PENCIL POINTS

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Heads vs. "Isms"

By William F. Lamb

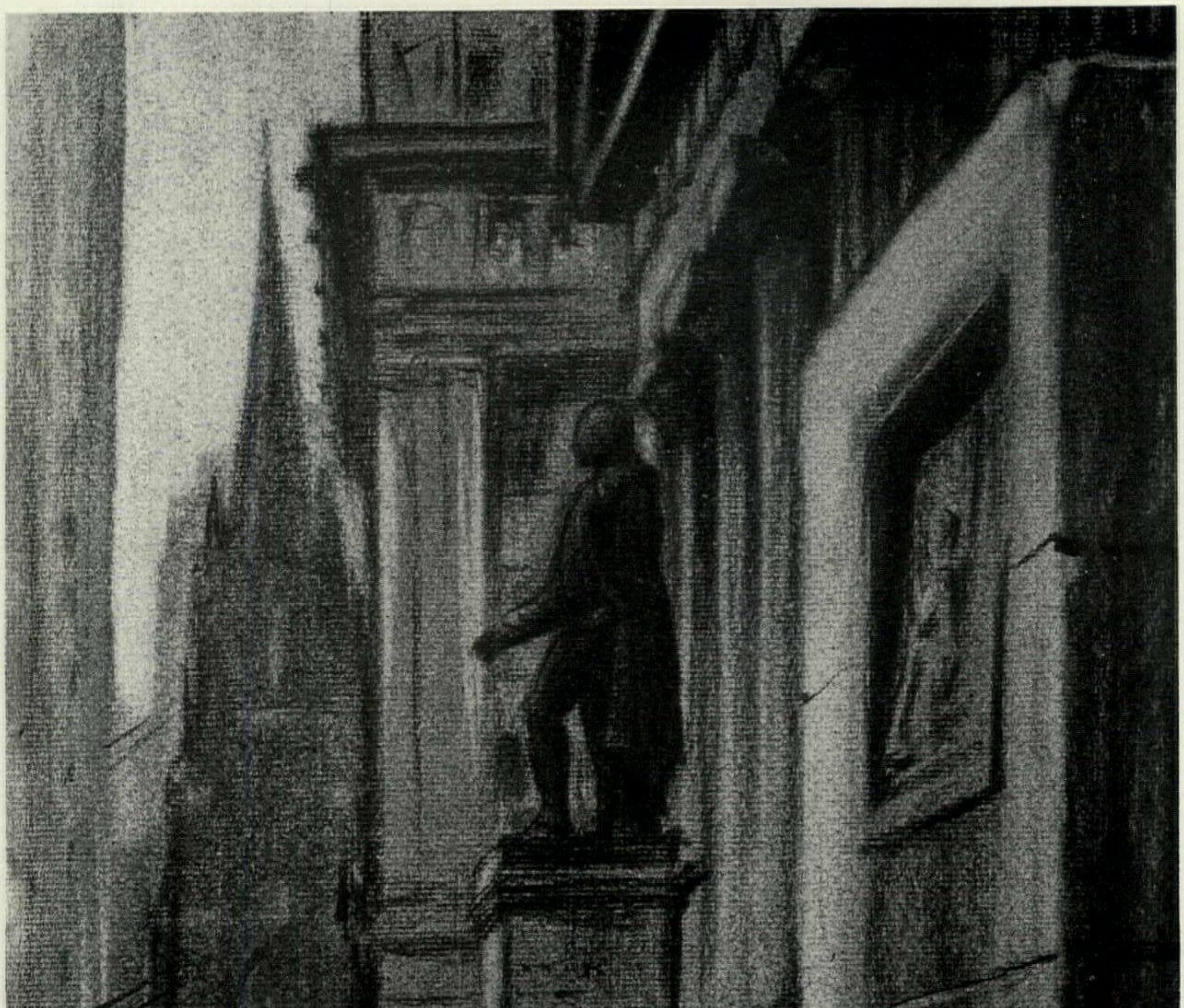
Editor's Note:—*This article, by William F. Lamb of Shreve, Lamb, and Harmon, Architects, New York, is the sixth of a series of articles in which leading architects will discuss the philosophy of contemporary design. Next month's article will be by Dwight James Baum of New York. We recommend that all designers read this entire series.*

There has been so much written on the subject of our "Modern Architecture" that one is hard put to digest all of it. We are told that we must be horizontalists or that we must be verticalists; that we must be "functional," a nice word which had such surprising results that it isn't mentioned any more in polite architectural society; that we must follow the dicta of the Internationalists and eschew anything that even remotely resembles ornament or decoration, and a dozen other things that we must do or not do, as the case may be, in order to become the perfect modernist. I wish they wouldn't make so many rules—Vignolas who are trying to freeze our intelligence with pat formulas for perfect architecture—but instead insist that we use our heads and not follow blindly the latest "ism" that comes from someone's bright idea.

For there still exists, unfortunately, the same old fault for which a few years ago, when we were all feeling our architectural oats, we were criticising the Old Guard. There is this difference, however: the role of the Italian Palace into which we squeezed our apartment house and our office building has been taken over by the Cantilever Front. In these days of depression, and perhaps for some time to come, this criticism may be merely academic. By that I don't mean that there is anything wrong with this much discussed "new" idea of the Hung Façade, but its blind application as the answer to the solution of any problem that may be, makes function fit "functional and ism," and not the other way about. For instance, an office building is, or should be, simply space created for the use of an infinite variety of tenants, each with his own conception of how his own portion should be laid out to produce its most economic use. That means, in the ideal, complete flexibility in the location of all of the various subdivisions which can be created in this space. This is A. B. C. to anyone who has tried to make tenant layouts of any but the simplest kind; it is the first rule in the book of office building design, and, except the very important fundamentals of light and service, is the last. What happens when we execute our Hung-Wall office building? We have a row of columns some five feet or so back from the exterior wall, spaced about twenty feet apart, and the wall is made up of continuous glass sash separated every three or four feet by mullions as narrow as we can make them. The partitions are immediately fixed by two somewhat difficult-to-remove elements of the construction, column and mullion, with the result that the subdivisions are limited to units of three or four feet, and unless your client is sufficiently up-to-date to like a column in the middle of his private office, to a partition somewhere on the line of each column.

This is simply one example; which, to me, makes the point that is so important, that if our new Architecture is to live and grow, as I think it will, it must be kept in good health, not on horizontal quack nostrums nor on vertical pink pills, but on the everlasting search for the fundamental requirements of each problem, housing, factories, office buildings or whatever, and finding the answer to them. We have had too much effort at "6-dollar" housing with tiled baths for the convenient storage of coal or the manufacture of illicit beverages—housing that is so expensive to build with land and erection costs, that the rent has to be twelve dollars to pay the carrying charges, and the poor must still live in the slums because we are not able to invent anything that will answer their particular cry. We have built office buildings that weigh in steel and stone and machinery over *eighteen tons* for every occupant, and which have gone broke by the dozens in the economic storm because they have cost so much to build and to operate. We must learn how the poor work and live, how the rich work and play, how all those in between do some of each, and apply this knowledge to the design and to the economy of our construction before we can lay very much claim to real Modernism that is not simply a new veneer which may be different, but after all often covers the same old mistakes which we have always made.

I was asked to write something about the trend of Modern Architecture, and I haven't, for, as a matter of fact I do not think it is very important just what road it is going to take, as long as we are honest and intelligent and not too self-conscious about directing it. I believe in spite of what I have said about certain aspects of it that it has gotten back on the track again during the past few years and will stay there, but its ultimate destination may never be known until long after we have reached it.



STEPS OF THE SUB-TREASURY BUILDING, NEW YORK—FROM A CHARCOAL DRAWING
BY EDWARD P. CHRYSTIE
Size of original, 11¼" x 15¾"

"Good Buildings"

By Edward D. Pierre

Editor's Note:—*The program outlined below was drawn up by Edward D. Pierre of Pierre and Wright, Indianapolis architects, with the idea of stimulating some sort of a movement on the part of the profession to assume its rightful leadership in the field of home building. It is interesting to note that the recent formation, by a group of Chicago architects, of The Architectural Guild of Small Home Design is a step directly in line with one of Mr. Pierre's suggestions. The carrying out of the author's whole program would require some sort of organization and it is not clear just whose is the responsibility to act as organizer. It is left to existing architectural societies and chapters to consider first, whether the program is worth going ahead with and, second, how to start the ball rolling. The possible benefits are all clearly enumerated.*

The future American City is now in the making. What it shall be and how it shall be built should concern us all. To arouse a national consciousness to a new system is the aim of this program.

Home Building in America. Home building has been in the hands of the amateur and the untrained builder so long that many have accepted this as an established procedure. Many builders have used home building as a game and a racket with the result that our cities are literally jammed with homes of low standards and high depreciation. Many families of culture are living in homes of vulgar design and trashy construction. In short, the public has been taken in and as a result it has lost confidence in the building industry. Before home building can be resumed on a sound basis, the public confidence must be restored and the business of building returned to legitimate channels.

The President's Conference on Home Building and Home Ownership. The possibilities of the President's conference have been so deeply impressed on the hearts and the minds of the American public that it should be carried to a logical conclusion; if it is to be successful its findings must be administered locally by a qualified building industry.

If housing movements are left to heartless exploiters, the effect will be detrimental to the finer sensibilities of the home and the community. The need is for homes that will inspire and not merely for more efficient and colorless commercial houses.

Building is a science and an art that requires the talents and skill of the most qualified artisans. Finer standards of the "qualified" building industry should be our goal for all buildings.

Housing the Nation—Somebody's Business. Housing the nation is somebody's business—somebody's obligation.

When the great Sifter has finished his job and the minister is back in the pulpit and milliners are again making hats and the public realizes that a "good building" is the product of a good architect, a good contractor and good craftsmen using good materials, then, and not until then, will this truly great work begin.

The architectural tastes of the nation should be molded by the qualified architect instead of by the untrained speculative builder. The architect alone is qualified by training and experience to conceive and direct the work. His understanding of the problem will be the nation's protection. He is a planner and the course he will chart will be inspiring and practical.

Architect Should Protect All. The architect should realize that his obligation to society is one of full coverage. Instead of merely serving some of the people all of the time and all of the people some of the time, he should serve all of the people all of the time.

In the past the architect has been most uncharitable. He has sought the favor of the chosen few to the detriment of the best interests of the masses. Housing is not only a problem of sticks and stones but one that involves lives of babies, citizens, families, cities. The small home is the most important phase of architecture and should be cherished as our most sacred treasure.

We must cease thinking of the small home as it affects the profession and adopt a nobler program of service and protection to the nation. We will find that rich benefits will accrue the profession if such a program is carried out.

The architect should be the real custodian of our cities. His efforts should extend to the remotest corners instead of only the desirable sections. If he is to be a master builder he cannot content himself with designing the unit building but should concern himself with the arrangements of these units as they affect each other and a general plan.

