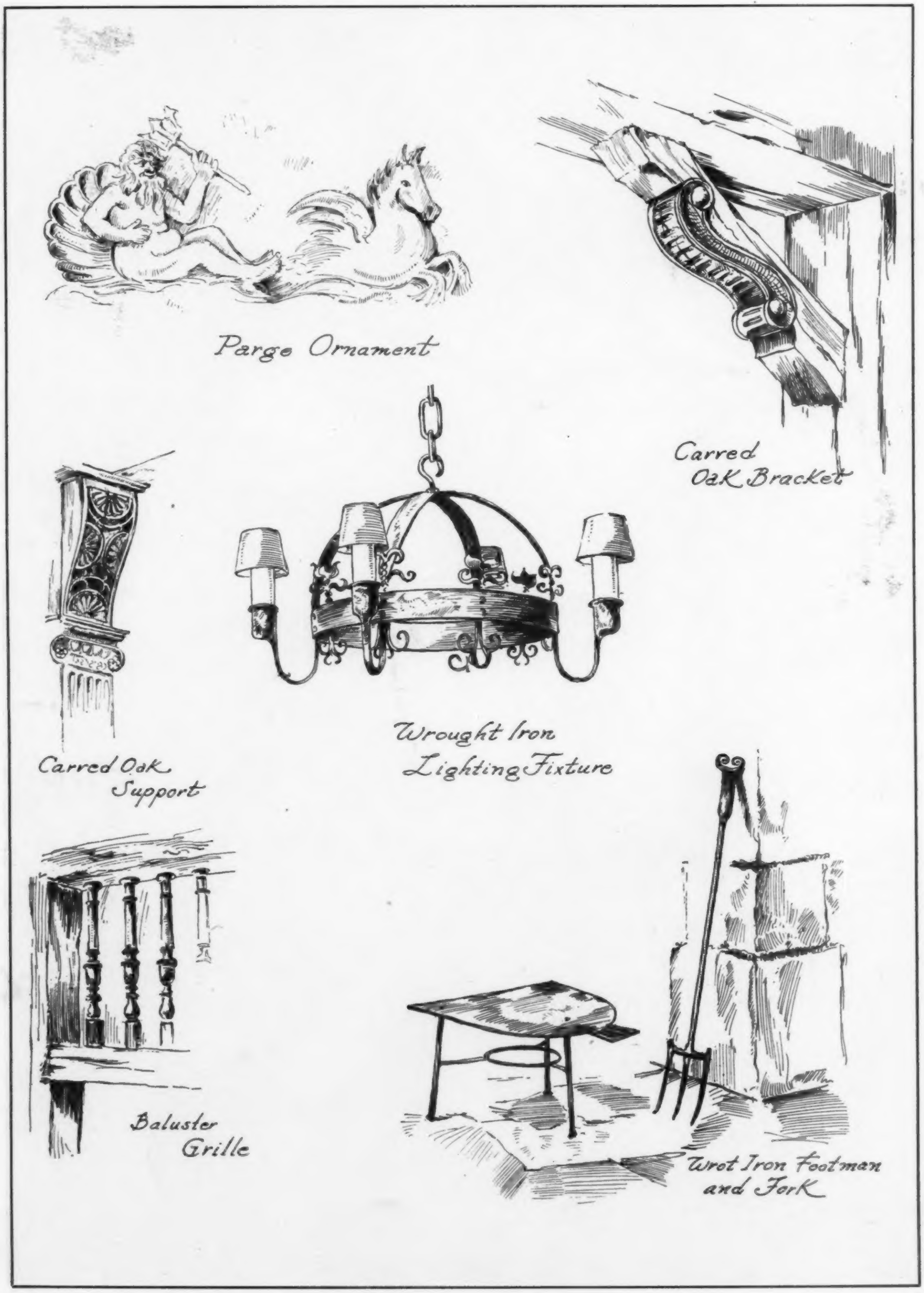
TAVERN ROOM DESIGNED BY TODHUNTER, INC.



DETAILS OF TAVERN ROOM
TODHUNTER, INC., DESIGNERS

Photo by Gillies

TAVERN ROOM
TODHUNTER, INC., DESIGNERS



DETAILS OF TAVERN ROOM

TODHUNTER, INC., DESIGNERS

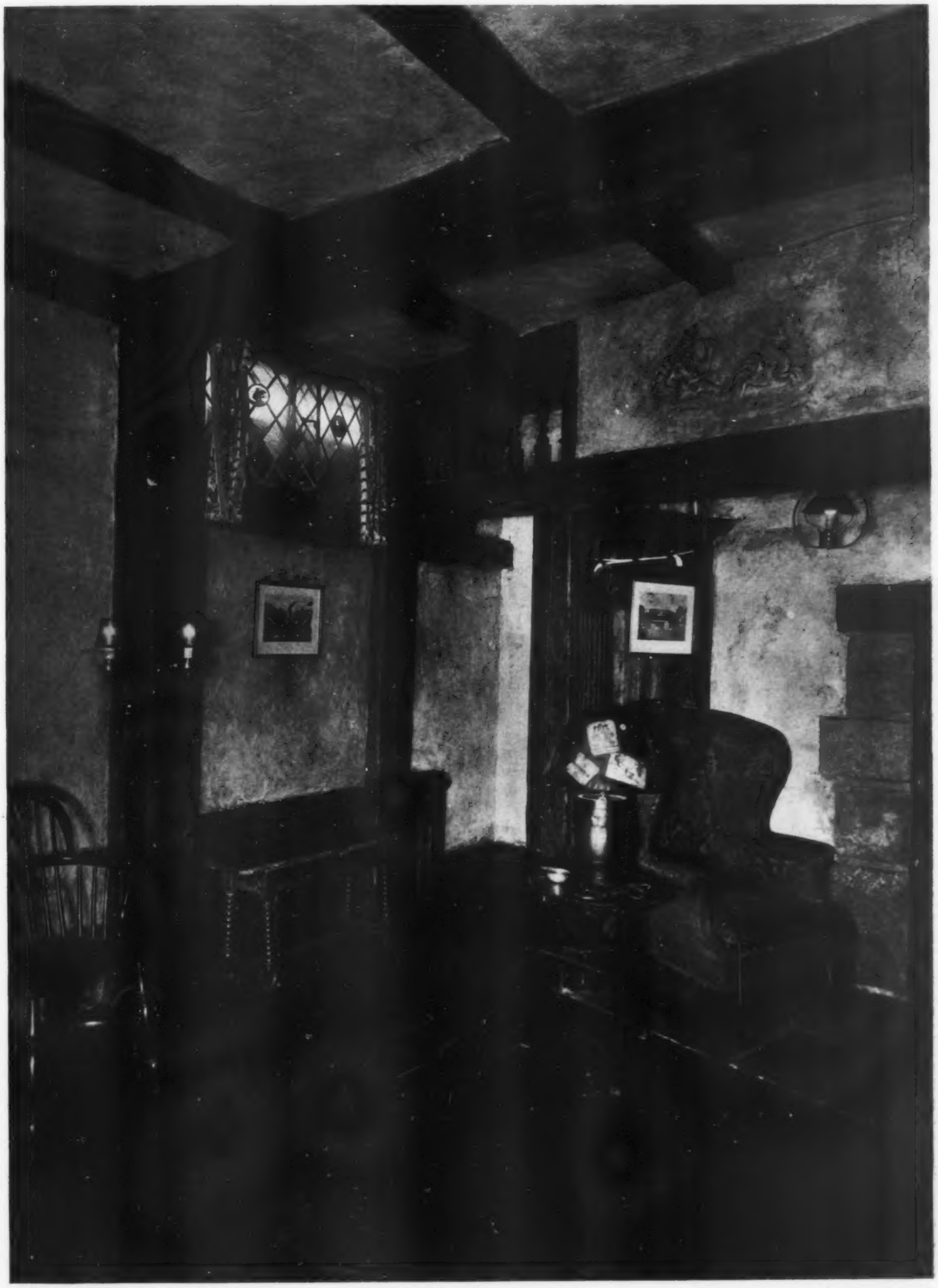


Photo by Gillies

TAVERN ROOM
TODHUNTER, INC., DESIGNERS

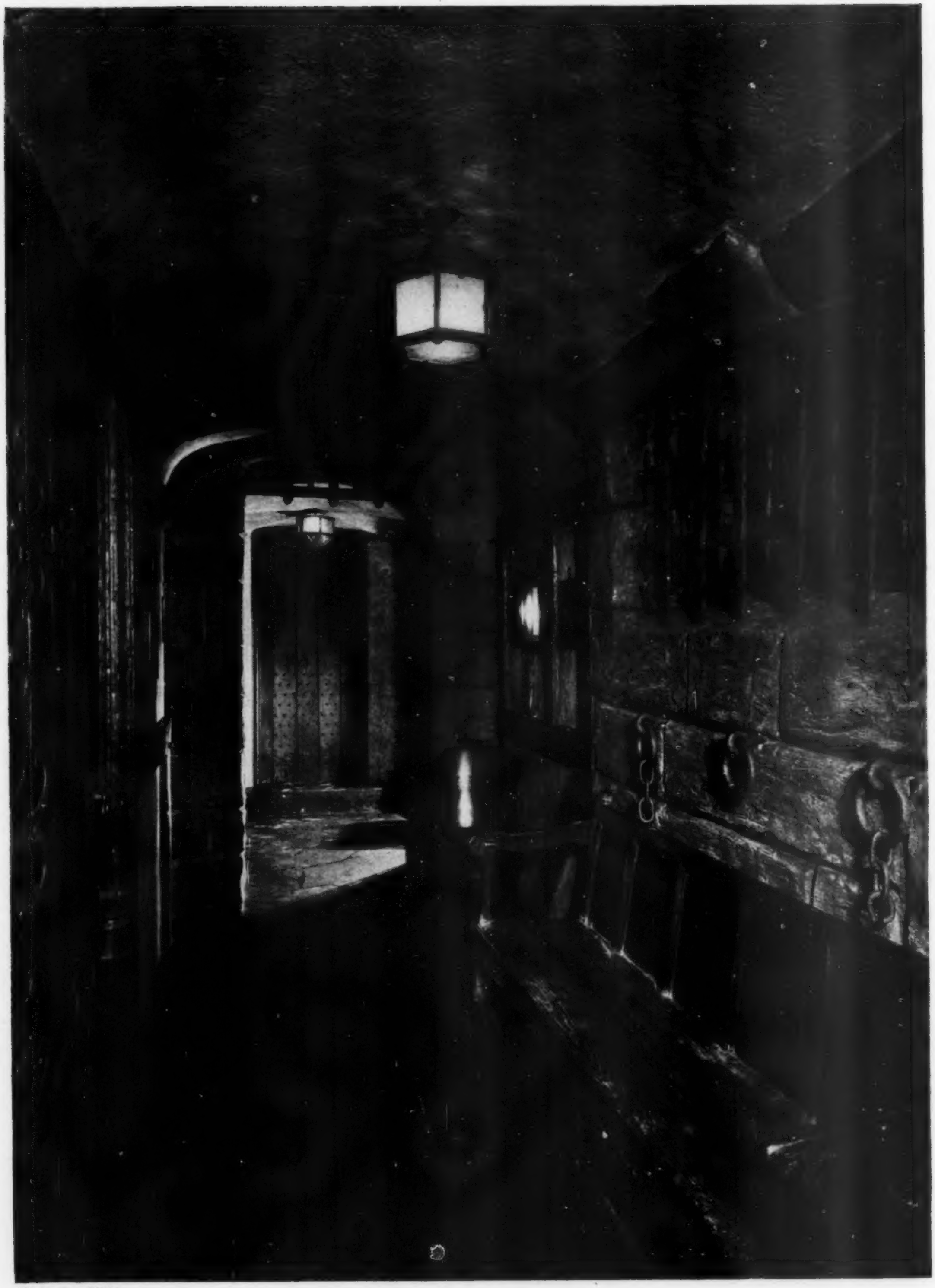


Photo by Gillies

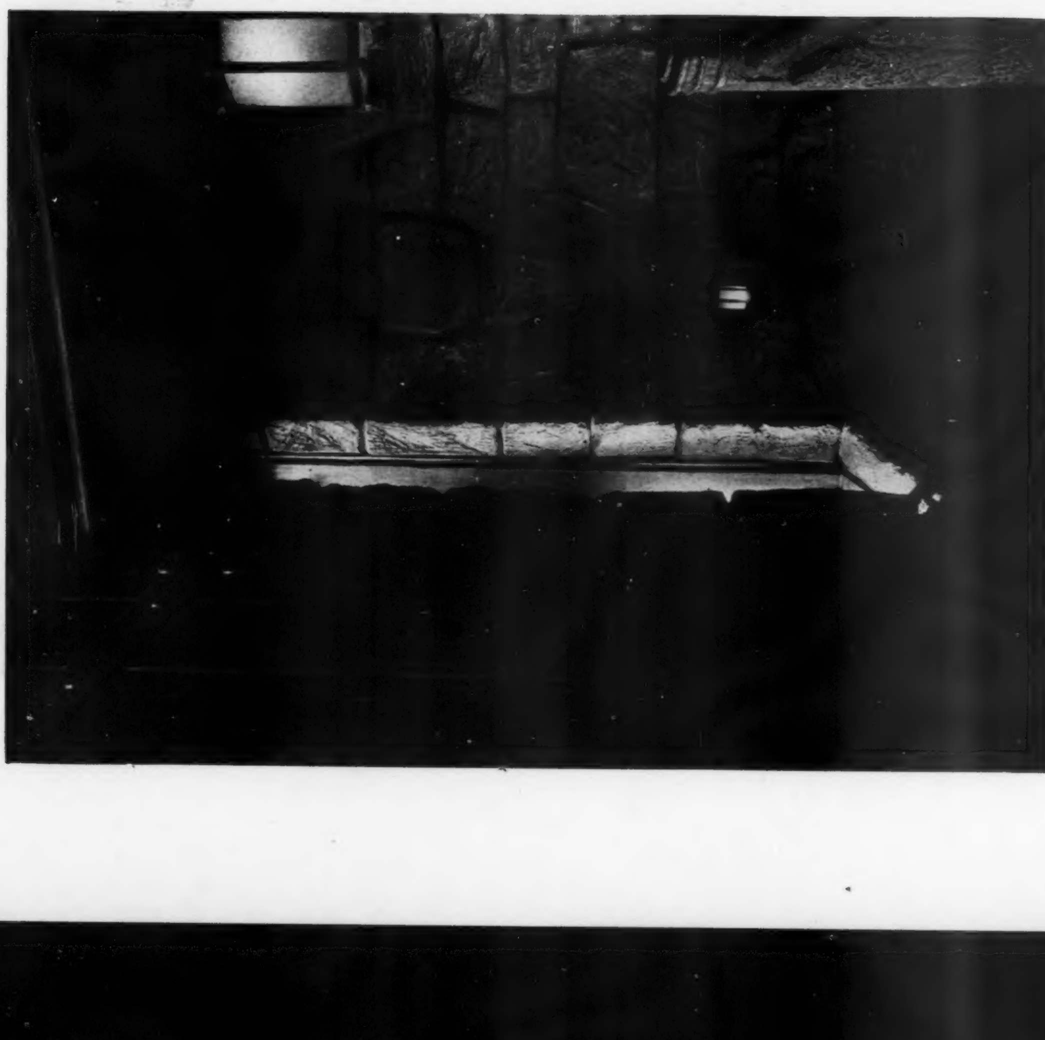
PASSAGE TO TAVERN ROOM

TODHUNTER, INC., DESIGNERS

Photo by Gillies

PASSAGE TO TAVERN

TODHUNTER, INC., DESIGNERS



DETAILS, PASSAGE TO TAVERN ROOM—TODHUNTER, INC., DESIGNERS

Photos by Gillies

EDITORIAL COMMENT

THE CLEVELAND HOSPITAL TRAGEDY

AS we go to press the shock of the Cleveland Clinic Hospital tragedy overshadows all other news. In consideration of loss of human life, and injuries to those victims still living, and wreckage of property, this explosion is among the most costly calamities that we have had in America in recent years.

Every phase of the explosion is being studied by technicians and others and it is certain that much will be learned to prevent the recurrence of such a happening in the future. The immediate need seems to be to determine what X-Ray film should be used in the future, and how old X-Ray records and new film are to be stored. The National Board of Fire Underwriters, in New York, urges the passing of a law for hospitals to use only the acetate or safety film in place of the nitro-cellulose film which is still largely used. Pyroxylin film, or nitro-cellulose compound—the explosive in the Cleveland Clinic fire—releases in combustion three compounds, camphor, carbon monoxide, nitric oxide gases and other compounds. Just which of these gases is the more deadly, and under precisely what conditions an explosion will occur, we do not know, but it seems to be an established fact that acetate film is slow-burning and non-explosive and that pyroxylin has been known to be a menace and should have been banned for hospital use before this disaster.