The leadership of the architect is challenged. If he is to thrive he must become the architect of cities, not merely the designer of buildings.

Costs Must Be Reduced. The housing requirements of the country have been estimated at 120,000 new houses a year. We have been led to believe by statisticians that architects are employed on twenty-five per cent. of all houses built when actually less than ten per cent. receive the attention of a qualified architect in a strictly professional fashion.

If this is true approximately 98,000 houses do not receive the protective service of the architect. Fifty per cent. of all houses built are in the class of $8,000.00 or under. Of this group one half of the houses have standard requirements and do not require the designing services of the individual architect. In fact, it would be economically wrong to employ a designing architect to design this type of structure. They do, however, require a complete set of working drawings and supervision of the architect if the owner's interest is to be absolutely safeguarded.

The only fashion in which the architect's fee can be reduced to a point where he can be employed is by duplication of the working drawings. It is quite apparent that if a working plan were evolved under which the better class of residence architects would band together as a cooperative firm of architects to service this work, considerable saving of time and effort would be saved and the profits of the young architect would mount.

It is not necessary to duplicate the same design in the same city with the resultant possibility of monotony or loss of individuality. Under this plan the designing of the reproduced house would get the attention of the ablest designers.

A competition of national scope could be employed once a year to secure material for this service. The judging and awards could be made an event of considerable importance. Generous prizes and national honors would attract the most qualified architects.

This event could become one of considerable value in directing the public attention to architecture at least once a year.

Selected designs of a certain price and with other restrictions would be selected for reproduction. The plans would bear the architect's name. These plans would then be available only through qualified architects. One firm of architects would design the house and another firm supervise its construction. This is predicated on the idea that these two architects will see fit to collaborate.

Considerable reduction could be made in the actual construction of these houses due to the intensive study of all crafts to a particular model. The smallest details would get the attention of highly paid technologists. The client would receive the same professional service as he would on a custom house except the design for his home would be duplicated several times. The cost for architectural services would be greatly reduced.

After each competition the material would be assembled into book form and used as a textbook for schools and colleges. It could be used by the prospective client in crystallizing his ideas, thus greatly reducing the cost of preliminary drawings. The competition drawings or photographs would also be reproduced and used as a traveling exhibit of good architecture.

Local agencies would be set up in which changes to plans could be made under the eye of an architect. This would provide work for the unemployed and student draftsmen. It would protect the future of the profession by giving work to those men who now find employment with the speculative builder, thereby creating new competition for the profession. We are very careless with the future of our profession.

The young architect would find means of support under this program that are not available to him now. This is in no way offered as a substitute for those houses requiring the designing ability of an architect, but is offered so good buildings will be available to all.

"Good Buildings"—A Labeled Product of the Building Industry. The product of the building industry should be labeled just as any manufacturer would identify his product. It should have known standards and be the nation's protection against imitations. Rapid obsolescence and depreciation are the shortcomings of the present construction system. A "good buildings" label will offer full protection against the following deteriorating forces:

1. Location—It will protect a "labeled zone" against obsolescence of location. A "labeled zone" is an area that has been investigated and approved and protected by arrangement against deteriorating influences, at least during the life of the mortgage.

2. Design—A building in good taste today will be in good taste throughout the life of the building. It will weather the effects of styles and modes.

3. Construction—Approved systems of construction, craftsmanship, and materials will protect the home against rapid depreciation. A crackless house is a reasonable possibility.

4. Excessive Costs and Maintenance—Research and scientific study of methods and devices will make a material reduction in construction and maintenance costs.

5. Financing—A qualified building will be free of all deteriorating elements and will be attractive as an investment. A long time loan is sounder when the equity exceeds the unpaid portion of the loan. Financing should include all fees and furnishings and equipment.

Once a labeled house is available the public will accept the idea for its own protection.

Under this plan a "good building" is available to all. The intelligent speculative builder will appreciate the opportunity of operating under the plan. He will be permitted to operate under this plan if his product meets its requirements.

New subdivisions and undeveloped areas could be protected under arrangements whereby only labeled houses will be permitted in these areas. This is a distinct protection to the future values of property. The first requisite of this plan is that the real estate have its future reasonably guaranteed.

Many of the older districts bordering on blighted areas could have their future guaranteed against further encroachment. Surely a man should have a right to protect his life savings which he has invested in his home.

Great institutions have been built on the monopoly of an idea. The building industry should create a monopoly for good buildings. The public can be made to realize that there is only one authentic industry and that it offers things that are not available elsewhere.

The inauguration of the plan would be one of international importance. As a suggestion, the President of the United States might be persuaded to go over to Henry Bacon's Lincoln Memorial and place thereon a "good work" stamp. Under the proper direction this ceremony could be made the most important architectural event ever held. At some later time Bertram Goodhue would be similarly honored for his Academy of Science and Research. The press and the movies would not overlook the heart interest that could be found in these ceremonies. The development of a building project of this kind will reveal a "back stage" story of considerable interest to the public.

Sooner or later the word would get to Indianapolis and the political and educational dignitaries of the state might make an award on Paul Cret's Public Library and George Schreiber's Scottish Rite Cathedral and a few others. Each year we would go into secret places and bring out for a public sunning a well designed filling station or an old Georgian home with the original roof on it that withstood for seventy-five years the tempests and whims of several generations. The manufacturers of quality materials would readily see the advantage of encouraging "good buildings" in their advertising.

A New Civic Consciousness. When the populace emerges from its period of reflection it will rub its eyes under a new set of conditions. The average individual has been doing some thinking for himself. He will demand the right to really live instead of to merely exist. He will be more concerned about things that pertain to the welfare of his family, his surroundings, and his city. He has been waiting for the proper leadership to coordinate his effort with his neighbors' in protesting against some of the things that have been happening to his community. He will protest when he sees a fine old thoroughfare going into decay or when he sees his city's streets needlessly strewn with freaks of architecture. Why should he be required to pass daily through a hideous development or one that has fallen into a low tenancy class or disuse? "Public nuisances" will not be tolerated when the citizen realizes he has a right to protest.

A man owning a piece of property will be accountable to the community for its proper upkeep and appearance. Public opinion and a national sense of humor will protect a property owner against the type of citizen who lives in one part of a city and maintains in disrepute a piece of property in another part. Our churches and colleges own considerable of this kind of property.

A "Tear Down or Build Up" program should be instituted in each community. No piece of property will be permitted to fall into the class of nuisances. Any property that has a deteriorating influence on adjoining property should be considered a menace and its owners notified to do something about it. The national ambition should be "Better Cities" instead of "Bigger Cities." Cities should establish a civic yardstick with which to measure their assets and liabilities. A city has a right to excellence and the individual property owner should not be permitted to place his interests ahead of those of the community. Is this not real democracy?

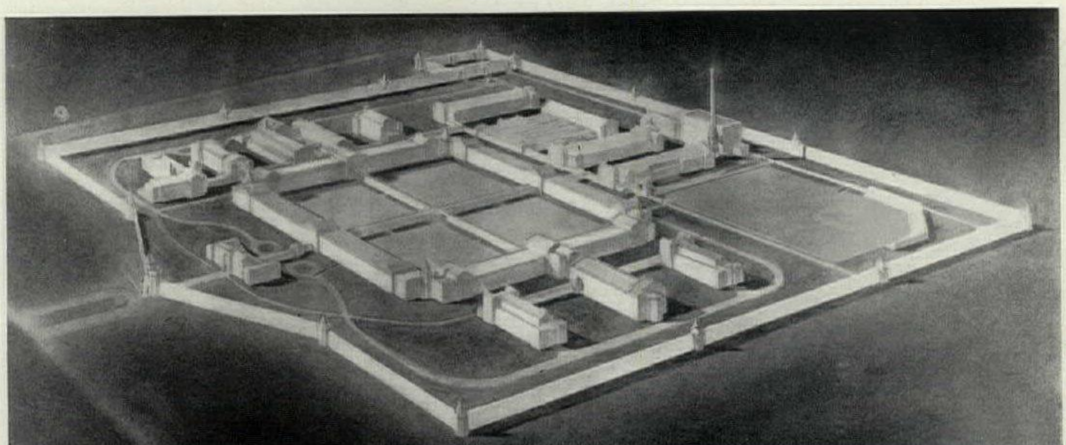
The profession cooperatively could offer a very effective service to owners of run down neighborhoods that are well located. Assembling of these various properties under an "arrangement" would enable entire neighborhoods to be restored in a scientific fashion to greatly enhance the value of the separate holdings.

Group effort to establish proper legislation for the elimination of slums and other undesirable nuisances would be effective. Every state should avail itself of the proper legislation for ridding it of its undesirable areas.

The answer to a "guaranteed future" for a city is the City Plan intelligently executed. A town without a plan is like a ship without a rudder, it will be lost in the shuffle. A well developed plan will insure the permanent beauty of a community. By beauty is meant that intangible quality of orderliness that in most cases costs less than disorder. After all a well planned city is the most economical to operate.

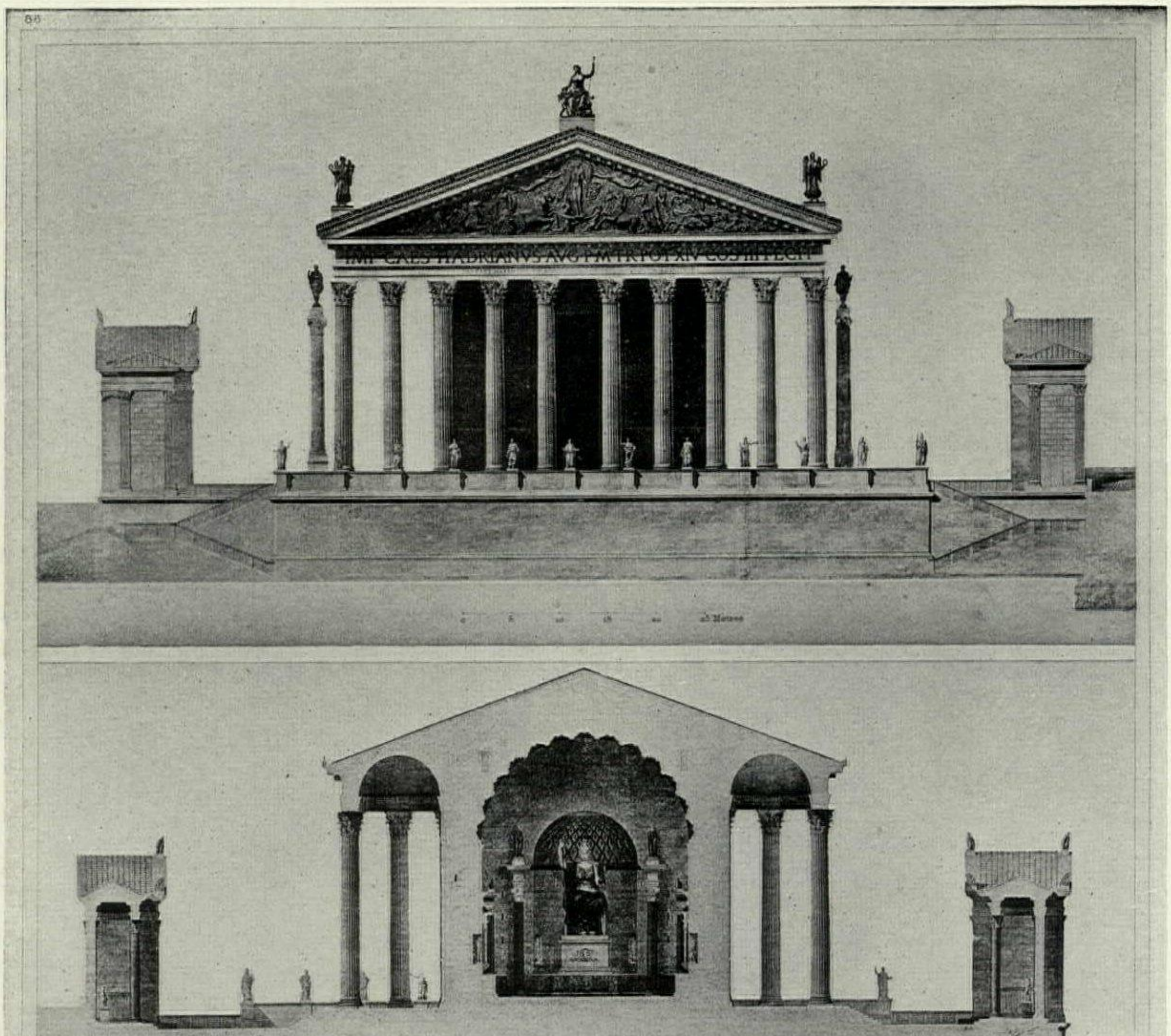
Public Endorsement. A program that protects a community against ugliness, that revitalizes blighted areas, that protects the future of our cities, that protects the citizen against himself and his neighbors should receive the acclaim and endorsement of our public leaders and officials. All good citizens should accept and encourage this leadership and prepare their city for the great battle of communities that is coming. A revised national consciousness to our living conditions will result in better citizenship.

This effort is dedicated to the proposition that the public, the industry, and the profession will gain by working under a plan instead of each stupidly working alone.



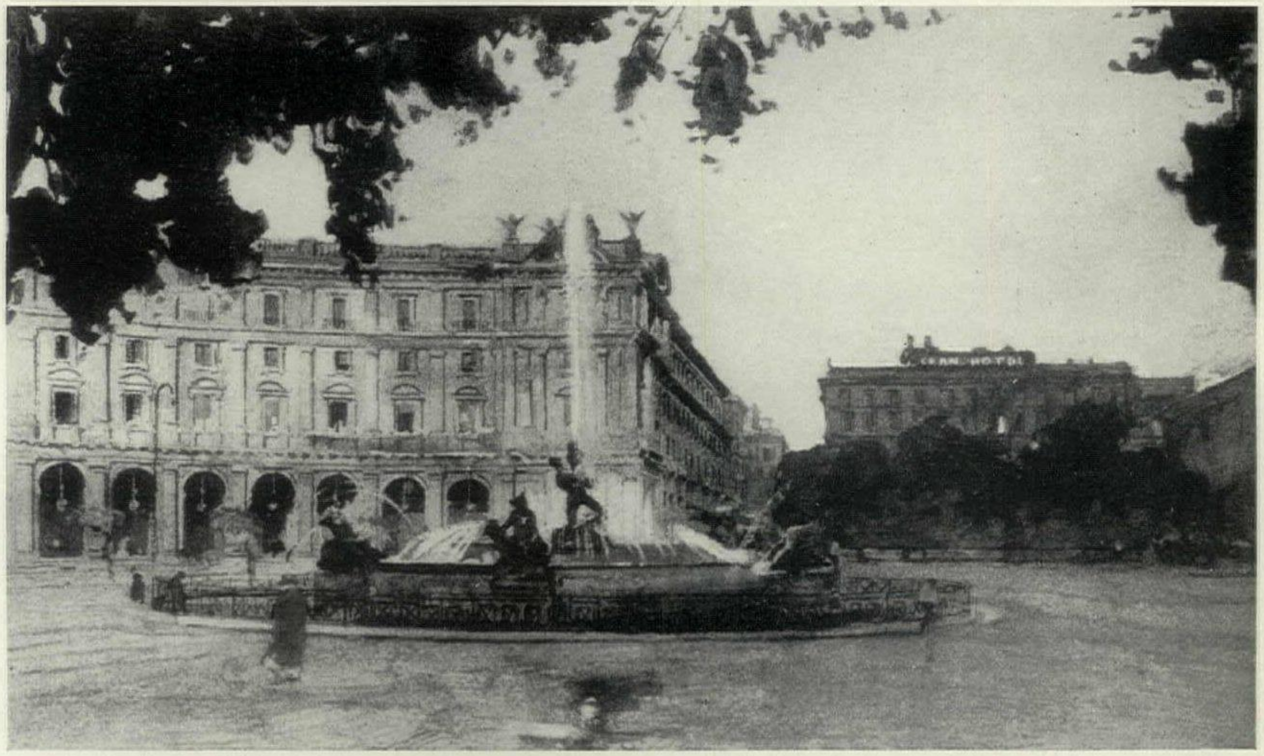
A SMOOCH DRAWING IN GRAY PASTEL, BY MAXFIELD E. GLUCKMAN

ATTICA STATE PRISON, ATTICA, N. Y.—WILLIAM E. HAUGAARD, ARCHITECT FOR STATE OF NEW YORK



From D'Espouy's "Fragments d'Architecture Antique"

TEMPLE OF VENUS AND ROME AT ROME—FROM A RESTORATION DRAWING BY M. VAUDOYER



THE FORECOURT AND HEMICYCLE OF THE BATHS OF DIOCLETIAN—ROME

The Architect and the Grand Plan

6—The Architect's Status and the Development of Rome

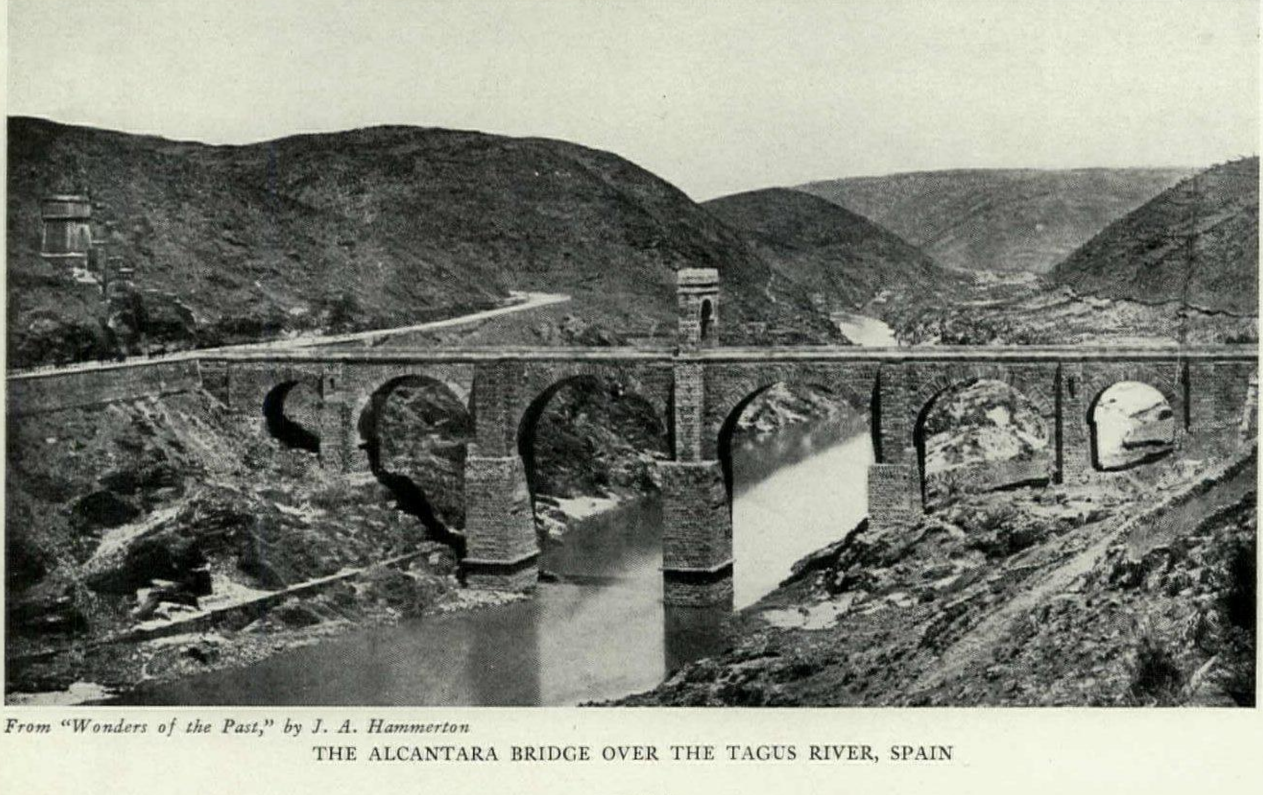
By Francis S. Swales

Editor's Note:—*Parts 1, 2, 3, 4, and 5 of this group of articles appeared in the March, May, and November issues of last year, and January and April of this year. Other parts continuing the discussion will be presented in the near future. The author is well known as an authority on the subject and a reading of the entire series will provide a good working knowledge.*