The problem of film storage is all-important. Many hospitals handle thousands of film a month, and old film are kept for record purposes. Dr. William Schroeder, Jr., Commissioner of Hospitals in New York, to assure safety, repeated an order three months ago that all film in New York hospitals, even the non-explosive acetate, be stored in protective cabinets approved by the Bureau of Fire Prevention, provided with automatic sprinklers, and proper ventilation and gas-escaping facilities. The question of whether to store film in the basement of a hospital or in a separate building is especially serious. It is stated that the National Fire Underwriters Association considers the safest place for such storage to be the roof. This is contradicted, however, by Professor Holzknecht, Chief of the X-Ray laboratory of the Vienna Public Hospital, and Dr. August Schoenfeld, X-Ray expert of Vienna, who, in a joint statement on the Crile Clinic explosion, say—

"Such catastrophies do not happen in Europe. Austrian regulations governing the installation of film rooms in hospitals are extremely strict. Film depots, darkrooms or archives are forbidden in any part of the hospital but the basement, owing to the danger of gassing, since gases thus generated aways sink downward."

Their statement continues—

"Only 100 pounds of films can be deposited in a hospital. Anything over this weight must be stored in special depots at least twenty yards from all other inhabitated buildings. No heating or smoking is allowed, and it is strictly forbidden to carry on any task there except the filing or removing of films. Iron doors are insufficient for protection. Tin doors with asbestos filling must be used, and must act automatically. No electric light switches are allowed. By following such regulations we have avoided all explosions."

The subject of safe hospital construction is an outstanding one for all those who are engaged in hospital design, construction and operation.

ARCHITECTURAL EXHIBITIONS

WE made a tour of the recent Architectural and Allied Arts Exposition, held under the auspices of the Architectural League of New York, in a very critical frame of mind determined to put in writing our findings that others contemplating a similar exhibition might profit by the League's mistakes as well as by any success which it may have achieved.

Personally, we are not in perfect sympathy with these great big showings. Although the League invites architects from all over the country, as well as those of other countries, to submit material, there is a great deal of space to be filled. The result is that practically everything that is submitted is accepted and hung. The exhibition is, therefore, spotted with a lot of material which, we think, is not desirable. The fact is that we much prefer a small exhibition in which only the cream of the year's architecture is shown to one so large in which the good things are interspersed amongst a mass of material of questionable merit.

We miss, too, in an exhibition of this size, what might be described as the individual touch of certain architects which used to be such an interesting feature of the old and smaller exhibitions held in the Fine Arts Galleries. For example, we would like to see more original studies and details, and fewer photographs and gorgeous renderings.

The hanging, too, of such a tremendous undertaking as the recent exhibition presents a difficult problem. It requires more time than the committee in charge can possibly afford. From this angle, too, then, the result is not wholly successful. In several instances, for example, we found photographs and sketches of the same building hung far apart from each other. We would suggest, too, the grouping of various classes or types of buildings together. This idea was attempted, to a certain extent, in the recent exhibition, in the hanging of material relating to domestic architecture. We feel that the eye cannot carry properly at a glance from a forty story commercial building to a bungalow nor can it change its focus immediately by turning from a detail of a painted ceiling to a piece of small structure.

As regards the allied arts, it would be our suggestion to feature along with the architecture the work of mural painters, sculptors, landscape architects and craftsmen, emphasizing the spirit of collaboration between these artists and the architects in the design of certain buildings. All other material exhibited by allied artists might then be hung in groups so that there would be sections devoted to mural painters, sculptors and landscape architects, as the various types of buildings would be grouped under such heads as skyscrapers, houses, bridges and so forth.

The manufacturers' booths at these shows are frequently disappointing. We were asked by a certain representative manufacture if we really thought that the money which these booths cost to rent and to erect was money well spent. He urged that we be very frank in our reply. Our answer was to the effect that it certainly could and would pay to go into such affairs if the booths were designed to demonstrate to the architect how certain particular products might be used to advantage in modern buildings. It is true, we think, that the majority of the booths in exhibitions of this kind are designed by men who are not architects, men who may be thoroughly familiar with their own product but who cannot present it in such a way that will arrest architectural attention or will carry an architectural appeal. Thus a great deal of money spent in these displays does not get the results that it might be capable of doing.

We have gone into such detail to express our opinion as we feel that these architectural exhibitions, wherever held, should be particularly valuable in cultivating on the part of the public a greater appreciation of architecture. Such shows should emphasize the artistic first and last. There is too often an element of commercialism discernible which is detrimental to their success.

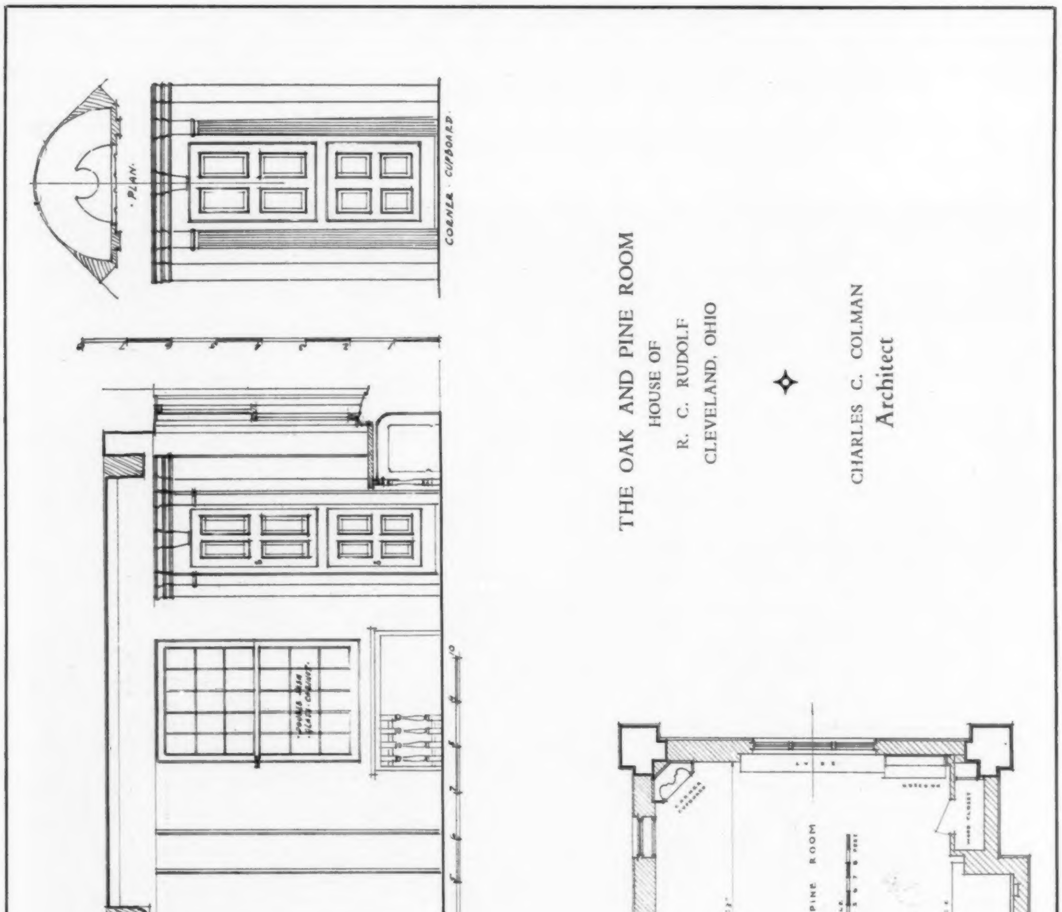
OFFICERS' CLUB BUILDING, FORT LEAVENWORTH, KANS.
RICH, MATHESIUS AND KOYL, ARCHITECTS
From the drawing by Schell Lewis

THE OAK and PINE ROOM

HOUSE OF R. C. RUDOLF, CLEVELAND, OHIO

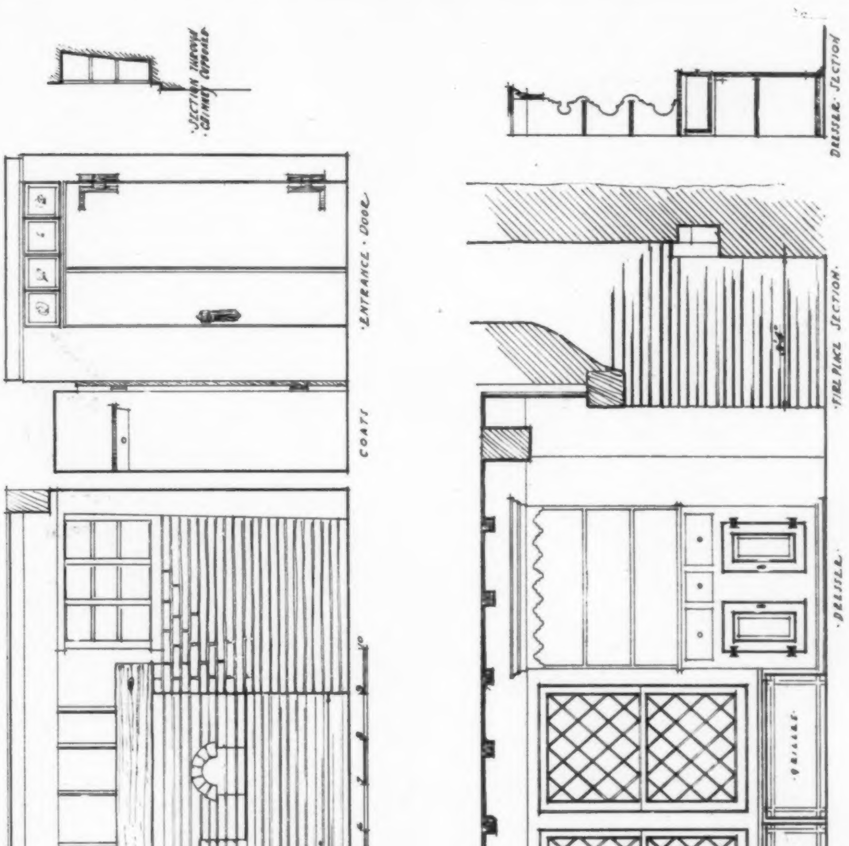
Charles C. Colman, Architect

ENTRY HALL
THE WALLS AND CEILING ARE OF HAND CUT PINE



THE OAK AND PINE ROOM
HOUSE OF
R. C. RUDOLF
CLEVELAND, OHIO

CHARLES C. COLMAN
Architect



THE OAK AND PINE ROOM, HOUSE OF R. C. RUDOLF, CLEVELAND, OHIO
CHARLES C. COLMAN, ARCHITECT

THE OAK AND PINE ROOM, HOUSE OF R. C. RUDOLF, CLEVELAND, OHIO
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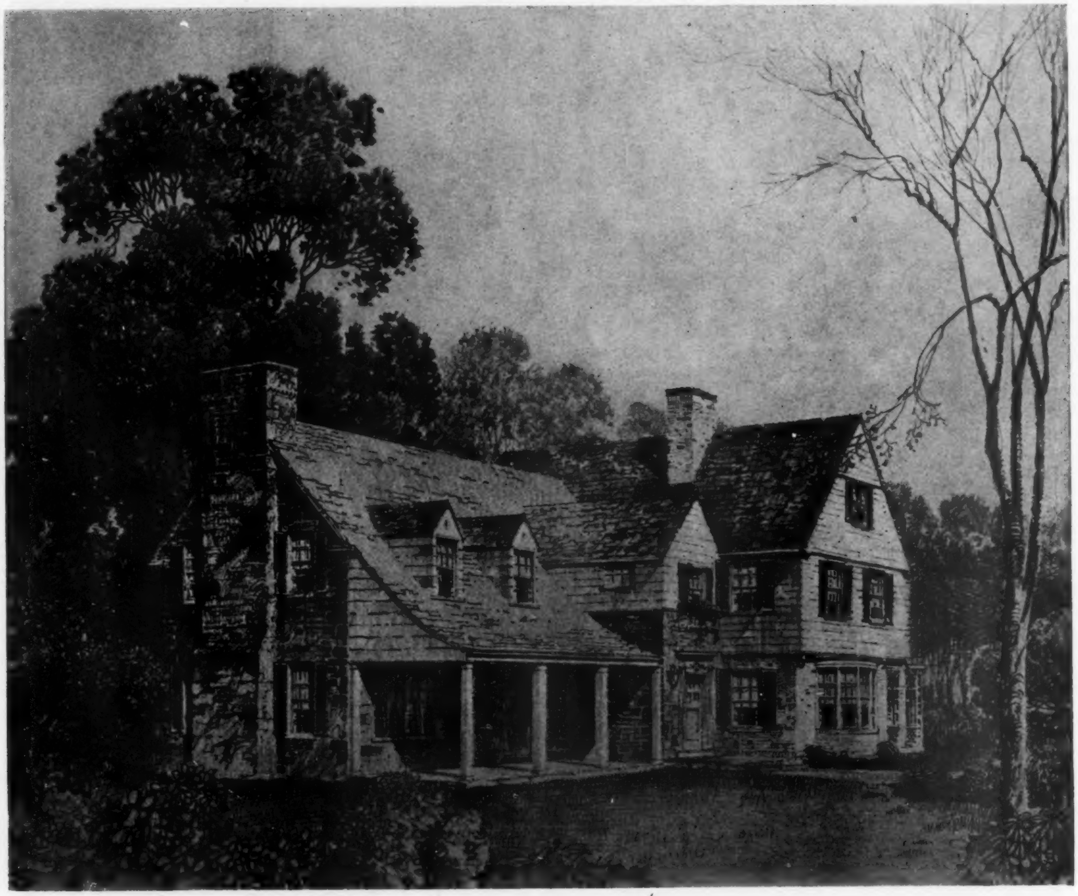
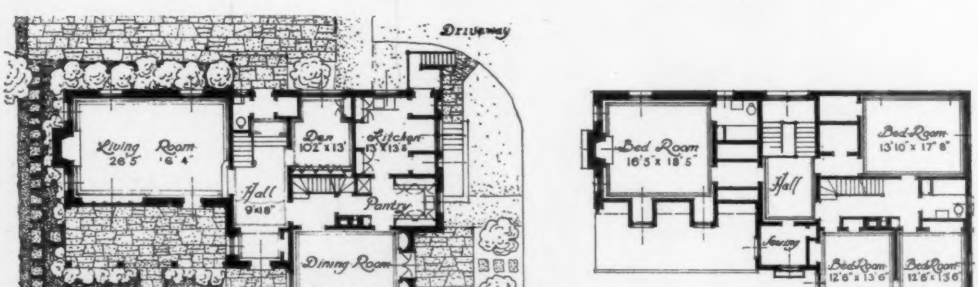


HOUSE OF ARTHUR B. HEATON

SPRING VALLEY, D. C.

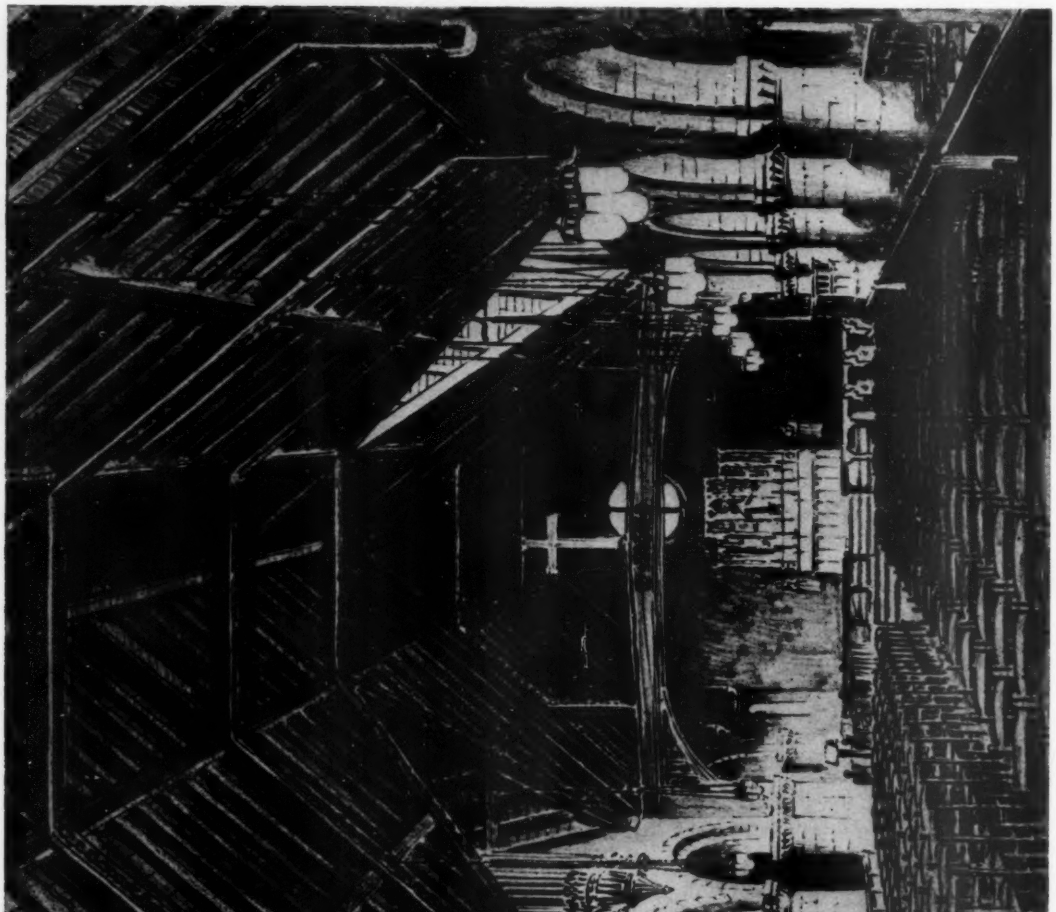
Arthur B. Heaton, Architect



PROPOSED DEVELOPMENT OF KENT SCHOOL
Kent, Conn.

ARTHUR L. HARMON, ROGER H. BULLARD, Associated Architects

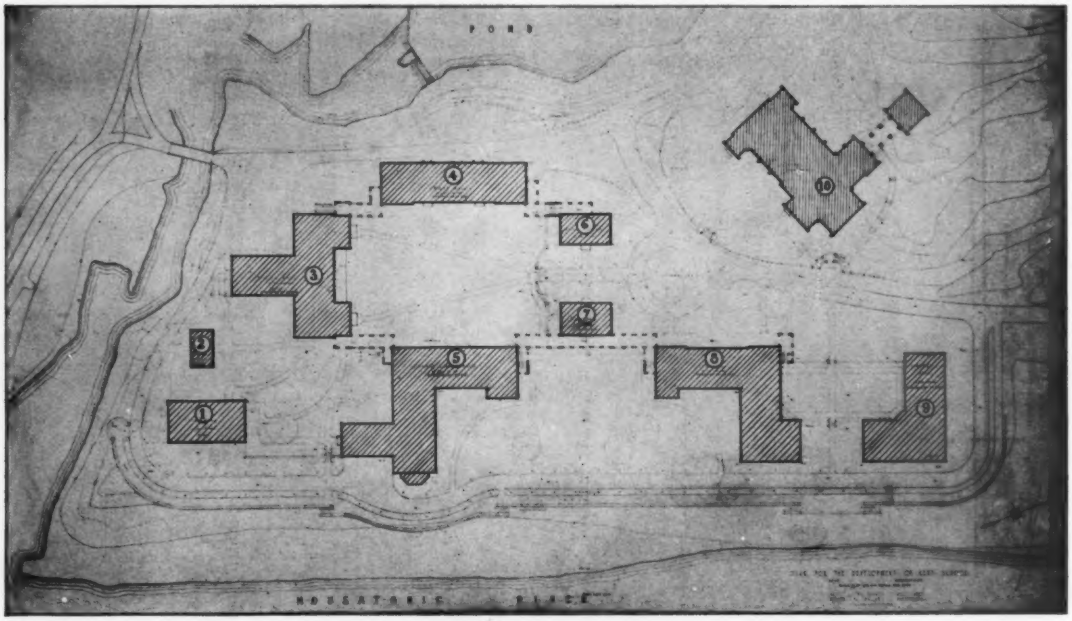
The building site of the Kent School is on a peninsula formed by the Housatonic River on the easterly side and the mill pond and dam on the west and south. The limitation of the space for a group of buildings is such that they have been arranged so as to take advantage of the existing conditions and also so as to interfere as little as possible with the functioning of the school during the construction of the various units. Three of the buildings shown in the model are existing buildings, all of which are of brick with slate roof and semi-fireproof. These are of simple New England Colonial design, the general character of which is to be carried out in the future school group. The Chapel, which is located at the base of the hill toward the north, and which is slightly removed from the main school group, is of local field stone of a Norman character. The bell tower located on the natural rock base is connected with the Chapel by a Cloister of three bays which ascends in steps to the base of the tower. The entire group is intended to be of fireproof construction. The retaining walls and base of the buildings, where the level is one story below the level of the school yard, is of field stone. The roofs are of slate, gambrel roofs having been adopted for the main building. Most of the units are inter-communicating by means of arcades. The future gymnasium will be located near the athletic field, north of the group.



INTERIOR OF PROPOSED CHAPEL, KENT SCHOOL, KENT, CONN.—ARTHUR LOOMIS HARMON, ROGER H. BULLARD, ASSOCIATED ARCHITECTS

From the drawing by Schell Lewis

PROPOSED CHAPEL, KENT SCHOOL, KENT, CONN.—ARTHUR LOOMIS HARMON, ROGER H. BULLARD, ASSOCIATED ARCHITECTS
From the drawing by Schell Lewis

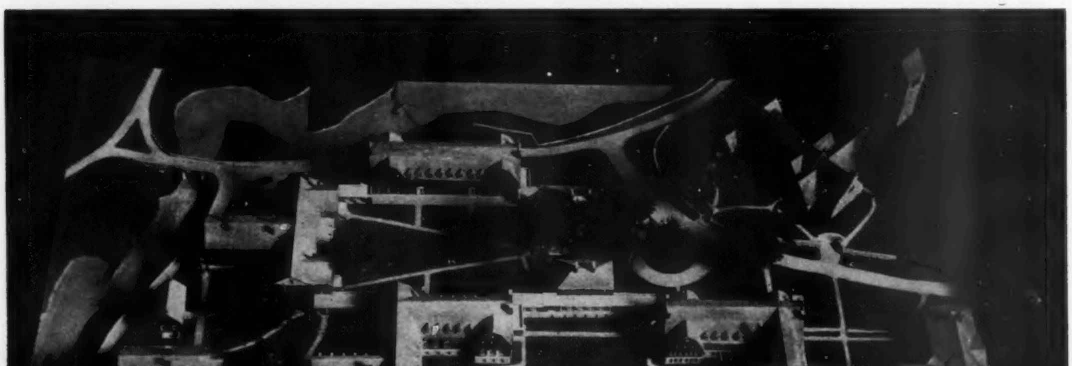


PLAN FOR THE DEVELOPMENT OF KENT SCHOOL, KENT, CONN.

ARTHUR LOOMIS HARMON, ROGER H. BULLARD, ASSOCIATED ARCHITECTS

EXISTING BUILDINGS: 1. INFIRMARY; 2. RESIDENT DOCTOR'S HOUSE; 3. SOUTH HALL (DINING HALL). PROPOSED BUILDINGS: 4. WEST HALL (DORMITORY); 5. EAST HALL (LIBRARY AND AUDITORIUM); 6. ALUMNI HOUSE; 7. RECEPTION HOUSE; 8. SCHOOL BUILDING; 9. NORTH HALL (DORMITORY); 10. CHAPEL.

THE PRESENT DINING HALL FORMS THE SOUTH END OF A MAIN SCHOOL YARD OPENING TO THE ROAD BETWEEN TWO LOW BUILDINGS. BUILDINGS NO. 6 AND NO. 7 HOLD THE SCHOOL LIFE DURING THE DAY AND ARE SAID TO RECEIVE THE MAXIMUM SUN AND LIGHT ABOUT A COURT FACING ON THE RIVER.



KENT SCHOOL, KENT, CONN.

BIRDSEYE VIEW OF MODEL, SHOWING EXISTING AND PROPOSED BUILDINGS

ENGINEERING AND CONSTRUCTION

ARCHITECTURAL ACOUSTICS

SOUND ABSORPTION COEFFICIENTS OF MATERIALS*

By PAUL E. SABINE, Ph.D.

Riverbank Laboratories

RESEARCH in architectural acoustics has, in late years, found an ever increasing application in the control of acoustic conditions in auditoriums. The more recent developments in phonographic recording, and reproduction in radio-broadcasting, and finally in the production and exhibition of talking motion pictures, have given to this work a practical importance that is very great. The widespread demand for scientific data upon new materials has attracted an increasing number of investigators into this field. Due partly to the inherent difficulties of sound measurements, and partly to variations in the methods employed, the results of different workers lack the complete unanimity that is desirable. This is true, particularly, with reference to the "sound absorption coefficients" of materials.

The two principal methods for the determination of the absorption coefficient of a material are (1) the Reverberation Method, developed and used by Professor Wallace Sabine, and (2) the Flue or Stationary Wave Method, first devised by H. O. Taylor and used with various modifications at the Bureau of Standards, at the National Physical Laboratory in England, and at the Bell Laboratories. The Reverberation Method is based on the fact that the presence of an absorbing material within a room reduces the time required for sound to decrease to the threshold of audibility after the source of sound ceases. It consists essentially in measuring the duration of the reverberant sound first in an empty highly reverberant room and then with a known area of the absorbent material introduced. If the total absorbing power of the empty room is known, the change in absorption produced by bringing in the test material is easily computed by the reverberation theory, and this total change divided by the area of the absorbent material gives the absorption coefficient. Clearly, if the reverberation theory is essentially correct a coefficient obtained in this way should give a value which may be used in computing the effect of a given area of the material in reducing the reverberation in any room.

The Stationary Wave Method consists in setting up a source of sound at one end of a tube, the other end of which is closed by a small specimen of the material to be tested. The coefficient of absorption of the specimen is computed from measurements of the relative pressure amplitudes at the nodes and antinodes of the stationary wave system set up within the tube. Various means have been employed for these measurements. At the Bell Laboratories the coefficient is computed from measurements by electrical means of a quantity called the "acoustic impedance" of the tube under varying conditions, such, for example, as varying the length of the tube. The Stationary Wave Method has the advantage of being applicable to small samples and of being available for use under ordinary laboratory conditions. There is, however, the question, as yet unanswered by experiment, as to whether the coefficients so obtained can be used in the reverbation equations, since the test conditions differ so widely from the conditions assumed in the reverbation theory. Until such time as this fact shall have been established, the use of coefficients determined by the Stationary Wave Method is a questionable procedure in problems of acoustical correction. Certain it is that, for materials like flexible fiber boards, for example, a large part of whose sound absorbent properties at the lower frequencies particularly is due to inelastic flexure of considerable areas of the material, the small scale tests do not give adequate information. For such materials absorption of sound is, to a certain degree, a matter of construction as well as surface condition.[1]

[1]For details of the Stationary Wave Method, see U. S. Bureau of Standards Sci. Papers No. 506 and 526. Eckhardt & Chrisler, Acoustics of Buildings: Davis & Kaye, *The Bell System Technical Journal*, Vol. VI, No. 1, p.1.

Experiments in the Riverbank Laboratories have shown that there are also hitherto unrecognized factors that affect the values of absorption coefficients as determined by the Reverbation Method. During the ten years of this laboratory's existence investigations as to the effect of these various factors have been made. A detailed account of these researches would exceed the scope of the present article. It is the purpose to present only such of the outstanding facts as may possibly be of interest to architectural readers,[2] together with a table of coefficients of a number of materials all obtained under identical test conditions.

CALIBRATION OF THE SOUND CHAMBER

The values of absorption coefficients obtained by the Reverberation Method will depend upon the value assigned to the "total absorbing power" of the empty room in which the absorption tests are made. If, for example, this assigned value is 10% too high, the computed values of the coefficients obtained by reverberation measurements will be approximately 10% too great. Obviously the determination of the absorbing power of the empty room is a matter of first importance. This determination may be made if one has a source of sound whose acoustical power expressed in units of sound of minimum audible intensity is known. At the outset of the work at the Riverbank Laboratories there was available a set of pipes which had been calibrated for the purpose by Professor Sabine at Harvard, and these pipes were used in determining the absorbing power of the Riverbank Sound Chamber. At the time it was not recognized that the difference in the acuity of hearing between two observers might be a source of appreciable error. Subsequent work on the sensitivity of normal ears, by Kranz, working in this laboratory, and by Fletcher and others at the Bell Laboratories, showed that the absolute sensitivities of normal ears was sufficiently great to leave some uncertainty in the accepted values for the absorbing power of our Sound Chamber. Therefore in 1925 a re-calibration was made using the method originally devised by Professor Sabine of employing sounds of known relative intensities, called by him the Four Organ Pipe experiment. Still later, in 1927, a third calibration was made, using a radio loud-speaker of the electro-dynamic type and assuming that the acoustical power output is proportional to the square of the electrical current input.

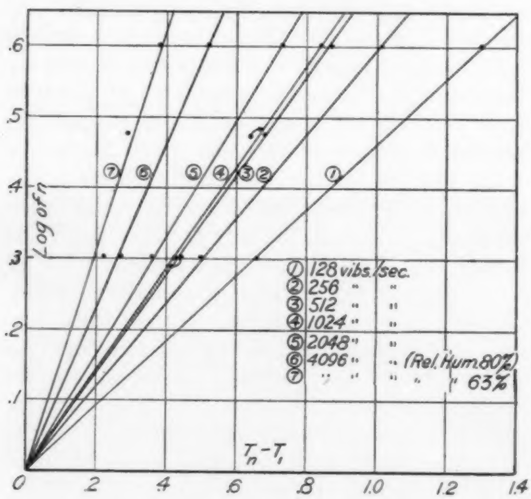


FIG. 1.
VARIATION OF REVERBERATION TIME WITH LOGARITHM OF NUMBER OF ORGAN PIPES PRODUCING THE SOUND.

In Figure 1 the logarithm of the number of pipes speaking simultaneously is plotted against the increase of the reverberation time over the time with a single pipe. The linear relation shown is consistent with the Reverberation Theory, and from the slope of the straight lines the absorbing power of the Sound Chamber, with the Four Organ apparatus in it, can be computed for each frequency. Figure 2 shows the results of similar experiments in which the acoustic power of the loud speaker source is varied by varying the alternating current which drives it. Assuming that the sound energy output of the loud speaker is proportional to the square of the current input, the absorbing power of the Sound Chamber is computed in the same way as with the multiple organ pipe sources. The agreement between the three methods of calibration is sufficiently close at C_4 and C_5 to meet all practical demands for precision of results. The discrepancies at other frequencies are greater than is desirable.

TABLE 1.

Method	Calibrated Pipe	Four Organs	Loud Speaker
Tone	——Absorbing Power (sq. ft.)——		
C_2 (128 vibs. per sec.)	37.0	33.2	43.3
C_3 (256 vibs. per sec.)	39.8	43.3	54.5
C_4 (512 vibs. per sec.)	44.8	48.9	49.0
C_5 (1024 vibs. per sec.)	50.8	53.5	57.0
C_6 (2048 vibs. per sec.)	63.0	63.6	75.5
C_7 (4096 vibs. per sec.)	84.0	90.0	...

Table 1 gives the results of these three independent determinations of the absorbing power

[2]For a fuller account, reference may be made to an article in the *Journal of the Franklin Institute*, March, 1929, "The Measurement of Sound Absorption Coefficients."

of the Sound Chamber in its standard condition. Here the values are expressed in square feet of an ideal perfectly absorbing surface.

As has been stated, the measured value of the absorption coefficient of a material will depend upon the value assigned to the total absorbing power of the empty Sound Chamber. Thus at C_3, for example, from a given set of observations, if the coefficient for a given material were found to be .398, using the figure in the first column as the absorbing power of the empty room, the computed coefficient would be approximately .545 if the value in the third column be taken as the correct figure for the empty room. It is thus easy to see how the values of the absorption coefficients for the same material as determined in two laboratories may differ very markedly as a result of employing different methods of calibrating the Reverberation Chamber. From the commercial point of view, if the choice between two materials for acoustical correction is to be based solely upon their relative sound absorbing efficiencies, it is apparent that the figures used for a comparison should be those obtained under identical test conditions.

As to a choice between the loud speaker and the four organs as a means of calibrating the Reverberation Chamber, it is to be said that the former has the advantage of giving a much wider range of acoustical output. In the present instance, assuming a strictly linear relation between the sound energy generated and the alternating current power supplied, the ratio between the largest and the smallest output used was 360,000 to 1, as compared with a ratio of 4 to 1 with the organ pipes. On the other hand, a variation from strict linearity in this relation, would invalidate the results of this means of calibration. If, in our experiments, the sound energy generated per unit of current were less for large amplitudes of the loud speaker diaphragm than for small amplitudes, this fact would give measured values for the absorbing power of the empty room that are too great. The type of commercial loud-speaker employed in these experiments and ordinarily used for this purpose was not such as to allow an exact experimental determination of this question. In view of this element of uncertainty, with regard to the loud-speaker, and also in view of the fact that the values of most of the absorption coefficients now used in practice were obtained by Professor Sabine from calculations based on a Four Organ calibration of his Reverberation Chamber, the results given in column 2 of Table 1 are taken as the values for the absorbing power of the Riverbank Sound Chamber, pending a fuller investigation of the characteristics of the loud-speaker as a source of sound. The absorbing power of the empty room serves as an "acoustical yard stick" for the measurements of absorption coefficients. Doubtless much of the discrepancy in the results of measurements by different observers results from a lack of agreement in the methods employed in calibrating their "yard sticks."