The architecture of Rome—the systematic planning of the city, logic of construction, and magnificence of scale and decoration—was a magnetic influence upon the public. It provided a tangible outlet for the expression of ambition, if not always of ideals, and it provided mass employment to ease off excessive concentration of money which followed each period of war profiteering. Such uneconomic conditions as the world faces today are but quantity productions of the old, old story of a monetary standard that can be, and often has been, "cornered." Rome found the way to solve big construction—during a period of four centuries the greatest problem of civilization—by the employment of the nomadic masses. Imperial Rome was a city of builders; by far the greatest number of its male inhabitants must have been builders' workmen, masons, sculptors, founders, smiths. Its carpentry, required for centering of arches and vaulting, alone provided a great industry. Brick making, marble cutting, mosaic working, painting, pipe making, and most of the other modern industries connected with building flourished then. Although Rome brought in its water supply by great aqueducts, the Romans also used pipes of lead, bronze, tile, and wood. Dr. Ashby found lead water pipes a foot in diameter during the excavations by British archæologists at the port of Ostia. Rome maintained good schools, such as the Pedagoguiam, on the patrician Palatine hill, where slaves were trained for professional intellectual service. Architects and builders were obtained in many cases from the ranks of slaves, who were probably among the number trained in such schools. Plutarch mentions that Crassus bought "slaves who were architects and builders. Then, when he had five hundred of these, he would buy houses that were afire, and houses which adjoined those that were afire, and these their owners would let go at a trifling price, owing to their fear and uncertainty. In this way the largest part of Rome came into his possession." He built no new buildings, however, and his "architects" must have been kept busy repairing old houses or altering them into tenement houses, thus mummifying large areas of the city and breeding that type of economist which has come down to us today through such much admired statesmen as Benjamin Franklin and Calvin Coolidge. If we consider the methods of Crassus in obtaining buildings, and of Nero, a hundred years later, in obtaining a site for his palace, which is estimated to have covered an area greater than that of the Vatican palace and St. Peter's and its piazza combined, as connected with the employment of slaves, or of graduates of schools of architecture, we may speculate upon the question whether the modern "racket" of incendiarism in the Bronx, New York, is so very modern, or still another classical tradition! Vitruvius says that in his day the "profession" was overcrowded with the uneducated and unskillful, who "do not possess the genuine art but term themselves architects falsely." Vitruvius agrees with Cicero that architecture is a profession for which men of good education are best suited; but does not raise the question—"What's in a name?" History is the real capital of the world upon which any age has earned or neglected to earn interest. It is the ever-present foundation of all worth while learning and the fertilizer of all progress and science. That which died this morning is just as dead as that which died with Cheops, and if history tells us anything in particular of men, it points especially to the value of the vision and foresight of men called "architects." It raises not so much the question "What is an architect?" and "What is education?" Cicero employed five architects who seem to have been in private practice and to have belonged to the patrician class. His several private enterprises in architecture, apart from the larger undertakings with Caesar and other friends, were such as a modern leading politician-lawyer of the same class might also undertake. They were that moderate class of house, or home, of those people who chose, in the words of a nearly contemporary poet:

"The way of Peace, the happy mean;
That bounded space that lies between
The sordid hut and palace hall."

Architects of his time were obviously not all statesmen, priests, politicians, promotors, nor even products of a particular fixed curriculum. Individualism flourished as well then as it did again later during the Renaissance. It was probably during the reign of Augustus that Vitruvius Pollio wrote his ten "books of architecture"—or long two-part letters—the first part or introduction to each book is addressed to "Emperor." The special significance of city planning may be found in his first book, which, after dealing with the subjects which an architect must know, plunges into technical matters pertaining to city planning, such as sites for cities, city walls, direction and form of streets, orientation and protection from the elements and sites for public buildings. His three last books deal with the design of machines of war, construction plant and water supply—the ingenious things from which the word *engineer* was derived—hence, etymologically, an engineer is only a designer of mechanical contrivances or equipment. It is not certain that Vitruvius was an architect at the time he wrote his books. It appears that he was then either a professor of architecture, perhaps advanced in years, or that he sought to become architect of some of the projects of Augustus. He mentions Caius Julius who "served with Caesar the father, who was once my guest," and things pertaining to siege operations of



From "Wonders of the Past," by J. A. Hammerton

THE ALCANTARA BRIDGE OVER THE TAGUS RIVER, SPAIN

Courtesy of Kennedy & Company

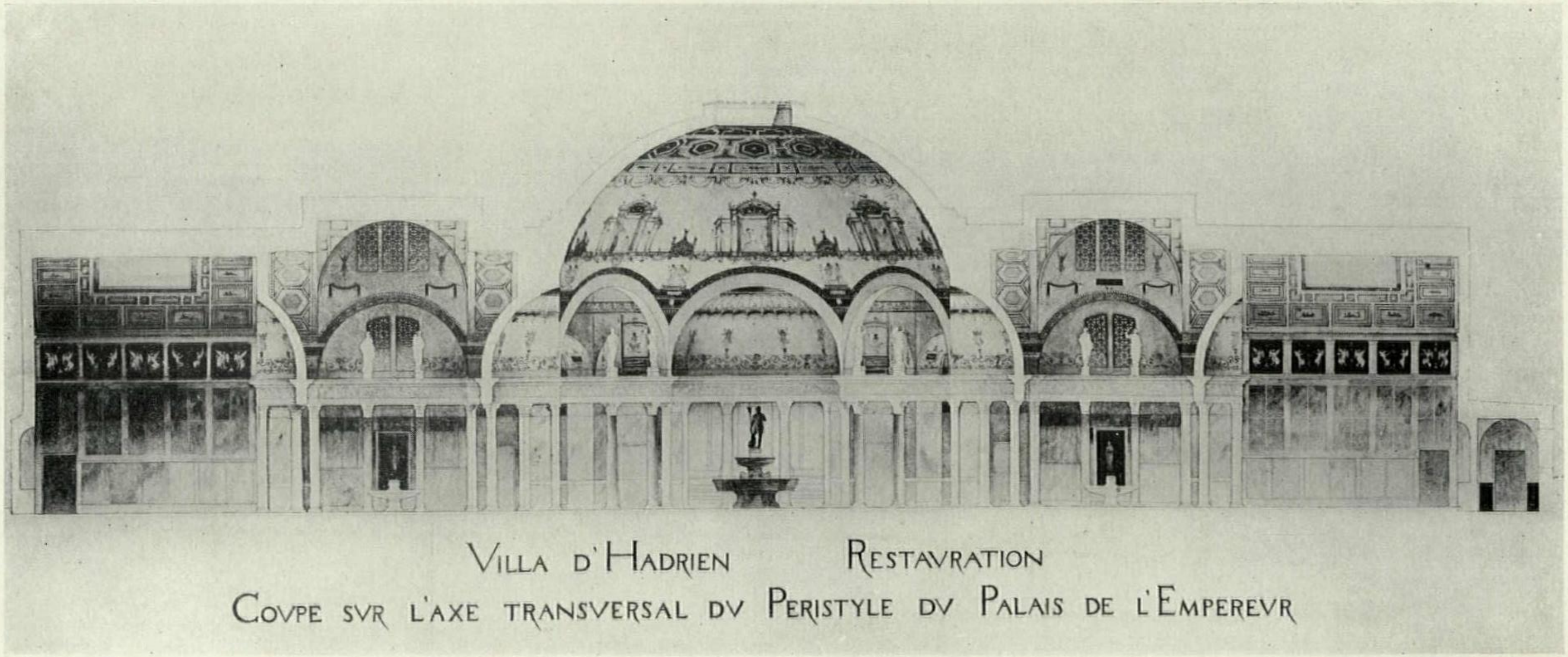
THE PANTHEON, ROME—FROM A DRYPOINT BY HEDLEY FITTON

Size of original, 22" x 17½"

Julius Caesar, and that he himself designed the Basilica at Fano. He was also an expert in hydraulics and both he and Frontius prove themselves familiar with most of our modern means of handling the water supply of large cities. His books provide verbal record to support the greater tangible evidence of such existing buildings as Vespasian's Amphitheatre (Colosseum) and the Pantheon, that the leading architects of Rome were men having direct contact and influence with the emperors, and leading citizens; which would seem to be necessary in order to execute such masterly conceptions in such complete form. It may be that Augustus himself was studying architecture or had sought information upon the subject from Vitruvius for the guidance of Agrippa, his son-in-law, who took the major part in the Augustan program. Virgil, who wrote his *Georgics* about the same time, gives a picture of country life around the great city showing the interest of the people in trees and landscape, and the source of the desire for grass plots and open spaces in the heart of Rome, which Augustus was busily changing from "all brick to all marble."

The Roman architect was also the civil and military engineer, or the chief or director of such men. He provided the ideas, and knew the science and was entrusted with "laying out and constructing camps whether temporary or permanent, roads, earthworks, bridges, gates, drains; the erection of market places (fora), temples, basilicas, the Imperial palaces and tombs, the public theatres, amphitheatres, and circus and public baths, etc."—the erection of all of which was entrusted to contractors paid either by the state treasury or by the emperor's privy purse, or by both.

"Under the direct supervision of the state officials, we shall not be far wrong if we ascribe the origin of these works to state architects," says Rivoira. He also states that they were forbidden to sign their buildings, and that the names of Greek architects who worked in Rome were recorded by the Greek writers, who jealously suppressed the names of Latin architects. Contemporary authorities, on the other hand, provide many evidences that the emperors, chief-priests, and independent architects of patrician class were the actual designers. The word *pontiff*, applied to the modern Pope, is derived from *Pontifex Maximus* or chief bridge-builder, which was a title first adopted by