ABSORPTION MEASUREMENTS USING LOUD-SPEAKER

It next becomes of interest to see whether or not, using the loud-speaker as a source of sound and making the usual assumptions, it is possible to make measurements of the absorption coefficient of a material which are mutually self consistent. The wide range of intensities which can be produced by means of a vacuum tube oscillator and a loud speaker makes it possible to determine in several independent ways the change in absorbing power in the Sound Chamber produced by the introduction of an absorbing area. The first of these, which we shall call Method 1, is to measure the reverberation times for different values of the current actuating the loud speaker first when the absorbent material is in the room, and then with

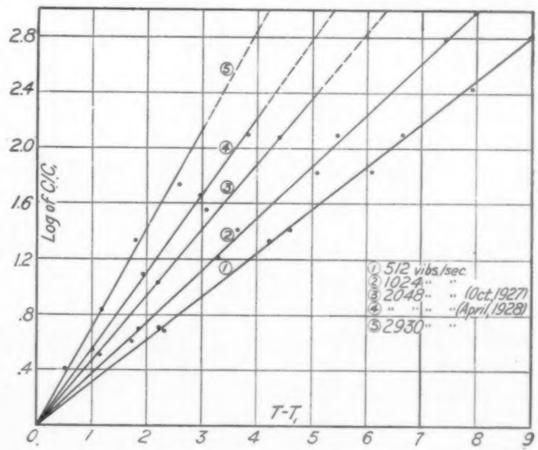


FIG. 2.
SOUND CHAMBER CALIBRATION USING A LOUD SPEAKER. CHANGE OF REBERBERATION TIME IS PROPORTIONAL TO CHANGE IN LOGARITHM OF THE LOUD SPEAKER CURRENT.

the material removed. From the reverberation theory, and the assumption that the acoustic power output is proportional to the square of the current input, it is possible to compute the total absorbing power of the room in both conditions. From the difference the absorption per unit area of the material, the absorption coefficient, is obtained. Method 2 consists in determining the reverberation time with a given fixed current in the loud speaker with the room in the two conditions successively. Assuming equal acoustic outputs in the two conditions for the same electrical current input and, taking the value of total absorbing power for the empty room given in Method 1, we compute the total absorbing power with the absorbent material in, and thence deduce the absorption coefficient. Method 2 can be used at different fixed values of the loud speaker current, so that the two methods taken together afford a considerable body of data for testing the self-consistency of the results obtained. A full account of the experiments here outlined is given in the paper already referred to. In Table 2 are shown the results of experiments conducted using the tone C_4. The column headed a′ gives the absorbing power of the Sound Chamber with the loud speaker apparatus in it; a″ and a‴ give the total absorbing powers after introducing 48 sq. ft. of each of two commercial absorbent materials respectively.

In Figure 3 are plotted the data from which the computations are made. The slopes of the three lines shown are proportional to a′, a″ and a‴, respectively. From the value for a′ thus given, a″ and a‴ can be computed by the Reverbation Theory from the values t′, t″ and t‴ at any given value of the loud-speaker current.

Inspection of the table shows a fairly close agreement between the results obtained with the loud speaker, using Method 1, and the organ pipe, using Method 2. It also shows the interesting fact that the measured value, using Method 2, depends upon the value of the loud speaker current, and hence upon the initial intensity of the reverberant sound. The most obvious interpretation to be placed upon these figures is that the absorption coefficient of a material is a function of the intensity as well as of the pitch of the sound, and that intense sound are absorbed more strongly than are faint sounds. While this conclusion is contrary to the fundamental assumption of the Reverberation Theory, yet it is entirely possible that this is the case, and that in this fact lies another source of discrepancy in the findings of different investigators. If so, Method 1 would be expected to give larger values than Method 2, and the values obtained by Method 2 would depend upon the initial intensity of the test tones. All of which leads to the practical conclusion that until some standardized conditions and method of test are agreed upon by workers in this field, the comparison of the absorbing efficiencies of commercial materials should be based on tests made under identical conditions and by the same method.

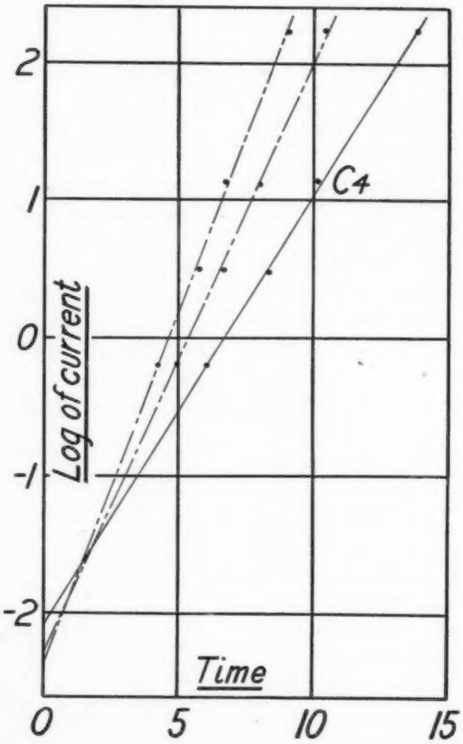


FIG. 3. LOGARITHM OF LOUD-SPEAKER CURRENT PLOTTED AGAINST REVERBERATION TIME, WITH THREE DIFFERENT CONDITIONS OF SOUND CHAMBER

Table 3 gives the values of the absorption coefficients at different frequencies on the more absorbent of the two materials mentioned above

TABLE 2.

	a′	a″	a‴
Method 1	52.0	70.0	84.0
Method 2—165 mil-amps. loud-speaker current	52.0	67.0	78.2
Method 2— 10 mil-amps. loud-speaker current	52.0	65.2	76.6
Method 2— 1 mil-amps. loud-speaker current	52.0	63.6	73.4
Method 2—Organ Pipe	52.0	71.4	83.0

TABLE 3.

Source of Sound	Method	Coefficient C_3	C_4	C_5	C_6
Loud Speaker	1	.44	.68	1.06	.85
Loud Speaker (current 168 m.a.)	2	.28	.58	.79	.70
Loud Speaker (current 1.0 m.a.)	2	.17	.44	.58	.56
Organ Pipes	2	.35	.65	.79	.75

obtained under the different conditions and by the methods indicated.

EFFECT OF AREA OF TEST SAMPLE

The highly reverberant conditions of the Sound Chamber make it possible to measure the change in absorbing power produced by very small areas of absorbent material. Experiments conducted on small samples showed abnormally high absorbing power unit area. In Figure 4 the results of these experiments for tones of different frequencies on samples ranging from 0.2 to 10.0 square meters of 1" standard hair felt are shown. Similar experiments upon the absorption coefficient of an opening showed a coefficient which decreased from 1.10 to .80 as the area of the opening was increased from 3.68 to 30.2 square feet. Computations from data found in Professor Sabine's original notes showed a decrease in the absorption coefficient of an open window from 1.01 to .86 as the size of the opening was increased. Further experiments demonstrated that the absorbing power for long narrow samples was greater than for square samples of equal area, that the absorbing power of a given area was greater when distributed in small portions about the room than when these were placed close together, and that the peripheral portion of a sample was more effective in decreasing reverberation than in its central portion.

All of these facts find a single explanation in the phenomenon of diffraction and in the "screening effect" of an absorbent area upon adjacent areas. A detailed explanation need not be presented here. The sound photographs shown in Figures 5A and 5B illustrate qualitatively this phenomenon of diffraction. A sound pulse incident upon a barrier with an opening is shown by (a). It will be noted that the portion cut out of the reflected wave is appreciably greater than the opening itself, illustrating qualitatively how it is possible for the apparent coefficient of a small sample of absorbent material to be greater than unity, a phenomenon which has been frequently observed. A sound pulse that has passed through a small tube is shown by (b). Emerging from the opening, it is seen to spread into what in the corresponding optical case would be the region of shadow. These photographs suggest why the

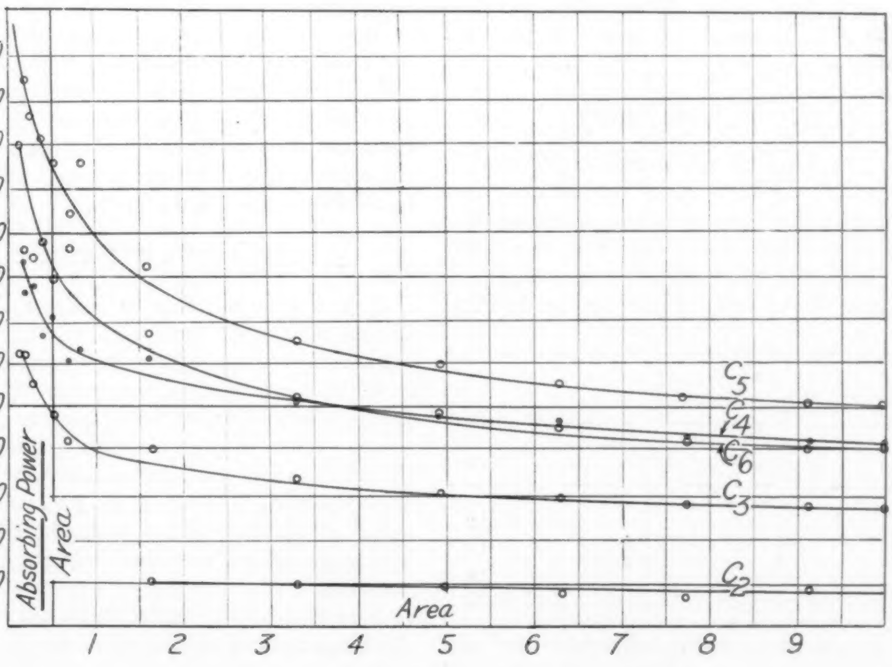


FIG. 4. EFFECT OF AREA OF TEST SAMPLE UPON MEASURED VALUE OF ABSORPTION COEFFICIENT

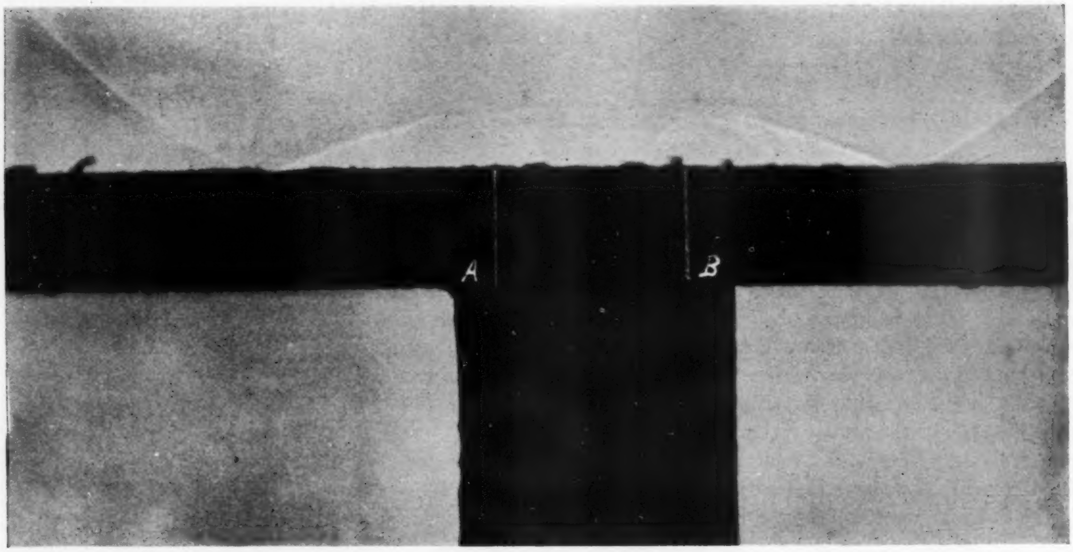


FIG. 5A. SOUND PULSE INCIDENT UPON A BARRIER WITH AN OPENING. A—B MARKS THE EDGES OF THE OPENING. PORTION CUT OUT OF REFLECTED WAVE IS GREATER THAN CROSS-SECTION OF THE OPENING

total absorbing power of a surface whose dimensions are not great in comparison with the wave length of sound is not strictly proportional to the area of that surface, and to explain the effects of size and shape noted above. Here again is illustrated the necessity for specified standard conditions.

EFFECT OF TONE QUALITY

What the physicist calls the "quality of a musical tone" depends upon the number and relative intensity of the harmonic overtones, due to the segmental vibrations of the sounding body. A tone in which these overtones are lacking is called "pure." An open organ pipe has the full series of harmonics with frequencies that are multiples of its fundamental pitch. A "stopped" organ pipe has only the odd numbered harmonics, and in a properly designed pipe these may be very faint in comparison with the fundamental, so that the sound from such a pipe approximates a pure tone. In using the loud speaker an "electrical filter" was inserted in the circuit, so that its tone also was approximately pure. In Table 4 are given the absorption coefficients for five different materials at C_4 (512 vibs. per sec.), using an open diapason pipe, a stopped flute pipe, and the loud speaker as sources of sound. The intensities of the tones from the three sources were practically the same, as measured by the reverberation time in the empty room, so that the difference in the coefficients shown is to be ascribed to the difference in quality.

TABLE 4.
(Coefficients at 512 vibs. per sec.)

Sample	Open Diapason	Stopped Flute	Loud Speaker
1.	.36	.24	...
2.	.43	.31	.31
3.	.18	.11	...
4.	.19	.13	...
5.	.63	.53	.54

COEFFICIENTS OF MATERIALS

The foregoing serves to indicate the various factors that affect the value of the absorption coefficients measured by the Reverberation Method, as well as to suggest an explanation of the divergence in the findings of different investigators. Up to the present, standard methods and conditions of test have not been agreed upon, with the result that there is a degree of uncertainty in the minds of many architects as to the reliability of figures quoted on commercial materials. In this situation it is essential that a comparison of the relative efficiencies of materials should be made on the basis of tests conducted under identical conditions.

During the last ten years many tests of materials have been made in this laboratory both for manufacturers and for our own information. The conditions of these tests have been kept con-

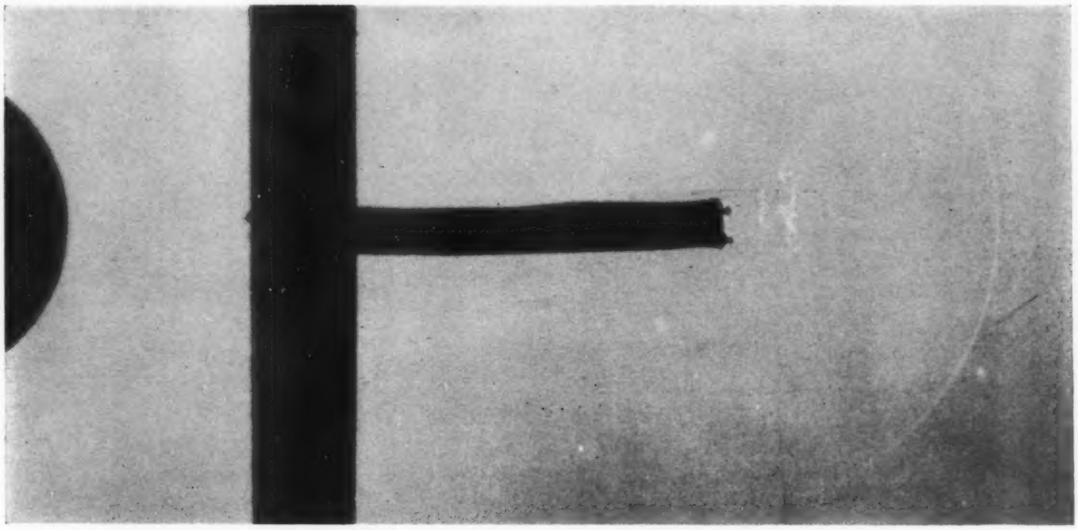


FIG. 5B. SOUND PULSE EMERGING FROM AN OPENING. NOTE THAT THE PULSE EXTENDS BEYOND THE PROJECTION OF THE OPENING. THE AREA OF THE WAVE FRONT IS GREATER THAN THE AREA OF THE OPENING

stant and the method used has been that by which the coefficients obtained by Professor Sabine, and now widely used in practice, were obtained. The test conditions may be summarized as follows:

1. Volume of Sound Chamber 10,000 cu. ft.
2. Absorbing power of empty room determined by Four Organ Calibration.
3. Sound sources—open diapason organ pipes speaking at 4-inch pressure.
4. Test samples 6 x 8 feet.
5. The power of the pipes and the initial intensities of the tones are approximately as follows:

	Tone Frequency C_2 128	C_3 256	C_4 512	C_5 1024	C_6 2048	C_7 4096
Power, ergs per sec.	20,000	5,000	4,500	10,000	1,500	1,000
Initial Intensity / Threshold Intensity	10^6	4×10^7	2.7×10^8	1.8×10^8	3.8×10^7	12×10^6

The precise values of the ratios of initial intensities to threshold intensity are of course functions of the absorbing power of the room and the acuity of hearing of the observer. The figures give the order of magnitude of the initial intensity of the test tones used, measured in terms of the threshold of audibility.