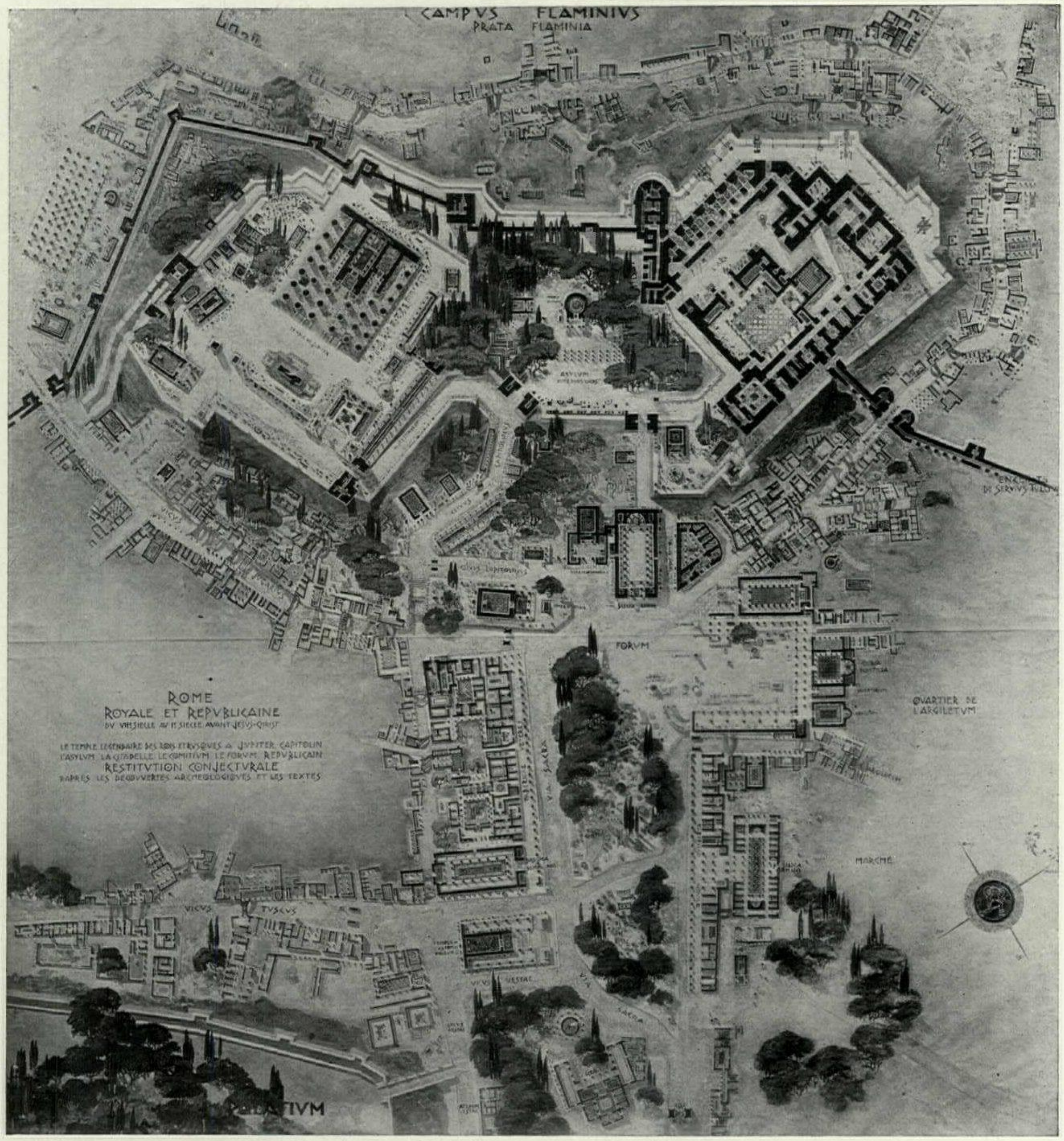


TRANSVERSE SECTION AND LONGITUDINAL SECTION OF HADRIAN'S PALACE AT TIVOLI—FROM RESTORATION DRAWINGS BY M. GIRAULT the emperors and later by the chief of priests when the church took over the government. The real evidence that state offices existed at Rome towards the close of the Empire may be found in the low character of the visible architecture towards and after the time of Constantine, when most of the men of talent had gone elsewhere. Nevertheless, many Roman architects' names are inscribed on buildings and bridges which they designed, such as Cossitius, referred to by Vitruvius, who inscribed himself as architect of the Temple of Olympian Zeus at Athens; and Julius Lacer, who built the bridge at Alcántara, in Spain, and inscribed upon it: *Pontem perpetui mansurum in sæcula mundi fecit divina nobilis arte Lacer.* This bridge great Lacer built with noble art to stand throughout eternity. (Concerning Lacer's foresight, it has been computed that since its construction it has been crossed by four hundred million people—equal to the present population of the world!) Other architects are mentioned by Latin authors. Tacitus mentions two famous architects, Severus and Celer, who planned the Claudian Aqueduct and the Baths of Nero. Nero himself is credited with limiting the height of private buildings, ordering them to be faced with fire-resisting material, and to be provided with ample courtyards (the first attack upon excessive coverage of sites); and of personally laying out broad streets flanked with colonnades. Thus carrying forward the first restrictive steps made by Augustus, who limited the height of certain buildings to sixty-six feet, and encased them in marble. Trajan reduced the height limit of private buildings to sixty feet. Gellius mentions Rabircus, the architect who designed the palace of Domitian, and perhaps the palace and nymphæum in the Gardens of Sallust, in which case is a hint as to the authorship of the plans of the parks and gardens of ancient Rome. Gellius also mentions a gathering of architects at a friend's home, which suggests a competition (for a bath house): "They showed designs drawn on parchment and he selected from among them the one which seemed best in plan and appearance." Apollodorus, who designed the Baths of Trajan and the greatest feat of Roman construction—the bridge across the Danube which stood below the Iron Gates of Arsova—as well as the great Forum, was a "Syrian" (Syrian-Greek?) from Damascus. He has left a bas-relief on the Column of Trajan showing his design of the bridge among those important illustrations of Roman history. From his time onward the profession of architect, beginning with Hadrian, seems to have been held in high and increasing esteem, though the art declined.

Hadrian's recorded quarrels with Apollodorus, the old architect of Trajan, of whose prestige as an artist the emperor was jealous, show at least his intense interest in architecture as *the* fine art, his pride in his own efforts, and his ambition to shine as an architect. He had the head of Apollodorus cut off in return for the latter's caustic criticism of one of his designs for a temple with a seated goddess. Apollodorus said that she was necessarily seated because her head would go through the roof if she stood up. Hadrian succeeded in his ambition to become a great architect if we may accept the opinion of the eminently learned Italian authority, Rivoira, who ascribes to him the actual designing of the Pantheon, as reconstructed with the dome, the Temple of Venus and Rome, his own mausoleum (Castle of St. Angelo), and the bridge across the Tiber leading to it, as well as his palatial villa at Tivoli. Here he caused reproductions of antique buildings and sculpture to be erected, which could have no other motive than that of the amateur of architecture. He sent young men abroad to study, measure, and make drawings of ancient buildings—just as our universities do today.

The trend of the wealthier classes was to build villas in the environs, as does the modern citizen of Rome, and spend much time in these country villas. The character of the country palaces which they erected is described in the letters by Pliny the younger—a friend and deputy of the Emperor Trajan—and is illustrated by Girault's artistic restoration of Hadrian's Villa, or summer capital, at Tivoli. Hadrian's Villa was, of course, rather the country palace of the emperor than of merely a multi-millionaire. The palace, with its entourage of quarters for the Emperor's retinue, was the center of a satellite city during his occupancy. Like most suburban seats, it did not long continue. It was the residence assigned to Zenobia as a prisoner of Rome after her capture by Aurelian, which seems to be its only recorded use after Hadrian's occupancy. The plan of its court is essentially the same in scheme as the Forum of Trajan and of the Great Temple of Ammon at Karnak (see PENCIL POINTS for May, 1931, page 346); but with Roman construction so developed that the pylon gates of the Egyptian original and the triumphal arch at entrance to the Forum is hardly remembered as the forerunner of the light and airy vestibule to the palace courtyard. Without the plans of the three groups of identical solution to show the tradition, there is nothing at all in the section of the large domical room which takes the place of the Ulpian Basilica and its counterpart, the hypostyle hall at Karnak; or in the pleasing cloister of the Villa to remind us of the monumental colonnades of Trajan's Forum or of the Forecourt at Thebes.

Both Pliny the Younger and Hadrian found a major interest in architecture. The former probably, and the latter almost certainly, practiced professionally to the extent of designing and directing the construction of buildings of beauty. Pliny's role may have suggested the idea that public buildings were designed by "state" architects, but it will be observed that in such case he was rather a royal deputy in charge of public works. The great Baths of Caracalla, and the still more extensive Baths of Diocletian (see page 230, PENCIL POINTS for April, 1932), were the last important units in the plan of the Imperial City. Diocletian, after extensive restorations of Rome, retired to Spalato on the Dalmatian Coast where he built his curious fortress-home facing the sea—half palace, half castle, a mixture of Roman and Roman-



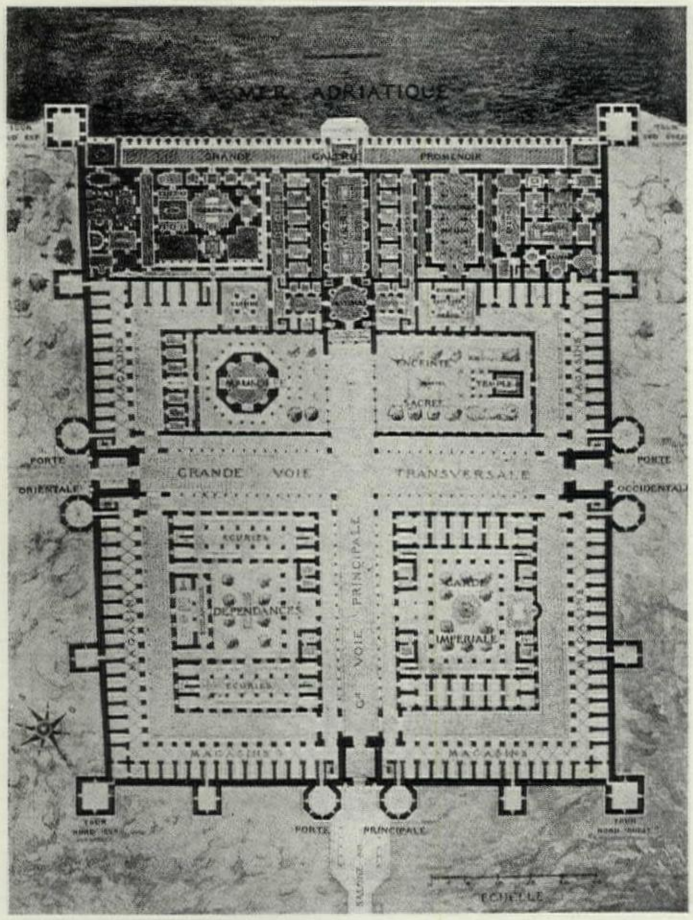
PLAN OF THE CAPITOLINE HILL AND FORUM AS IT WAS IN ROYAL AND REPUBLICAN ROME

FROM A RESTORATION DRAWING BY JACQUES CARLU

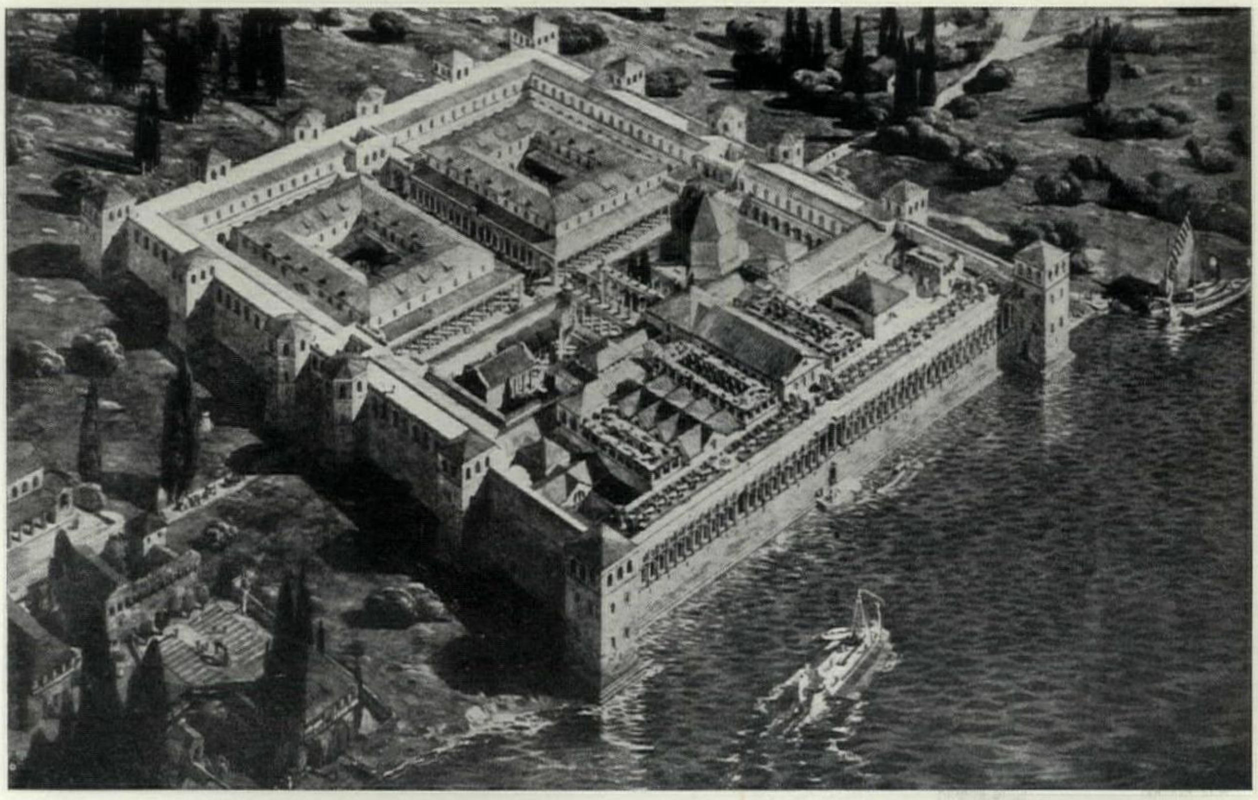
esque architecture—a kind of small city with the appearance of a large prison.