In Table 5 are given the coefficients of various materials that have been measured under the above test conditions. Many of these tests have been made for the manufacturers, and grateful acknowledgment is made in each case for permission to include these figures in the present table. It should be remembered that slight variation in the physical properties may cause considerable variation in the absorption coefficients. In some cases it is not possible to specify these properties with exactness. For example, slight variations in the thickness of felt materials will cause an appreciable difference in the coefficients over the range 256-1024 vibs. per sec. A tolerance of ± 3 per cent. of the values given is allowable. This degree of precision is quite ample for practical purposes of acoustical correction.

It should be borne in mind that the assumptions made in these measurements are those generally made in the application of the Reverberation Theory to the acoustic properties of rooms. Specifically stated they are as follows:

1. It is assumed that E, the acoustic energy generated per second at the source is constant and is not influenced by the reaction of the standing wave system in the room.

2. In the steady state, the sound energy in the room is uniformly distributed in space, and is diffuse as regards direction of propagation. This assumption ignores the inequalities of energy distribution due to interference.

3. The level of the steady state intensity is that at which the rate of emission of acoustic energy from the source is equal to the rate of absorption

TABLE 5.

Material	Pitch 128	256	512	1024	2048	4096
	Coefficient					
1. Acousti-Celotex, Type A, perforated fiber board, 13/16" thick, 441 holes per sq. ft., 3/16" diameter ½" deep, plain side exposed.		.20	.21	.19	.17	.24
2. Acousti-Celotex, Type B. Same as Type A, but with perforations exposed.		.27	.40	.46	.42	.42
3. Acousti-Celotex, Type BB, 1¼" thick, 441 holes per sq. ft. 3/16" diameter 1⅛" deep.		.39	.63	.73	.55	.46
4. Acousti-Celotex (tested 1924) 1"' thick, 400 holes per sq. ft. ¾" deep.		.32	.46	.66	.53	.47
5. Akoustolith Tile, ⅞' thick, fine texture cemented to clay tile.	.06	.22	.28	.48	.50	.31
6. Balsam Wool, soft wood fiber, paper backing, scrim facing, 1" thick .254 pounds/sq. ft.	.10	.27	.50	.68	.56	.48
7. Same covered with perforated metal cover, 1/16" holes, 64 per sq. in.	.09	.25	.48	.66	.57	.47
8. Standard Celotex 7/16" thick, on 1" furring.		.16	.22	.20	.16	.15
9. The same on 2x4" studs.	.19	.14	.13	.14	.14	.16
10. Draperies, hung straight, in contact with wall, cotton fabric, 10 oz. per sq. yd.	.03	.04	.11	.17	.24	.35
11. The same, cotton fabric 14 oz. per sq. yd.	.04	.07	.13	.22	.32	.35
12. The same, velour, 18 oz./sq. yd.	.05	.12	.35	.45	.38	.36
13. The same as No. 12, hung 4" from wall.	.06	.27	.44	.50	.40	.35
14. The same as No. 12 hung 8" from wall.	.08	.29	.44	.50	.40	.35
15. Cotton fabric 14 oz./sq. yd. draped to ⅞ its area.	.03	.12	.15	.27	.37	.42
16. The same as No. 15, draped to ¾ area.	.04	.23	.40	.57	.53	.40
17. Same as No. 15 draped to ½ area.	.07	.31	.49	.81	.66	.54
18. Felt, Standard 1", all hair.	.09	.34	.55	.66	.52	.39
19. Felt Asbestos-Akoustikos (hair and asbestos fiber) ½" thick.	.07	.14	.31	.51	.51	.43
20. The same ¾" thick.	.08	.23	.45	.65	.56	.46
21. The same 1" thick.	.11	.31	.59	.68	.58	.46
22. The same 1½" thick.	.13	.41	.73	.73	.58	.46
23. The same 2" thick.	.21	.46	.79	.75	.58	.46
24. The same 3" thick.	.33	.56	.79	.77	.58	.46
25. Flax-linum, semi-stiff flax fiber board ½" thick.	.09	.15	.34	.57	.51	.47
26. Masonite Standard ½" board (pressed wood fiber), laid on 1" furring 18" O. C.	.09	.30	.33	.32	.30	.37
27. The same nailed to 2x4" studs, 16" O. C.	.16	.26	.34	.36	.30	.25
28. The same, nailed to 1x2" furring 16" O. C.	.15	.26	.31	.32	.30	.28
29. 1" Nashkote AAX, 1" Felt, with cotton fabric cemented on surface two coats special paint.	.11	.25	.34	.46	.48	.36
30. Nashkote B-332, 1" felt with perforated oil-cloth, 3/32" perforation, 10 per sq. in.	.11	.31	.67	.81	.64	.50
31. Plaster, gypsum on wood lath on wood studs, rough finish.	.016	.032	.039	.050	.030	.028
32. The same, with smooth finish ("lime putty").	.020	.022	.032	.039	.039	.028
33. Plaster, lime on wood lath on wood studs, rough finish.	.027	.046	.060	.085	.043	.056
34. The same, smooth finish.	.024	.027	.030	.037	.019	.034
35. Plaster, "Calacoustic" ½" thick.	.06	.10	.14	.15	.15	.20
36. Plaster, Sabinite ½" thick.	.06	.16	.21	.29	.34	.37
37. Plaster, Sabinite (1929)		.22	.28	.34	.32	
38. Stockade slab, wood fiber cemented with Magnesite, 1" thick.	.11	.13	.27	.50	.63	.40
39. The same 2" thick.	.09	.35	.60	.67	.45	.53

at the bounding surfaces.

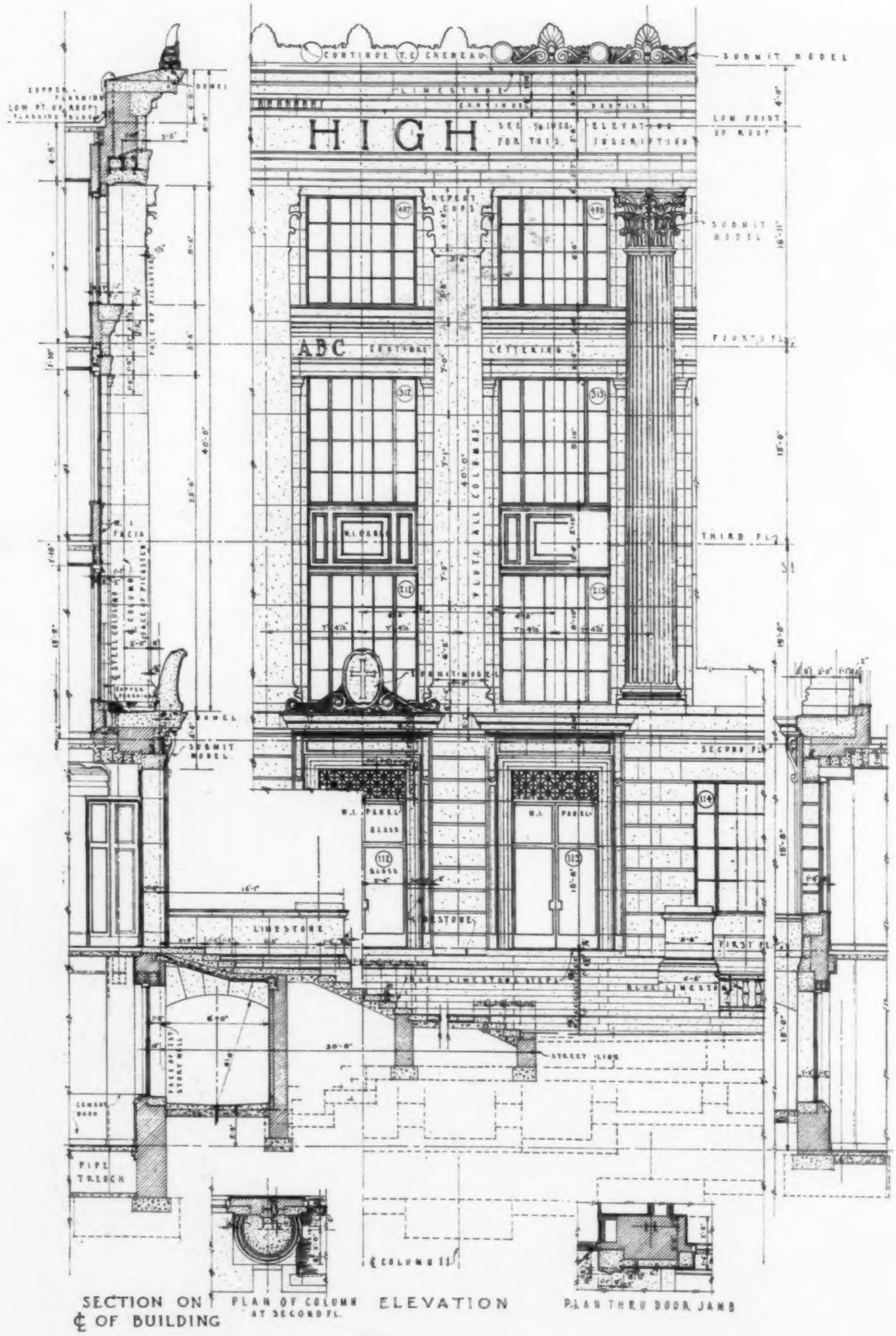
4. The time rate of change of intensity at any instant due to absorption is strictly proportional to the intensity at that instant.

5. At any given surface, a certain fraction of the energy is absorbed at each reflection of sound from that source. This fraction, the absorption coefficient, is constant for a pure tone of given pitch, and is not a function of intensity. It may or may not be a function of the angle of incidence. It is only assumed that as a function of the angle of incidence it has a mean statistical value for sound incident at the random angle of incidence assumed in the theory.

6. The contribution to the total absorbing power of the room by any surface is the product of the area and the absorption coefficient of that surface. This assumes that the actual energy absorbed per unit area is uniform over the entire surface.

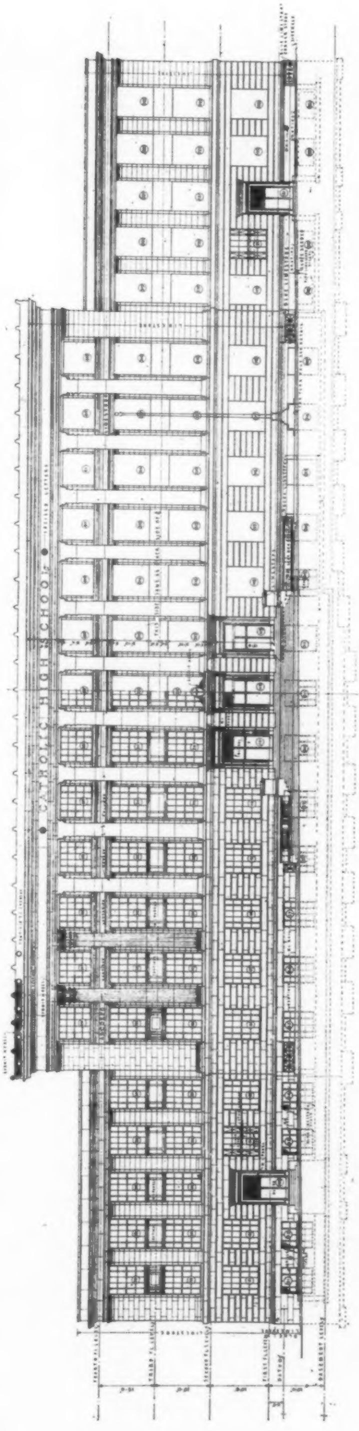
7. The dissipation of sound energy in the atmosphere, due to the viscosity of the air itself, is negligibly small in comparison with the dissipation at the boundaries of the room.

CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.
ROBERT J. REILEY, ARCHITECT

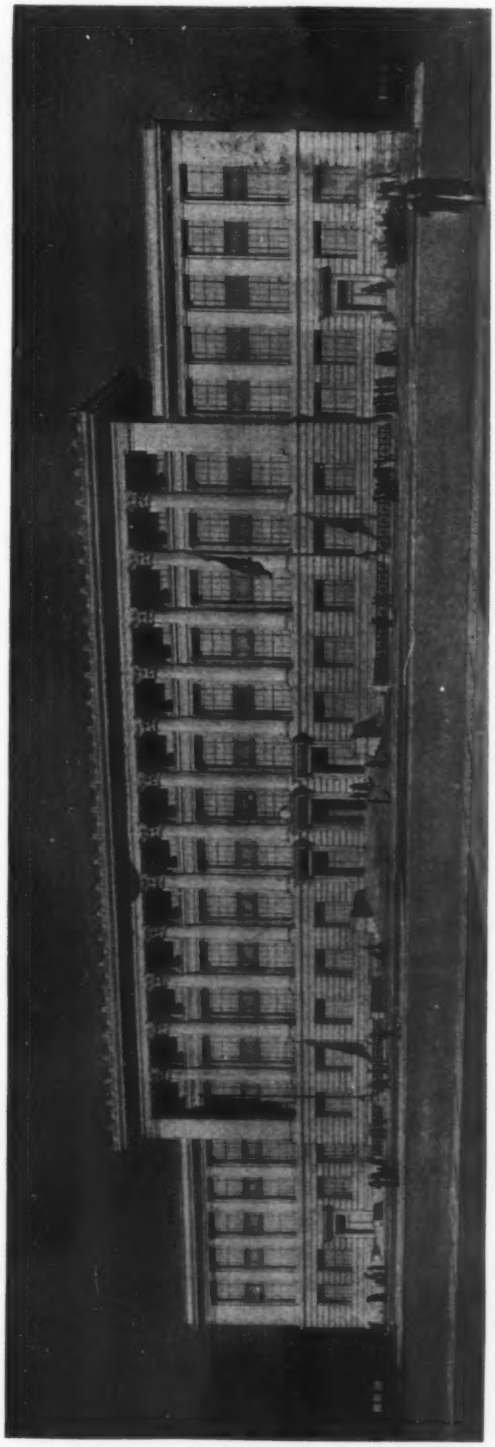


CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.

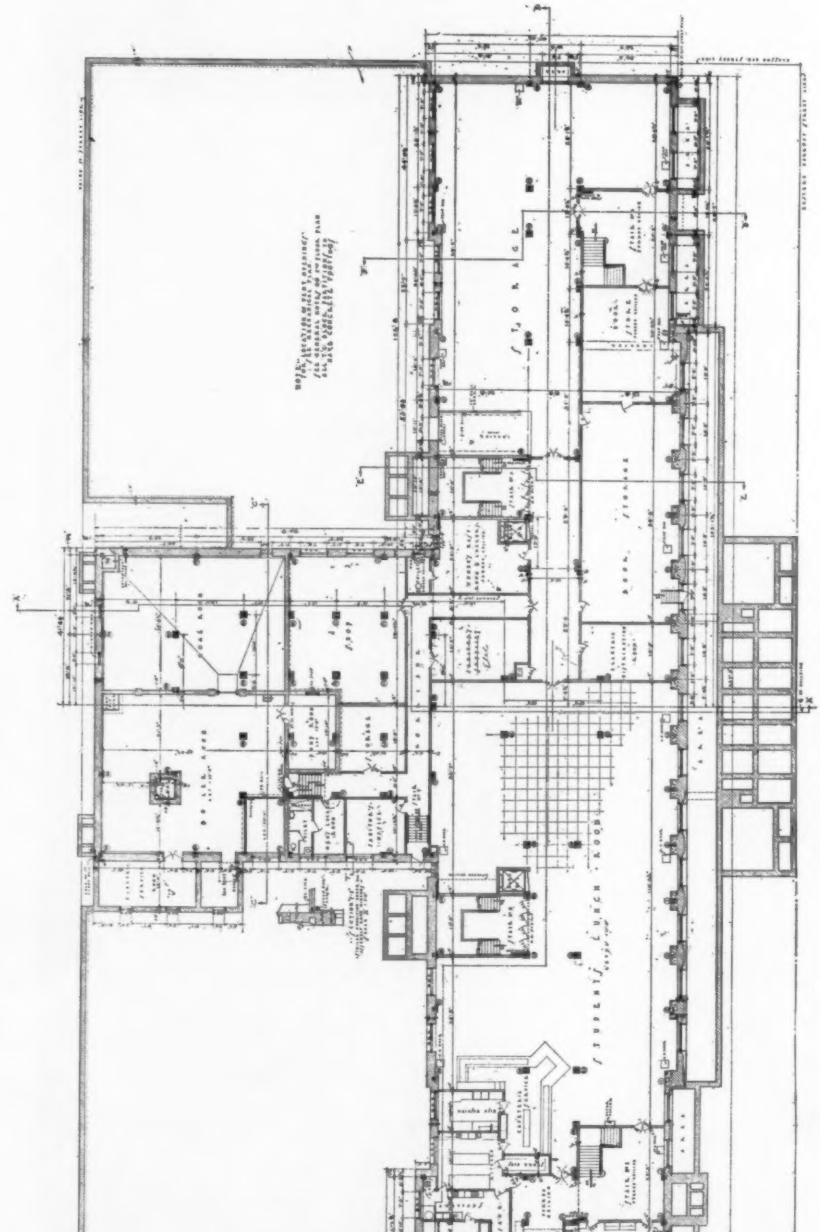
ROBERT J. REILEY, ARCHITECT



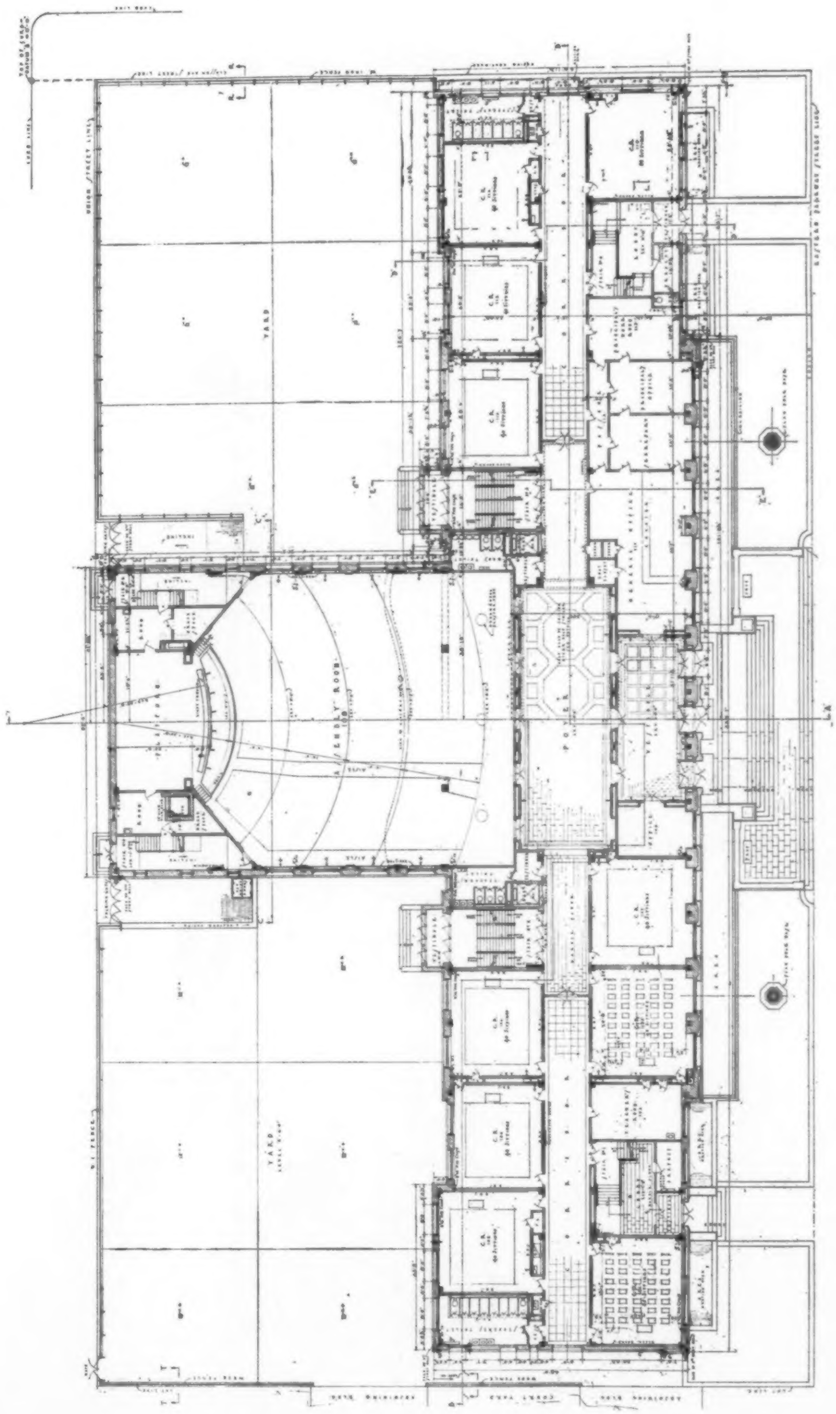
FRONT ELEVATION TO SCALE



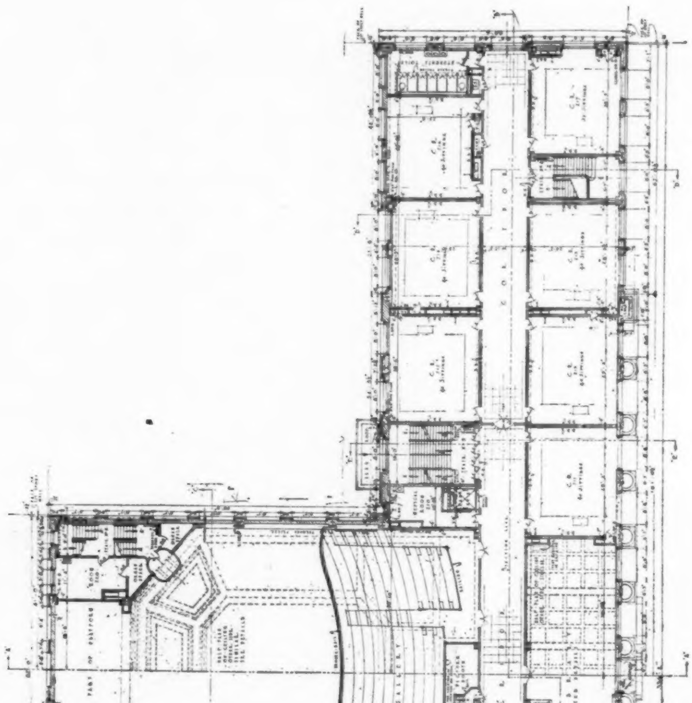
REPRODUCTION OF THE RENDERING BY V. HAGOPIAN
CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.
ROBERT J. REILEY, ARCHITECT



PLAN OF BASEMENT
CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.
ROBERT J. REILEY, ARCHITECT



PLAN OF FIRST FLOOR
CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.
ROBERT J. REILEY, ARCHITECT



PLAN OF SECOND FLOOR
CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.
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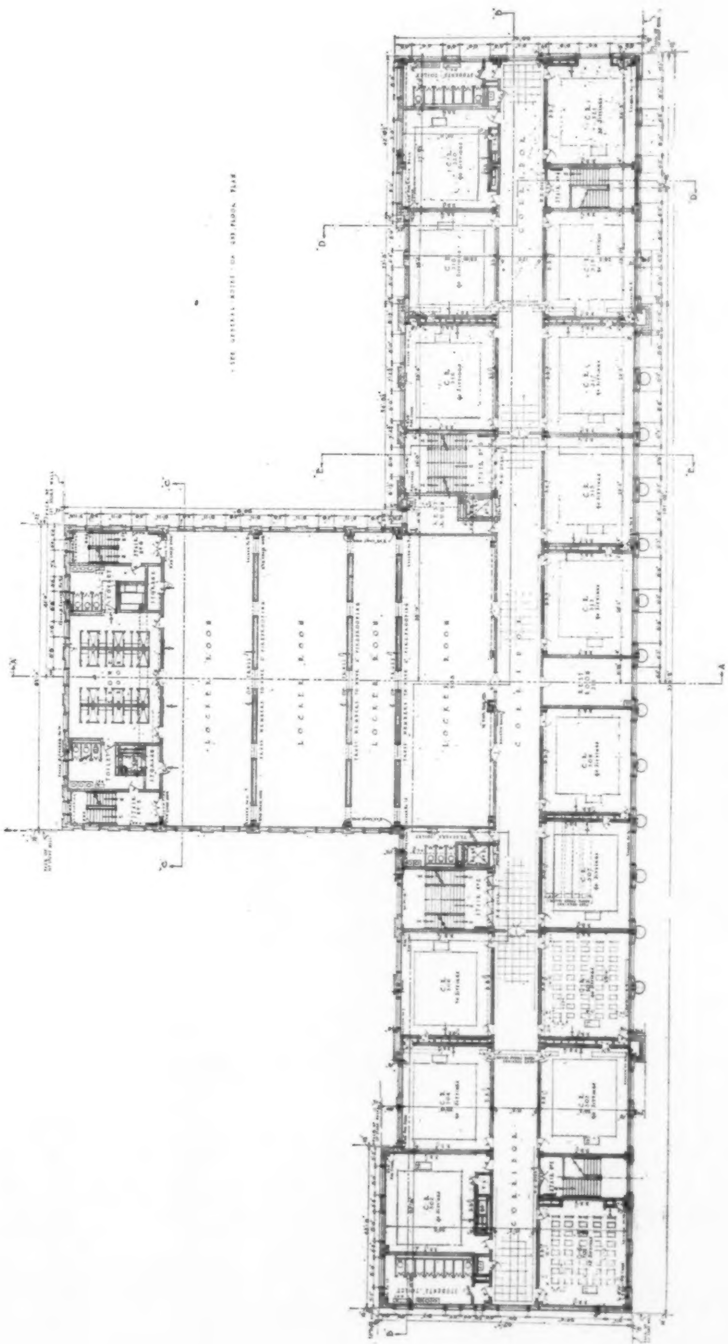

PLAN OF THIRD FLOOR
CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.
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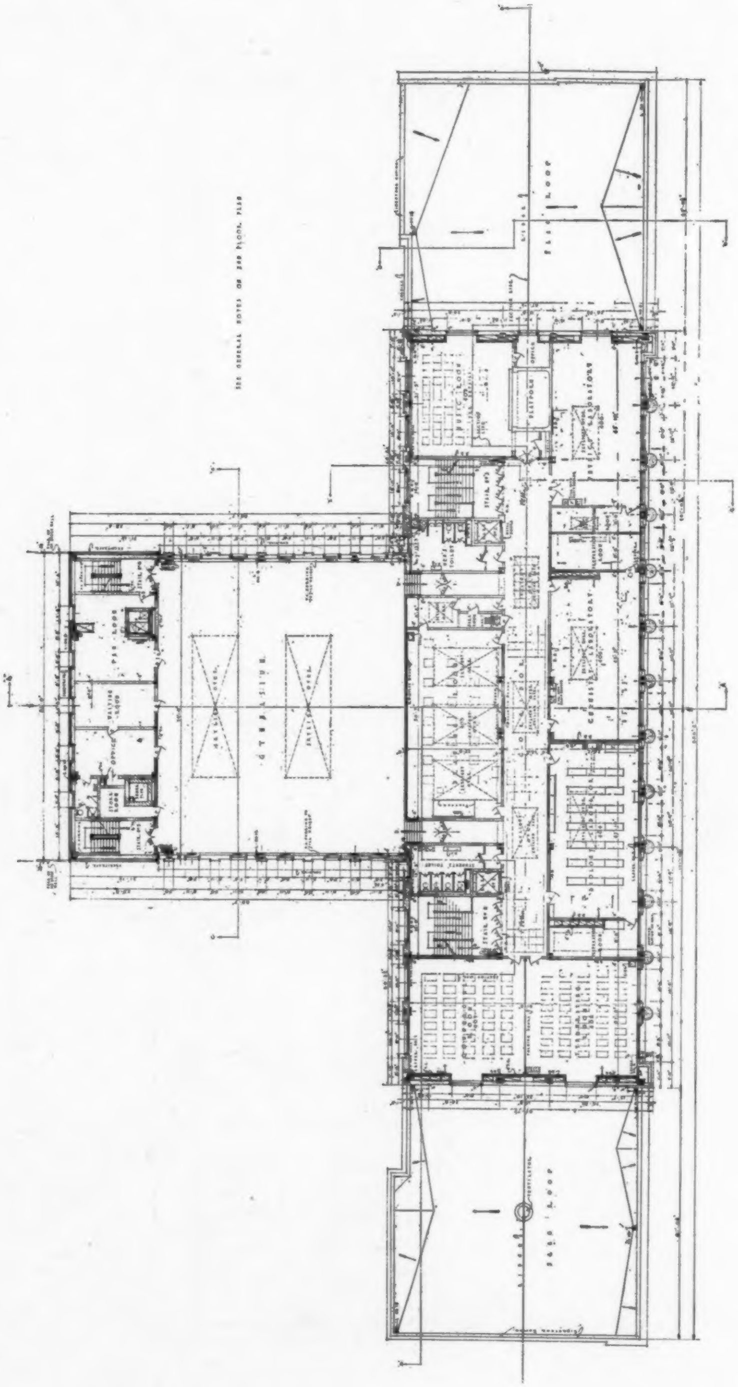

PLAN OF FOURTH FLOOR

CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.

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CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.
ROBERT J. REILEY, ARCHITECT

GYMNASIUM

TYPICAL CLASS ROOM

CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.

ROBERT J. REILEY, ARCHITECT

MAIN CORRIDOR

LIBRARY

CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.

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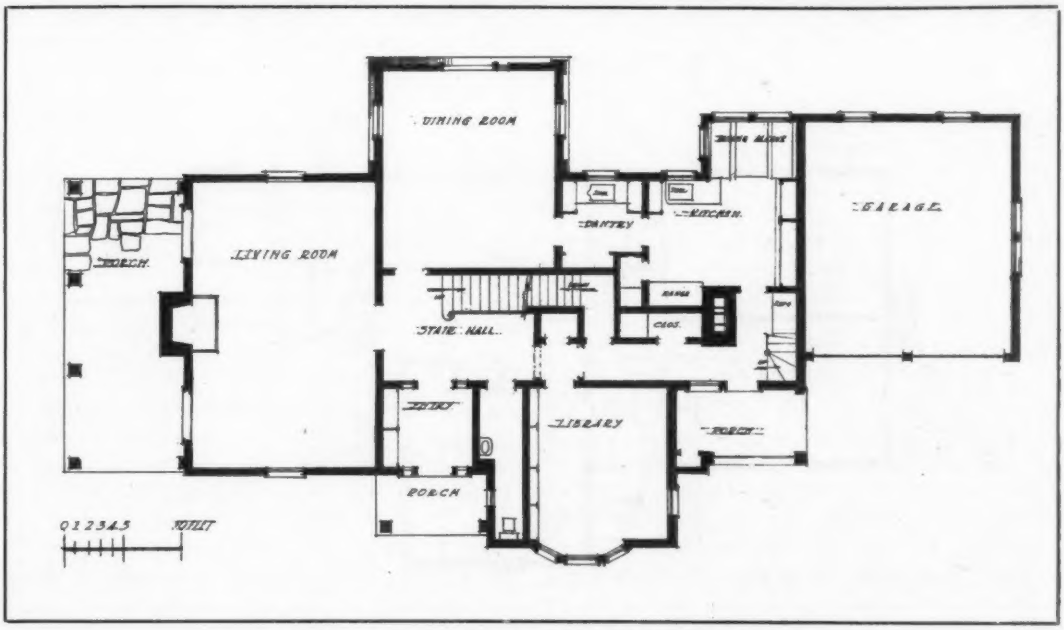
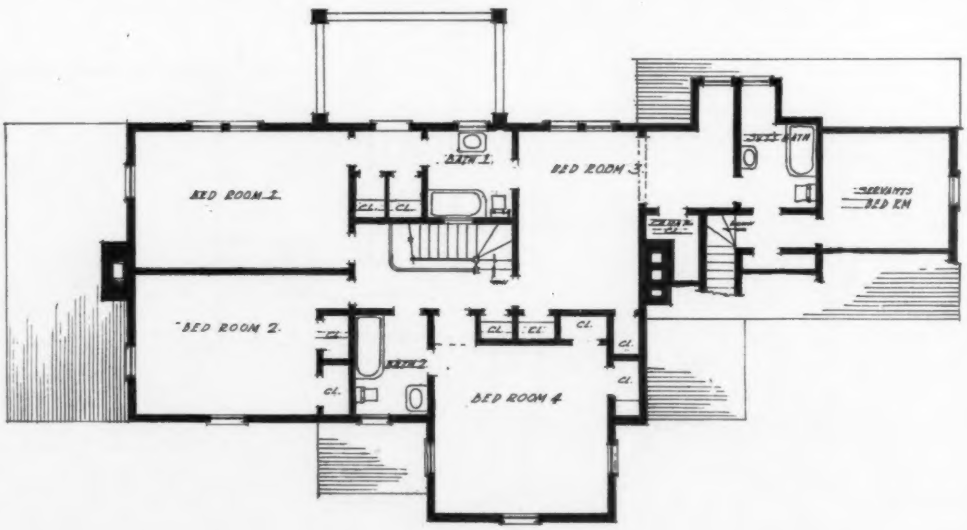
CATHOLIC HIGH SCHOOL, BROOKLYN, N. Y.
ROBERT J. REILEY, ARCHITECT



HOUSE AT CALIFORNIA RIDGE, NEW ROCHELLE, N. Y.