Graft in politics, swindling in real estate transactions and the financing of buildings, fraud in all business dealings, hypocrisy, theological strife, and avarice among the ecclesiastics, and a final desire of personal peace in which to end his days at his native town, drove Diocletian—after an heroic attempt to rid Rome of socialistic or anarchial Christians, and to rebuild the city on a "bigger and better" scale—to plan and construct his private "palace" or fortress-city at Spalato.

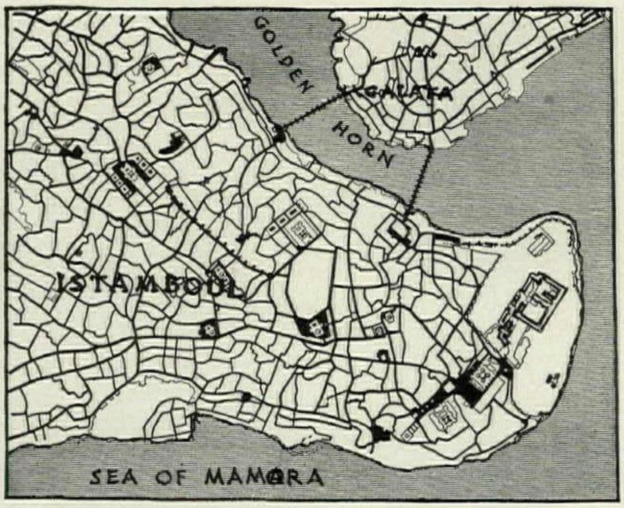
Mr. Ernest Hébrard's restorations show that Diocletian took an able architect with him, perhaps one of those who had designed plans of colonies such as Aosta, Madama, or Timgad. The concept of the elevation is in the plan—the beginning of "the Romanesque style," of the architecture of Western Europe, to replace the classical. The two principal streets in the palace-city at Spalato need but to be roofed over and a tower added at their crossing to form the medieval church establishment with its nave, aisles, transepts and chancel, adjoining cloisters, and surrounding monastic cells, within the walls of the church precincts. The large, nearly square, forecourt with its axial arrangement and colonnades along the wall again recalls the plan of the Great Palace-Temple at Thebes. The general form of the total enclosures of the mausoleum and temple, and the central street leading to the vestibule of Diocletian's palace recall the hypostyle hall, and the tablinium takes the place of the Egyptian shrine. Shops or stores are disposed under the covered ways along the walls of the great square. An inner paved road (approximately the width of roadway of a side street of modern New York) provides a vehicular or equestrian circulation. Orderly city blocks of stables and barracks, each with its own large courtyard, lie at either side of the entrance to the royal city. The division of the palace with the royal apartments associated on the one side with the enclosure of the mausoleum, and on the other, apartments associated with the temple, suggests the seat of learning to be included with the latter. Diocletian's example of removing his immediate friends and personal following to a location sufficiently far from the strife of Rome to be at a safe distance from it when financial cataclysm seemed to approach, provided a precedent to Constantine to remove, a few years later, the entire Court and Capital of the Empire to a still more distant site—at the most secure and strategic military position in Europe — and the founding of a new chief city at the old city of Byzantium. When Constantine followed Diocletian's example by leaving the city, Rome had grown to such state of completion that



RESTORED PLAN OF THE PALACE OF DIOCLETIAN



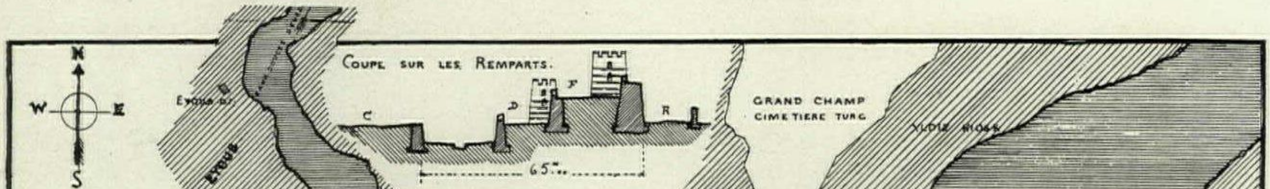
GENERAL VIEW OF THE PALACE OF DIOCLETIAN AS IT APPEARED IN THE DAYS OF THE EMPEROR



STREET PLAN OF MODERN CONSTANTINOPLE

little was left to be done by the talented architects, many of whom migrated to the colonies. Others were obviously attracted to the new capital which Constantine projected and named after himself, Constantinople. In founding his new capital for the empire at Byzantium he embarked upon an extensive program of city planning. "When Constantine founded Constantinople he discovered that in the decline of the arts the skill as well as number of his architects bore a very unequal proportion to the greatness of his designs. The magistrates of the most distant provinces were therefore directed to institute schools, to appoint professors, and by the hope of rewards and privileges to engage in the study and practice of architecture a sufficient number of ingenious youths who had received a liberal education." The economic purpose was to further concentrate wealth in fewer hands at Constantinople; to substitute by forced education, of questionable worth, a mass of mediocrity from which it was expected to derive *quantity* of ideas: to obtain "low cost art" inspired by the hope of profit, in gold or "royal honors." With a mercantile limit of understanding it failed to observe that the true object of the artist has always been the enrichment of his own life by the gratification of his independent vision by experiment and by opening up new fields of thought to interest and please his contemporaries.

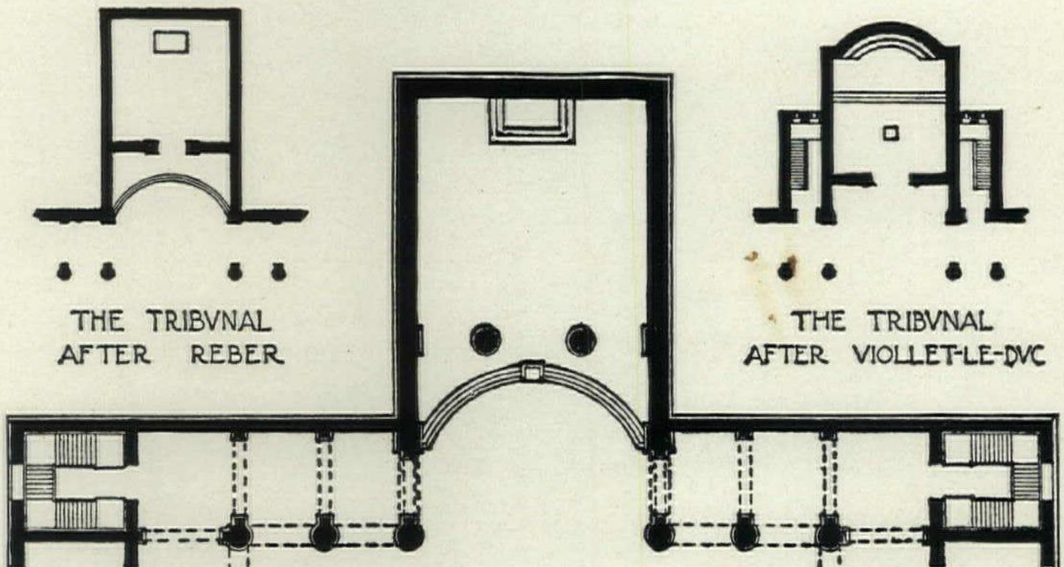
To what extent was the architectural planning of Rome successful in producing human happiness? Answer may be deduced from the type and position of the men who were interested in it. If it gave pleasure to and aroused the personal ambition of men like Augustus, Trajan, and Hadrian—who in all respects seem to have been at least the equals of the ablest administrators that the world now produces—it also supplied a moving picture—educational, entertainment to the masses—as well as finding popular employment to keep the dear public out of various kinds of mischief, which Satan is said to find for idle hands to do.