TREANOR & FATIO, ARCHITECTS



HOUSE AT CALIFORNIA RIDGE, NEW ROCHELLE, N. Y.

TREANOR & FATIO, ARCHITECTS

SPECIFICATIONS

Communications relative to specifications addressed to THE AMERICAN ARCHITECT *will be answered, in the pages of this department, by H. R. Dowswell, of the office of Shreve, Lamb & Harmon, Architects.*

IT HAS already been stated that in developing the New York Building Congress Standard Specifications, the Standards Committee have consulted trade associations wherever such authorities were available. The National Terra Cotta Society some years ago issued a very complete specification covering the manufacture and furnishing of Terra Cotta and this has been taken as the basis of the Congress Part B Specification. Additional clauses have been inserted where necessary to make the specification a complete contract document.

Anchors, Dowels, Clamps and Metal Supports have been covered under the "Specifications for Setting Terra Cotta," which will be printed in the next issue. Paragraph 14 of this, the Furnishing Specifications, requires the manufacturer to furnish a schedule of such anchors, et cetera. The difficulty of determining the division under which Anchors should be furnished, has been discussed in a previous issue. The final decision must be made by the Architect.

Many Architects are satisfied to have the manufacturers' staff artists model ornamental work, but occasionally, in order to obtain the desired character, special artists are employed. Paragraph 15 requires the Architect to state, under Part A, who is to execute the models, and if by the manufacturers' modellers Paragraphs 16 and 17 will apply. Paragraphs 18, 19 and 20 have been written to cover special modelling. When special modelling is required a cash allowance covering the cost must be specified under Part A.

The surface finish of Terra Cotta should be specified under Part A using terms given in the National Terra Cotta Society's Glossary of Terms. This is so well known it was considered unnecessary to reprint it with the Specifications.

Architects' drawings before being issued for bidding should be carefully checked to see that requirements for flashing are clearly shown as called for under Paragraph 35. Part A specifications for this division should specify the method of delivery as required by Paragraph 41.

Where Terra Cotta work is extensive or complicated in character, Paragraph 45 provides for special coöperation on the part of the manufacturer. Where this is desired Part A of this division should specify it and include the cost in Part A Specifications for "Setting Terra Cotta."

The Standard Specifications for general construction trades developed by the Standards Committee of the New York Building Congress are now available in printed form and may be obtained by addressing the Congress at 101 Park Avenue, New York City. Bound volumes containing 133 pages of specifications for thirty-three subjects are available at $2.50 per volume. Individual specifications can be purchased separately at the rate of two cents per page. Specifications purchased in quantities of twenty-five or more copies will be sold at a discount of 10 per cent.

Specifications available, number of pages and prices are as follows:

Subject	No. of Pages	Cost Each
1. Demolition	2	$.04
2. Excavating	3	.06
3. Waterproofing by Bituminous Membrane	2	.04
4. Waterproofing by Plastic Coatings	3	.06
5. Masonry and Concrete Materials	4	.08
6. Masonry	4	.08
7. Mass and Reinforced Concrete	8	.16
8. Concrete Arches and Fireproofing	3	.06
9. Structural Steel	4	.08
10. Cement Finish	4	.08
11. Furnishing Granite, Cut Stone, Marble or Manufactured Stone	5	.10
12. Setting Granite, Cut Stone, Marble or Manufactured Stone	3	.06
13. Furnishing Terra Cotta	4	.08
14. Setting Terra Cotta	3	.06
15. Vault Lights	2	.04
16. Mail Chutes	2	.04
17. Caulking	2	.04
18. Metal Window Frames and Sash	4	.08
19. Roofing and Sheet Metal Work	7	.14
20. Carpentry	8	.16
21. Architectural Iron	8	.16
22. Architectural Bronze	3	.06
23. Metal Furring and Lathing	3	.06
24. Plastering	5	.10
25. Interior Marble, Slate and Structural Glass	5	.10
26. Terrazzo and Mosaic	4	.08
27. Tile (Keramic)	5	.10
28. Hollow Metal Work	6	.12
29. Metal Covered Wood	5	.10
30. Glass and Glazing	3	.06
31. Painting	3	.06
32. Window and Door Screens	3	.06
33. Weatherstrips	3	.06

THE AMERICAN ARCHITECT will continue to publish a specification in each issue, accompanied by suggestions regarding their use and through the Specification Department will answer any inquiries in connection with these specifications or discuss the general subject of specification writing.

New York Building Congress Standard Specification for the MANUFACTURE AND FURNISHING OF TERRA COTTA

PART B.

General Conditions.

1. GENERAL CONDITIONS OF THE CONTRACT of the American Institute of Architects, current edition, shall form a part of this Division, together with the special conditions, to which this Contractor is referred. **General Conditions**

Arbitration Clause.

2. Any dispute or claim arising out of or relating to this Contract, or for the breach thereof, shall be settled by arbitration. Arbitration shall proceed under the requirements specified in the General Conditions, current edition, of the American Institute of Architects; or under the Rules of the Arbitration Court of the New York Building Congress, or of the American Arbitration Association, and judgment upon an award may be entered in the court having jurisdiction. One of these methods of arbitration shall be chosen at the time of the signing of the Contract, or, if not then determined, the choice of these methods shall be at the option of the party asking for arbitration. **Arbitration Clause**

Scope.

3. The following requirements in regard to materials and workmanship specify the required standards for the manufacture and furnishing of all Terra Cotta. Portions within quotation marks are reprinted from the "Standard Specification for the Manufacture, Furnishing and Setting of Terra Cotta," adopted by the National Terra Cotta Society, issue of 1923. **Scope**
4. These requirements, however, form a part of the Contract only insofar as they describe items mentioned in Part A of this specification, or as indicated on the Contract drawings.

General Information.

5. "The Terra Cotta manufacturer shall be furnished with all drawings, details and other information necessary for the manufacture of Terra Cotta, including drawings for all classes of work with which the Terra Cotta engages." **General Information**
6. "Wherever Terra Cotta is required to match, in contour, color, finish and surface treatment, existing Terra Cotta, as for example in connection with alterations or additions to existing work, the Terra Cotta manufacturer shall be furnished with the required profiles and samples of the original work and other needed information."

**Manufacture—
Drawings and Schedules.**

7. The manufacturer, before proceeding with the manufacture of any Terra Cotta, shall prepare and submit to the Architect, in duplicate, shop drawings showing construction and jointing and illustrating all of the work in this Division. **Manufacture—Drawings and Schedules**
8. These drawings shall be based upon and follow the Contract drawings, and all scale and full size details prepared by the Architect, consistent with the Contract documents as true developments thereof and reasonably inferable therefrom, except where it is agreed that changes be made.
9. Shop drawings shall show in detail all sizes, the arrangement of joints, the bonding and provisions made, in keeping with standard practice, for anchoring, dowelling and cramping; also for the support by shelf angles, loose lintels or other supports and the provisions made for flashings.
10. The shop drawings shall be modified and revised as may be required by the Architect for the purpose of more perfectly carrying out the intent and meaning of the Architect's drawings and specifications. When these shop drawings have been approved by the Architect, the Terra Cotta manufacturer shall supply the Architect with two additional prints. He shall furnish also, the required number of prints to secure the coöperation of other trades, at the cost of reproduction.
11. The Architect's approval of shop drawings shall not be construed as relieving the Terra Cotta manufacturer from the responsibility for errors of the Terra Cotta manufacturer contained in them.
12. After approval, the shop drawings shall have the setting number of each piece of Terra Cotta shown thereon. These drawings shall then be designated as the setting drawings. The Terra Cotta manufacturer shall provide copies of each setting drawing for the use of the Setting Contractor.

New York Building Congress Standard Specifications—
MANUFACTURE AND FURNISHING OF TERRA COTTA—*Continued.*

13. Each piece of Terra Cotta is to be marked on the back or bed with a number corresponding to that on the setting drawings.
14. "The Terra Cotta manufacturer shall furnish, as promptly as possible, a schedule of all special anchors, hangers, etc. necessary to secure and support the Terra Cotta in a manner approved by the Architect."

Modeling.

15. All ornament, and such other portions so noted on the Contract drawings, shall be carefully modeled by the Terra Cotta manufacturer's artists or by a modeler selected by the Architect, as specified under Part A. **Modeling**
16. When the modeling is executed by the Terra Cotta manufacturer's staff, the work shall be executed to the satisfaction of the Architect. "Photographs, in duplicate, of all ornament shall be submitted to the Architect for his approval or correction, or, if he so desires, he may inspect all modeling at the factory. Such approval by inspection by the Architect shall be made promptly."
17. No modeled work shall be fired until modeling has been approved.
18. When the modeling is executed by a modeler selected by the Architect, he will be paid either directly by the owner or by this Contractor, from the cash allowance noted under Part A. Where such an allowance is specified, this Contractor shall include same in his estimate, and shall expend it as directed by the Architect, any unexpended balance reverting to the Owner.
19. Models to be supplied in this manner shall be indicated by individual number on Contract drawings, and shall be accurately made to a full size shrinkage scale approved by the Terra Cotta manufacturer and shall cover fully each different kind and spacing of ornamental feature on the building so that the Terra Cotta manufacturer may make all his moulds from them without additional modeling. The models shall be subject to the Terra Cotta manufacturer's approval except for character of ornament. They shall be cast in plaster, securely crated, and delivered to the manufacturer at the modeler's studio, at address noted under Part A.
20. The Terra Cotta manufacturer will be required to pay all cartage, shipping and other charges in connection with their transportation to his plant.

Surface Finish, Ceramic Finish and Color.

21. "The surface finish, ceramic finish and color of all exposed surfaces of Terra Cotta shall be as indicated" on the Contract drawings or as specified under Part A. **Surface Finish, Ceramic Finish and Color**
22. Terms used in Part A of this specification shall be interpreted as defined in the "Glossary of Terms Relating to Terra Cotta," published by the National Terra Cotta Society.
23. "The ceramic finish shall be applied to the Terra Cotta in such a manner as to thoroughly coat the exposed surfaces."

Samples.

24. Before any of the work is executed, samples illustrating the finish and color of the Terra Cotta, which the manufacturer binds himself to furnish, shall be submitted to the Architect for approval. **Samples**
25. When approved, a sample will be retained by the Architect for comparison with work on the building.

Design and Structure.

26. "Walls shall not be less than one (1) inch thick and webs shall be of such thickness and so spaced as to perform their proper functions with regard to form and structure." **Design and Structure**
27. "Beds generally shall not be less than four (4) inches deep."
28. "Each piece of Terra Cotta shall be provided with the necessary anchor holes and hand holes and shall be so formed as properly to engage the structure."
29. The Terra Cotta manufacturer shall carefully examine the structural steel or reinforced concrete diagrams for information regarding checking and fitting necessary to make the Terra Cotta clear the structural work or provide for its proper support and anchoring thereto.

Drips.

30. Drips of sufficient width and depth to shed water shall be provided on all projecting courses, cornices, sills and copings where required by the Architect. **Drips**

New York Building Congress Standard Specifications—

MANUFACTURE AND FURNISHING OF TERRA COTTA—*Continued.*

Weep Holes.

31. Weep holes are to be provided where shown on shop drawings. **Weep Holes**

Washes.

32. All projecting courses, cornices, sills, copings and other members with exposed top surfaces shall be formed with a wash. **Washes**

33. Unless otherwise specified under Part A, in all cases where such work is built upon, members having a wash shall be provided with raised seats and lugs.

Lugs and Stools.

34. Unless otherwise specified under Part A, "all capping courses, copings and sills, except of 'slip' type, shall have stools and lugs at intersection with vertical surfaces." **Lugs and Stools**

Preparation for Flashing.

35. "Where so shown the washes of all projecting cornices and other exposed horizontal surfaces shall have provision made for flashing. All surfaces where the wash pitches inward toward the structure and stops against superimposed work, all balcony floors and all gutter grades shall have provision made for flashing." **Preparation for Flashing**

36. "Raggles shall be provided to receive gutter linings and flashings when the joints cannot be used for the purpose. Raggles shall not be less than ¾ inch deep."

Moulded Work.

37. Shall be carefully executed to conform to full size details as provided by the Architect. **Moulded Work**

Columns.

38. All columns shall be formed with the entasis shown on Architect's drawings. **Columns**

Joints.

39. "All joints shall be straight and true and of an approximate uniform width of not less than ¼ inch." **Joints**

40. "All Terra Cotta shall be laid out at the factory and tested for uniformity of joint widths and overall dimensions. Where necessary to secure accurate dimensions and uniform joint widths, the Terra Cotta shall be sized straight and true."

Transportation.

41. All Terra Cotta shall be furnished by the manufacturer either F. O. B. cars factory, with freight allowed to destination or delivered on trucks at the building. Unless the method of delivery is specified under Part A, the manufacturer shall state the method of delivery upon which his proposal is based. **Transportation**

42. "All Terra Cotta shall be carefully packed in hay, straw, excelsior or other suitable material."

Protection of Adjoining Work.

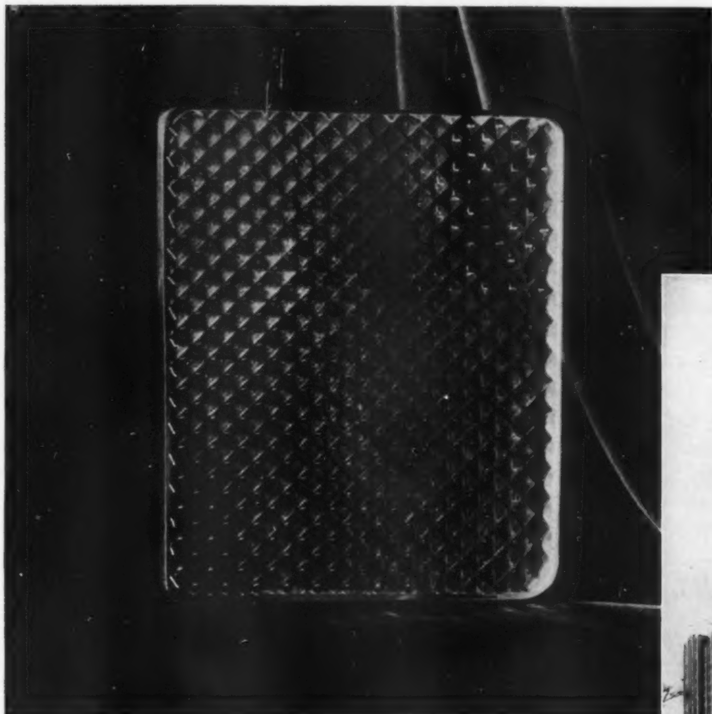
43. This Contractor shall exercise extreme care to protect all adjoining work against rubbing and polishing stones and from splashing with rubbing and polishing materials. This Contractor shall, as a part of his Contract, bear the expense of repairing any damage to the work of other trades, resulting from the execution of work in this Contract. **Protection of Adjoining Work**

Cleaning.

44. This Contractor, at completion of his work, or when so directed by the Architect or General Contractor, shall thoroughly clean all Terrazzo and Mosaic surfaces, cut out and replace all damaged or imperfect surfaces, leaving all work in a workman-like and perfect condition. No oil nor acid shall be used in cleaning down unless permission is given by the Architect. **Cleaning**

Guarantee.

45. This Contractor, as a part of his Contract, shall furnish a written guarantee, warranting all materials and workmanship for a period of one (1) year from date of completion and acceptance, as evidenced by date of final payment and agreeing to cut out and replace, without additional compensation, any and all portions which crack or otherwise prove in any way defective, within the period of the guarantee, except such as may be due to ordinary wear and tear or to expansion or contraction of the building construction or to defects in the foundations which could not have been disclosed by the examination of preparatory work called for under Paragraph 10. **Guarantee**



BOOK REVIEWS

NEW YORK SOCIETY OF ARCHITECTS YEAR BOOK, 1929

THE Eighteenth Edition of the Year Book of the New York Society of Architects is now off the press. This volume is uniform in size and content with those previously issued. Revisions have been made and additional material has been included to bring the Year Book up to date. Copies of the Architects' Registration Law of New York State, Labor Law, Building Zone Resolutions, Board of Standards and Appeals, New York City Building Code and the Tenement House Law are printed in full with all amendments to January 1, 1929. Miscellaneous items of interest and value are included.

The volume conveniently arranged and indexed, contains 480 pages, size 6 x 9 inches.

DOMESTIC ARCHITECTURE OF ENGLAND DURING THE TUDOR PERIOD

A GREAT deal of the domestic architecture of this country suggests the influence of the Tudor period in England. Because the English architecture of this period reflects so definitely the social and economic conditions of the country at that time, we look to it for the finest examples of the application of the fundamental principles on which architectural design is based. Tudor architecture, too, illustrates the work of the craftsman at his best. In those days the craftsman was a designer as well as a skilled workman, and, as a result, in the execution of his work we can readily distinguish the tools with which he worked as well as the material in which his designs took form. Although living conditions have changed radically both in England and in this country since the days of the reign of the Tudor family, the domestic architecture of those days possessed many characteristics which lend themselves to adaptation in the design of our modern houses.

A second edition of a book entitled "The Domestic Architecture of England During the Tudor Period" has just been published. The authors, Thomas Garner and Arthur Stratton, are recognized as authorities on Tudor architecture. The two volumes of the book have been revised and enlarged so that in this new edition there are introduced certain rare examples of the architecture of the period which were not included in the previous edition. The illustrations take the form of photographs, measured drawings and sketches and they are accompanied by text of an historical and descriptive nature. The measured drawings, many of which are full page plates, are especially valuable; details are accurately drawn, enlarged sections are carefully reproduced and ornament is rendered in a particularly appropriate manner. The two volumes of this book are in themselves a library of domestic architecture of the period.

The Domestic Architecture of England During the Tudor Period, by Thomas Garner and Arthur Stratton. New York: Charles Scribner's Sons; London: B. T. Batsford, Ltd. 237 pages of descriptive text and illustrations, and 210 plates; size, 12 x 15½; board covers. Two volumes, $65.00.

BRICK ENGINEERING

IT seems a little curious that technical knowledge of our oldest building materials should be more or less slow in development, or, generally, exist in fragmentary form. Nevertheless it is true, and particularly so of brick. It is therefore timely that a book should be prepared that presents the latest authoritative information on the subject. The author of this volume is Major L. B. Lent, Chief Engineer of the Common Brick Manufacturers' Association of America. Wherever possible, original sources of information have been given to enable the reader to become more fully informed on any individual points of particular interest. The volume is divided into two chapters: Brick—The Building Unit, and Brick Masonry.

The chapter on Brick—The Building Unit contains valuable data on the chemical and physical properties of brick; compressive, tensile and transverse strengths; and other pertinent data. Specifications of the American Society for Testing Materials and the U. S. Government are included.

The chapter on Brick Masonry deals with the various properties of brick laid up as a masonry unit; data on tests conducted by the Bureau of Standards; effect on strength of masonry laid with different types of mortar; thermal resistance, sound resistance and numerous other considerations. Architects and engineers will find this volume of interest and value.

Brick Engineering. Vol. I: Physical Properties of Brick and Brickwork, by Major L. B. Lent. Common Brick Manufacturers' Association of America, Cleveland, Ohio. 92 pages, illustrated, size 5 x 7½.

The texture shown here, produced with a whisk broom, is particularly suited to rooms designed in the modern manner.

TEXTURED FINISHES

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created with white-lead and oil plastic paint

Low-relief wall textures that carry out the spirit of modern interior decoration easily obtained with Dutch Boy white-lead—for years the standard in making exterior and interior paint.

WHAT is the spirit of the interiors you design? Old English? Spanish? Italian? Modern?

In every case you may have textured side wall decoration in keeping by using white-lead and oil plastic paint.

More and more architects are specifying this plastic paint, made with Dutch Boy white-lead, Dutch Boy flatting oil, whiting and drier when they want an interesting modified texture finish. They find this "plastic lead" lends itself to the creation of all kinds of appropriate treatments and gives finishes with the durability and washability that are such outstanding characteristics of lead-and-oil paint.

These advantages . . . White-lead and oil plastic paint is easy to mix, tint, apply and texture. It is mixed of materials the painter carries regularly in his shop—Dutch Boy white-lead, dry whiting, Dutch Boy flatting oil, and drier. It is tinted in the usual way with colors-in-oil. It is applied with a paint brush, remaining workable on the wall for about an hour and thus permitting the handling of large wall areas conveniently. It can be textured with a sponge, paint brush, whisk-broom, graining comb and in many other ways.

Applied today, a "plastic lead" finish is ready for glazing tomorrow. It sets up sufficiently overnight to take a glaze properly. Many beautiful glazed effects are possible. However, glazing is not necessary in order to produce a washable finish with white-lead and oil plastic paint. By itself, this plastic paint can be used to give a complete finish and one which is thoroughly washable.

. . . For further information about white-lead and oil plastic paint and illustrations of various textures, write to our Department of Color Research and Decoration for the booklet, "White-Lead and Oil Plastic Finishes." Address your inquiry to our nearest branch.

· · FORMULA · ·

The formula for white-lead and oil plastic paint is 100 lbs. Dutch Boy white-lead (heavy paste), 22 lbs. dry whiting, 1½ gals. Dutch Boy flatting oil, ¼ pint drier. Break up the whiting with the flatting oil and drier. Stir this mixture into the white-lead. The "plastic lead" is now ready for application.

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Dutch Boy red-lead makes paint that insures complete protection for metal surfaces. Proven beyond question in its ability to lengthen the life of iron and steel, this paint is accepted as the standard. Three coats of paint—made with Dutch Boy red-lead—form a protective coating that eliminates danger from corrosion.

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D U T C H B O Y W H I T E - L E A D

CURRENT NOTES

CREDIT OMISSION

IN the April 5th issue, in the article on the Tulsa Air Terminal, Tulsa, Okla., there was no acknowledgment made of credit due F. Ray Leimkuehler, who designed the Pilots' Quarters—shown on page 435—for the B. Russell Shaw Company, Inc., Airport Engineers. We regret that this occurred through an oversight, and are very glad to give proper credit to Mr. Leimkuehler at this time.

TOUR THROUGH JAPAN AND CHINA

PROFESSOR P. H. ELWOOD, JR., of the Department of Landscape Architecture, Iowa State College, is conducting a landscape study tour through Japan and China in coöperation with Upton Close, author and formerly Professor of Asiatic Culture at the University of Washington.

It is stated that the chief purpose of the trip is to study Oriental gardens and landscape art as well as the architecture and native crafts of Japan and China, "and to glimpse the alluring Philippines and Hawaiian Islands." A special library on shipboard will be available to members of the party and Mr. Close will give daily lectures aboard ship on various phases of Oriental art.

The sailing date is June 24th from Seattle and the return date for the full length itinerary is September 18th at San Francisco. Inquiries for further particulars and reservations are to be addressed to Professor P. H. Elwood, Department of Landscape Architecture, Iowa State College, Ames, Iowa.

ROTCH TRAVELLING SCHOLARSHIP AWARD

THE 44th Rotch Travelling Scholarship was awarded May 7th to Charles St. George Pope. The competition leading up to this award called for a United States Embassy near the Capital of a great South American Republic and was judged by a jury consisting of Albert Kahn, of Detroit, Mich., J. Monroe Hewlett, of New York, and Isidor Richmond, the 38th holder of the Rotch Travelling Scholarship, of Boston. The prize carries with it travel and study during two years in Europe and $1,500 in money per year. There were eleven competitors this year.

AMERICAN SOCIETY FOR TESTING MATERIALS

THE Thirty-second Annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 24-28, 1929. The meetings will be held at the Chalfonte-Haddon Hall Hotel. The reports of various committees will be received. A symposium will be held on physical properties of cast iron and mineral aggregates. Papers on other subjects will also be read. Dr. Saul Dushman will deliver the fourth Marburg lecture, "The Nature of Cohesive Forces in Solids." The third Charles B. Dudley award will be made to J. J. Kanter and L. W. Spring.

HARVARD SUMMER COURSES IN ARCHITECTURE AND LANDSCAPE ARCHITECTURE

THE Harvard University Summer School of Arts and Sciences and of Education announces summer courses in Architecture and Landscape Architecture from July 8th to August 17th, 1929.

The courses offered include Elements of Architectural Form, Elementary Drafting and Landscape Design, Plant Materials, Elementary Landscape Topography and Elementary Freehand Drawing. Definite enrollment for courses must reach the Chairman, School of Architecture, Robinson Hall, Cambridge, Mass., before June 22nd.

SPECIFICATIONS FOR WELDING STEEL BUILDINGS

THE March, 1929, issue of the *General Electric Review* contains "Specifications for Welding Steel Buildings by Electricity," prepared by Frank P. McKibben, Consulting Engineer. The sections of the specifications cover General Application, Definitions, Quality of Materials, Apparatus, Permissible Unit Stresses, Workmanship, Qualification of Welders, Proportion of Parts and Protection of Steel.

Considerable interest has been shown in the question of welded connections in the fabrication of steel framed buildings to replace riveted connections. With the demonstration of the practicability of this method, architects and engineers are then confronted with the manner in which the work should be specified. Mr. McKibben has made a careful study of welding applied to building construction and is well qualified to prepare a definitive specification.

FOUR SUMMERS A YEAR INSTEAD OF FOUR SEASONS

Doctor Johnson said that nobody ever read Robinson Crusoe without wishing it were longer . . . and everybody feels the same way about Summer . . . children dream of its arrival and poets deplore its departure . . . the face of the world is lifted to the sun and the hearts of young and old seem to blossom with the flowers! . . . outdoors, of course, Summer can never be anything but one season out of four . . . but indoors, an American Radiator plant makes life a perpetual Summer . . . keeps the house warm and the family well . . . lightens a woman's cares and a man's expenses . . . preserves health, promotes happiness, and caters to the human longing for continually finer living conditions in the home.

Not expensive . . . in fact . . . not an expense . . . but an investment in family welfare and property improvement.

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This advertisement is one of many that are being published by the American Radiator Company as their contribution to the far-reaching campaign to "bring America back home."

PERSONALS

The address of W. Kenyon Drake, architect, has been changed from Bisbee Building to 21 Ocean Street, Jacksonville, Fla.

Notice has been received from Samuel Glaser, architect, 1508 Terminal Tower, Cleveland, Ohio, saying that he would appreciate receiving catalogues and samples from manufacturers in order to complete his files.

The offices of James Riely Gordan, architect, have been moved from 507 Fifth Avenue to 475 Fifth Avenue, New York City.

Owing to the retirement of Frank J. Helmle, the firm of Helmle, Corbett and Harrison, architects, will be known as Corbett, Harrison and MacMurray. The members of the firm are Harvey Wiley Corbett, Wallace Kirkman Harrison and William Henry MacMurray. The address is 130 West 42nd Street, New York.

Frank H. Wood, formerly of the New York State Education Department, has become associated with Carl W. Clark, architect of Cortland, N. Y., as educational consultant in schoolhouse planning.

The offices of Paul Boucherle, architect, are now located at 301 First National Bank Building, Youngstown, Ohio.

Harvey A. Schwab, Chas. J. Palmgreen and Frederic I. Merrick announce their association for the practice of architecture under the name of Schwab, Palmgreen & Merrick, with offices at 305 Seventh Avenue, Pittsburgh, Pa.

Joseph W. Heiler, architect, is now located at 507 Henry Building, Portland, Ore.

V. G. Iden, Director of Public Relations of the American Institute of Steel Construction, Inc., announces that the new address of the Institute is 200 Madison Avenue, New York.

Norman W. Cook, architect, formerly located at 5657 Magnolia Avenue, announces that his new address is 5842 Wayne Avenue, Chicago.

NATIONAL BETTER HOMES COMPETITION CHANGES CLOSING DATE

CLOSING date of the 1929 National Better Homes Architectural Competition has been advanced to midnight, June 30th, according to a statement just received from The Home Owners Institute.

As a result of advancing the date of closing, it has been possible to add another region, bringing the total to thirteen zones and increasing the prize money to a total of $29,000. This means that there will be three $500 prize awards in each of thirteen regional competitions, a total of thirty-nine prizes aggregating $19,500. These winning designs will be automatically entered in the National Competition for the Grand Prizes of $5,000 $3,000, and $1,500, bringing the total prize money offered to $29,000.

All designs are to be submitted to the local jury of the region in which each contestant has his office or residence. Each competitor will be advised in ample time by the Institute as to the address to which his design is to be forwarded. All winning designs are to be constructed as Master Model Homes. Raymond M. Hood, of New York, is chairman of the Committee on Arrangements and also of the National Jury of Award of this competition.

AGAIN A VAGABOND TOUR

FOLLOWING the successful tour of 1928, the "Vagabond Tour for Architects" will sail June 26th, 1929, for two months abroad. Starting at Plymouth, there will be a private "charavanc" for a week's motoring in rural England. This trail leads north from Exeter, crosses the Cotswolds and Oxfordshire. After a week in London it is planned to visit Paris.

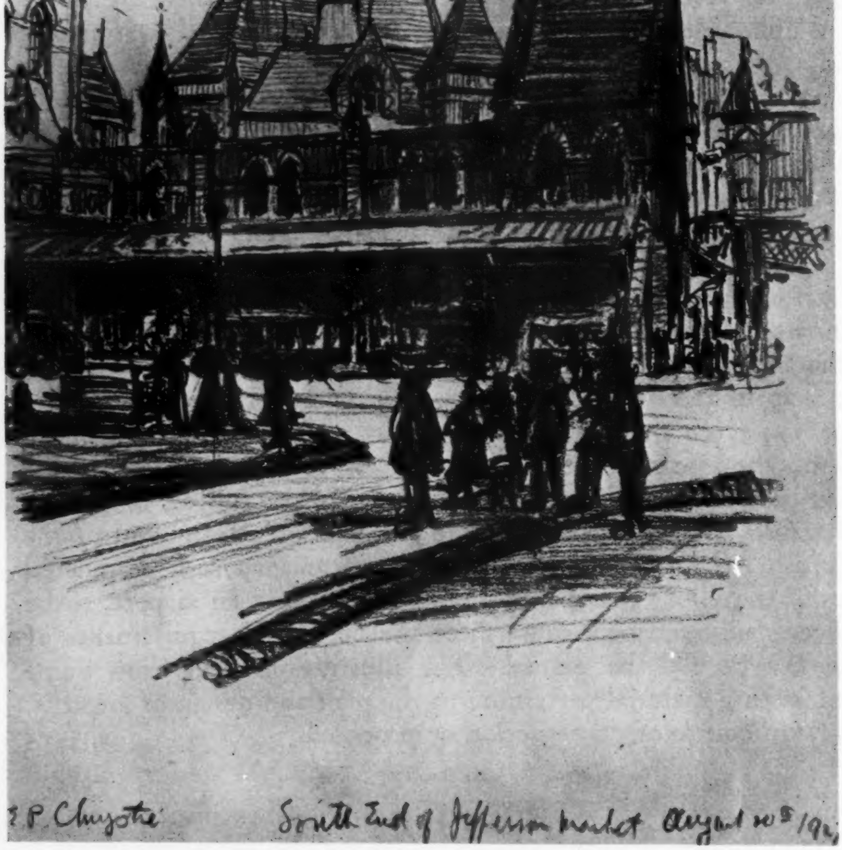
Another motor tour then makes a great circle of Paris, starting in the Loire chateau country, visiting Rouen and far into Burgundy, across Switzerland and the Italian centers as far south as Rome. From Rome to Siena and back to Paris via the Riviera after a stop at Arles and a drive in Provence. Return to New York, August 31st.

It is stated that the "Vagabond Architects" came from all sections of the country last year, and that no crowd ever found happier "camaraderie" or more thoroughly enjoyed their journey.

As before, accommodations will be comfortable but not expensive. Donald B. Kirby again leads the tour and those interested should write him at 180 Fifth Avenue, New York, or the sponsors, the Bureau of University Travel, Newton, Mass.

THE determination of the space required for mechanical equipment used in buildings is often a perplexing problem. Where the size of the equipment is a more or less unknown quantity at the time the sketches or working drawings are made, the difficulties and uncertainties are increased and may ultimately be a serious matter. This condition is perhaps most frequently encountered in connection with the installation of pipe organs. The working drawings are frequently far advanced or completed, and in many cases construction work is completed before a definite decision is made as to the size of the instrument. Arrangements have been made by the editors of THE AMERICAN ARCHITECT for a practical article on the space requirements of pipe organs used in churches and auditoriums. The article will be published in two parts in the issues of July 5th and July 20th. The character of the article is such that we believe our readers will find it helpful and of practical value in providing for adequate space to house the organ equipment. * * * Our readers will no doubt be interested in learning that we are preparing to devote the greater part of the July 20th issue to the subject of airport designs. We have had an article prepared by a lieutenant of the British Air Force in which the plan of an airport is considered from the pilot's viewpoint. It is natural that an airport, to be successfully planned, must meet the needs and requirements of those who fly the planes. The illustrations will show some interesting material pertaining to the plan and design of airports, now in course of construction or proposed.

June 20, 1929 *The Publishers*



JEFFERSON MARKET, NEW YORK CITY

Sketch by E. P. Chrystie