SITE PLAN OF CONSTANTINOPLE

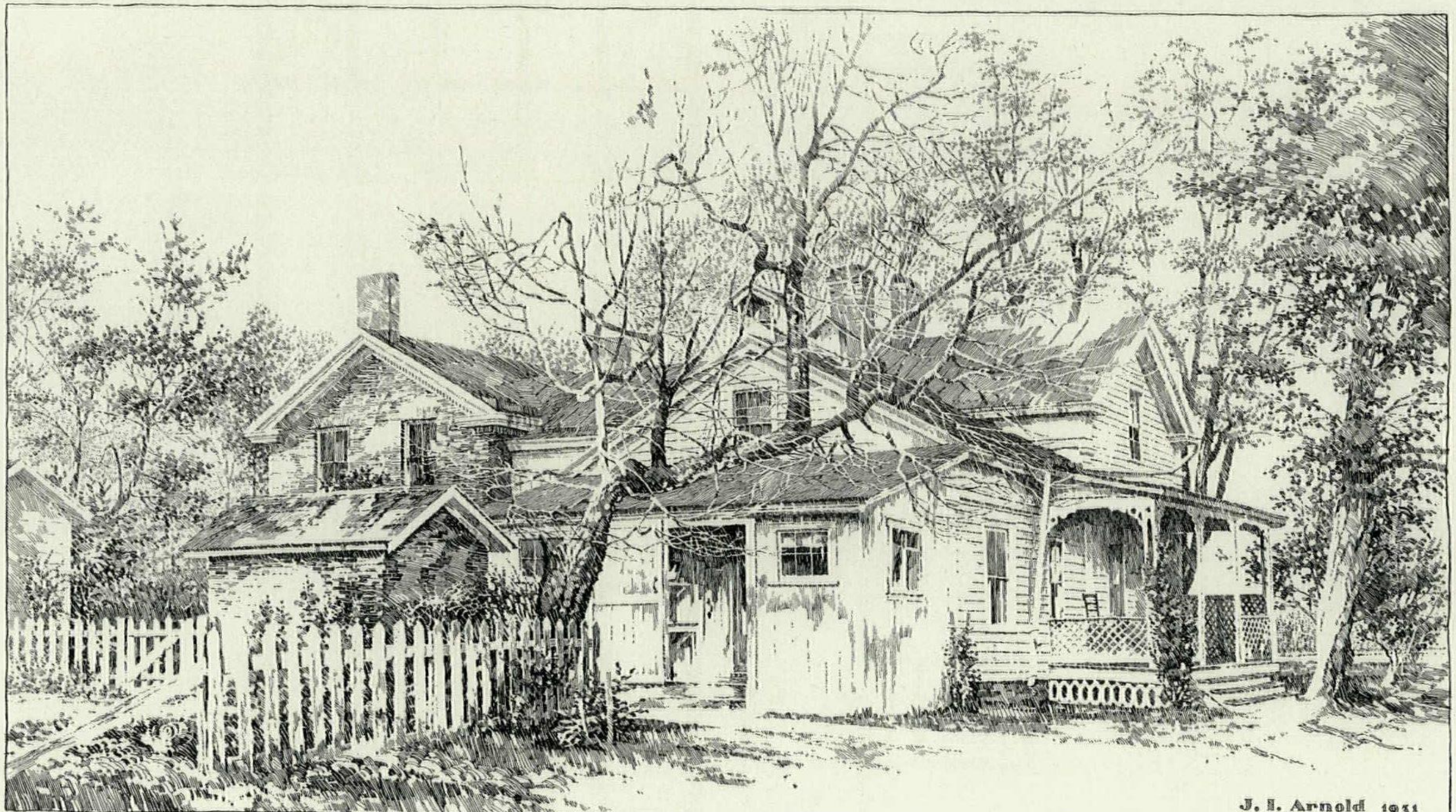
Gibbon says, "If a man were called upon to fix the period in the history of the world during which the conditions of the human race were most happy and prosperous, he would, without hesitation, name that which elapsed from the death of Domitian to the accession of Commodus" (96 to 180 A.D.). That was while Rome continued to seek quantity *of quality* begun by the policy of the first Cæsars.

Ammanius, the last contemporary historian of ancient Rome, paints a vivid picture of the city towards its culmination in recording the visit of Constantius, the son of Constantine, and dwells mainly on the great impression which the splendid buildings created on the visitors. The parks of Rome at that time covered one-eighth of the area of the city. What became of the schools of architecture instituted by Constantine? Vegetius states that at the beginning of the fifth century there were seven hundred architects in Rome. Quantity production, unemployment! Thousands of building men turned "barbarians." And then, in the year 410, came Alaric!



From Morgan's translation of "Vitruvius"

PLAN OF VITRUVIUS' BASILICA AT FANO



A BRICK AND WOOD FARMHOUSE AT GORDON, NEW YORK—FROM A PEN-AND-INK DRAWING BY JAMES IRZA ARNOLD

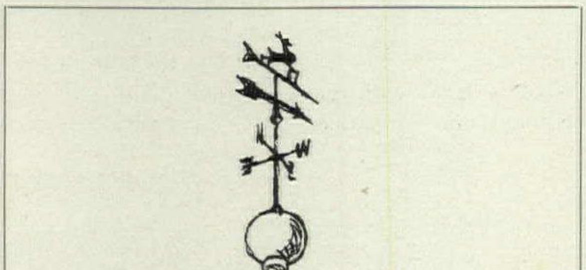
THE HOUSE WAS BUILT ABOUT 1840 AND IS THE SUMMER HOME OF THE ARTIST

An Architect's Notes on Pen Drawing, 8

By Sydney E. Castle, F. R. I. B. A.

In preparing to offer a few persuasive suggestions to pen and pencil draftsmen with the avowed object of inducing them to remain on the boat at Cherbourg on their voyages to Europe and land at Southampton instead, my thoughts go lazy with a myriad of delightful memories. But lazy though they are, these thoughts leave me confident about one thing. As an advocate, I am in happy office. For I am the pedlar of estimable wares.

Personally, I shall always believe that peoples of one language have mutual sympathies and outlooks. We may lose our thoughts among the romantic beauties of Normandy, or marvel at the piled-up rock villages nested in the olive groves near the Riviera. We may lose our thoughts in the medieval Rhine towns, or marvel at the Vatican gardens under the shadow of a great many-eyed dome. We may wander still further into the past and lose our thoughts when the beauties of Aegina's classic ruins are vital against a sky of wine, or stand aghast at the wonders of Santa Sophia's sprawling dome and minaret sentinels.



But there are further claims on our attention than these miracles—charms that seem to woo us in our own language—charms in which we may *find* rather than lose our thoughts—charms that *belong*. We don't want to marvel at them as at the dazzling exploits of our neighbors. We are not awed by them. Their voices are intimate—kindred. We easily understand, and we are drawn towards them by instinct. They are shy—they lurk bashfully among green hedgerows and oak and beech woods. They are difficult to locate, chary of railroads and main tracks, perhaps.

But they wait to be friendly—simple, maybe, wistful as pictures in a home fire: but somehow part of the breath of a spoken language.

They are all one with the delights of an English countryside.

* * * * *

I am a Londoner who would have preferred no other birthplace on God's earth. But as one who first saw light in the greys I met the countryside in wonderment, left my heart there and took my head back to cities. I found a plenitude of verdant green—the rich compensation for a climate which almost demands a knowledge of navigation. And I found that the people through the ages had not only suffered this climate cheerfully but made the pleasantest problem of it in the world.

A wet day is good for growth. And a wet climate, perhaps, is good for wits.

At any rate, I found every sign of it in the architectural endeavors of my forbears. For it would be little wide of the mark to aver that native English character in building is almost entirely climatic.

* * *

Forget the weather-protected towns, and go into the villages. Then study the work of late medieval English builders before the great fusion of ideals took place with the more cultured Europe. In other words, consider alone the indigenous work of the pure islander.

What do you find? Drips, overhanging storeys, steep roof slopes, a marked suspicion of water-trailing horizontals, wide eaves, weather boards and hanging tiles. There they all are—however attractive, indubitably the signs of storm and stress.

Enter these villages and consider any of their preservations from the past from this viewpoint alone. And if you have hitherto ascribed romantic beauty as the ruling faculty of the ancient builders you will soon find yourself rather dubious about it. That they had a sense of grace will be obvious—they were intelligent. But close study will very soon distinguish between good wholesome root and the flowers that spring from it.

It is very pleasant and perhaps diverting to weave our colored fancies over the people of the past much as time has weaved its fancies over their buildings.

But much of it is nonsense, of course. I decline to believe that people who foregathered in a holiday frame of mind to watch a fellow creature hung and disembowelled, or roasted alive, perhaps, were in the least degree squeamish about sentiment of the mellow and lichen order.

Beyond question, they had a strong sense of color. Apart from the evidences of their wearing apparel, strip a tile from one of their roofs. Do you find it the delectable snuff-brown or hoary grey of our old-world ideals where the weather has not got at it? Not a bit of it. You will find it a yellowy red—as bright and gay as the hues of their clothing.

But approach these people rightly. Their love of bright color and dramatic contrast did not mislead them. They were a live practical race. And their problem was the weather.

* * * * *

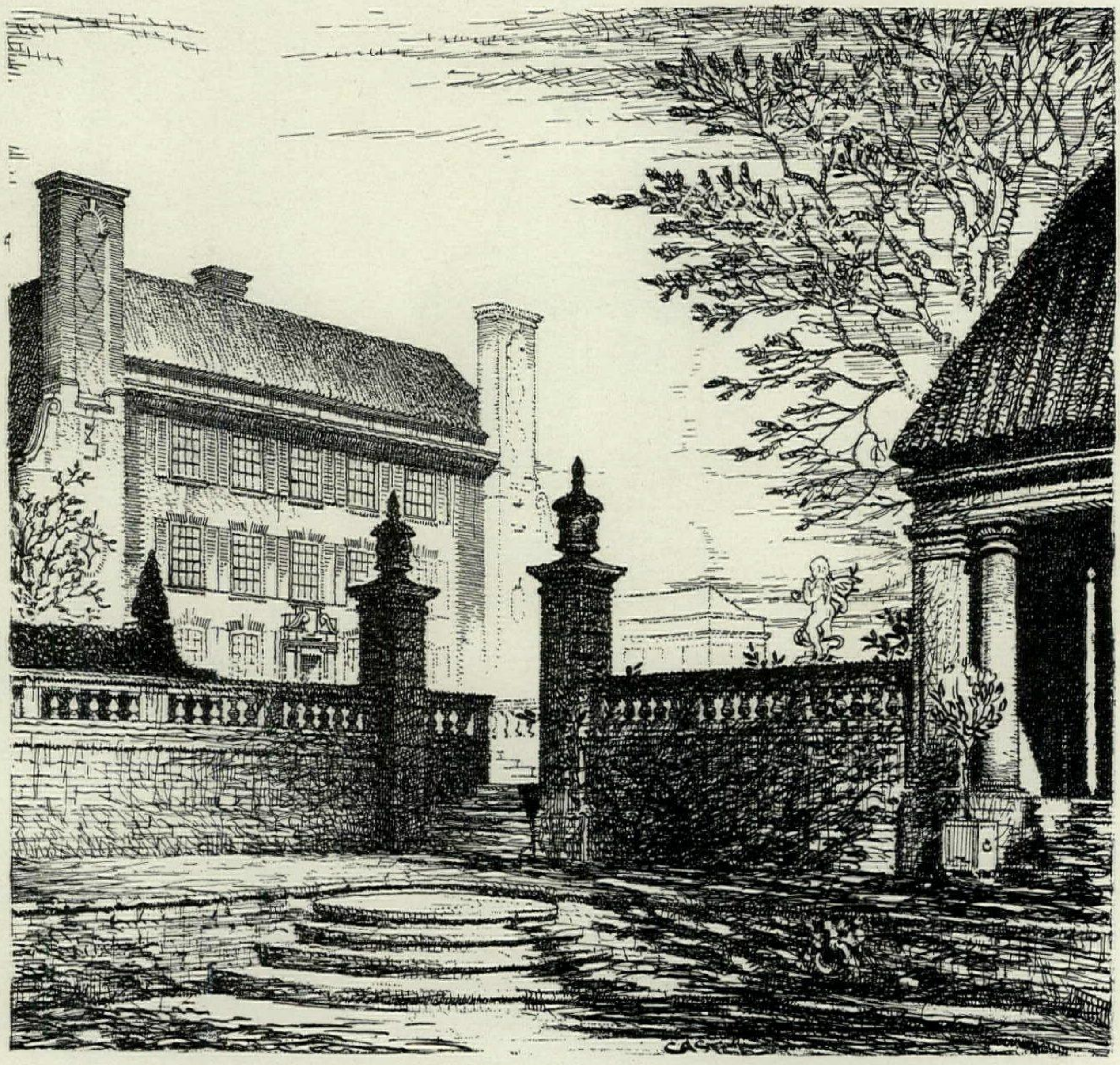
Therefore, when we march boldly forth with our sketchbooks and learn to scratch out our sympathies with bygone times, we do well to bear in mind how much of these sympathies is due to ancient builders and how much of them is due to about three hundred years of wind and rain.

I claim this. That in the very preservation of these old relics is the secret of their charm. They demonstrate the most convincing proof of all in architecture—endurance. And why? Because they began with common sense.

* * * * *

Take for example the stone buildings of the Cotswold country. Wander down that glorious hill into Broadway—pass Court Farm, the gable-prickly Tudor House and the Lygon, pass the green and the grey abbot's Grange, turn left where it all straggles away like the outer fragments of a stone quarry—and regard what you have encountered as if all these buildings had had no time as yet to gather their lichen.

Then think. How sane and well ordered they are! Simple, unsophisticated where the conscious



PEN-AND-INK SKETCH FOR A HOUSE NEAR WORCESTER, BY SYDNEY E. CASTLE modern hand has not touched them, and entirely practical. Good building stone has been near at hand, and good building stone has been used. And the pleasing steep pitch of the pointed gables and roofs have least of all been a mere vanity.

I speak with feeling. Years ago I sat imprisoned in Broadway for three whole days while the clerk of the weather broke his heart—if he has one—and wept over it. And having, from sheer desperation, braved those elements, and watched the effects of them on many of my old stone friends, I returned into the dry with a vastly improved respect for their weather cunning.

My appreciation for that rainfall bordered on blasphemy at the time. But since, I have come to rather change my views. There would have been no sleepy Broadway alive with dark, pleasing shadows in a bath of gilded sun had there been no such possibility as a distinctly wide-awake Broadway sturdily resisting the onslaughts of Jupiter Pluvius.

And the thought stuck.

* * * * *

I spend so long on practical issues merely to impress that while we may respect and reverence age, it is in the pattern of its once splendid youth that we are the better inspired.

* * * * *

I can imagine no more glorious sketching haunt than the western Cotswolds.

Take Chipping Campden alone. Here—where we are told Harold the Saxon was lord of the manor before the Norman conquest, and where the Flemish woolmen settled in the reign of Richard II—sketchbooks may indeed tremble!

What a feast for the hungry! A fine if somewhat poorly restored church, a perfectly joyous group of prim almshouses, on the left some comical Jacobean in the remains of a pavilion once belonging to a now destroyed mansion . . . then, as a wander into a fairy town, into the High Street past William Grevel's simple but famous house, until low cliffs of delightful stone bring a tiny Market Hall of unique beauty.

Let a sunny day smile on that adventure, and if you are the worst sailor that ever prayed for the relief of death, you will forgive the Atlantic to the degree of blessing it.

But though I maintain that Campden is the most unscarred and beautiful specimen in the Cotswolds, it by no means enjoys singular splendor.

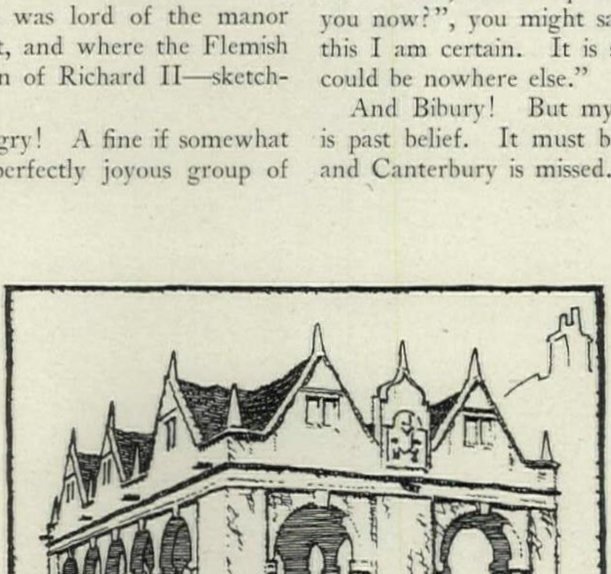
Apart from its near neighbor, Broadway, anyone who comes to England and misses Burford misses one of its quaintest little towns. Here again is a perfect gem of a church and a stone-banked street. But its unrivalled joy lays in its lean on a hill.

The late P. H. Ditchfield, a writer to whom so many of us have reason to be grateful, said of Burford that it was the most picturesque place in England with the moon at full.

But it has another time of day for me. I can recall no more sublime serenity in all my travels than the view of this sleepy little town when viewed from the bridge at hillfoot in the quiet stillness of a coral-tinted evening.

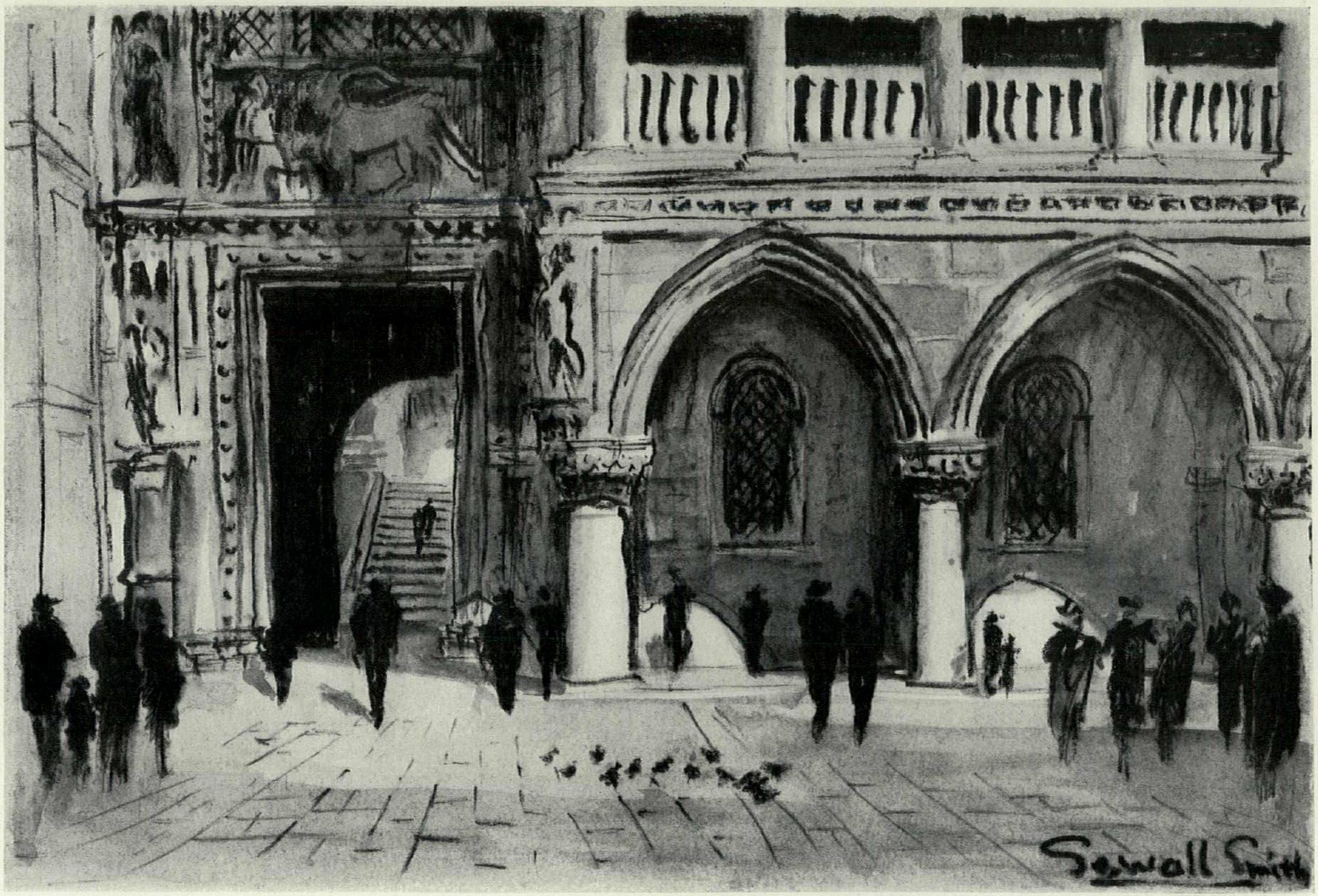
It seems to nod drowsily like an old man once active. The time of day seems to belong to it. Were you suddenly transported thither, all unknowingly and at such a time, and the question put to you: "Where are you now?", you might say, "I don't know. But of this I am certain. It is somewhere in England. It could be nowhere else."

And Bibury! But my wits are numbed. Bibury is past belief. It must be seen if the glass at York and Canterbury is missed.



MARKET HALL, CHIPPING CAMPDEN, GLOSTERS

FROM "DOMESTIC GOTHIC," BY SYDNEY E. CASTLE



FROM A SEPIA SKETCH BY SEWALL SMITH—"VENICE"

Drawn directly with a conté sepia crayon on wet paper, using a fairly wide line. A wet brush was used to produce the wash effect, adding water as needed. Size of original, 13" x 8¾".

Comparing the Cost of Different Types of Floor Construction

By H. Vandervoort Walsh* and Alexander T. Saxe†

A comparison of the cost of different types of floor construction reveals the opportunity for new inventions. It also shows why certain types have been more generally used than others, because cost, in the long run, is the major factor in the final selection of methods of building. Many of those who are complaining about the backwardness of the building industry in developing new and economical systems of construction fail to recognize that no one has so far proved that a newer system of floor construction is better and cheaper than those which are now used. We feel perfectly confident that if anyone has any cheaper way of constructing a floor than now in use, such will soon find its market.

In fact, we hope to show in this article the opportunities that are open for new ideas. We even offer it as a challenge to our readers to send in their ideas, along with their estimates of cost, and we will discuss them in a later article.

Our comparative figures, on the cost of different types of floor construction per square foot, including the materials and labor, the finished floor and the plaster ceiling, lead us to the following conclusions:—

1. That there is a large gap between the cost of wood floors compared to fireproof floor construction. For example the non-fireproof floor built with 2″ x 10″ joists, plaster below, and rough and finished floor above is about 49 cents per square foot in the New York area, but the cheapest fireproof floor construction is 72 cents per square foot, and this is regardless of the fact that the wood finish flooring in non-fireproof construction costs about 9 cents per square foot more than cement finish in the fireproof floor.
2. That there is a need for a fireproof floor construction that is in between these two extremes.
3. That the types of floors most commonly used in any community are those which have proved themselves to be the cheapest; for example in New York City cinder concrete slabs and steel beams are used for most fireproof floors, because the cost per square foot runs less.
4. That any new type of floor construction that can actually be built, in practical competition, at a lower cost than existing types, will eventually be used in most of the buildings.

Without getting down to actual figures, one might imagine that the cost per square foot of floor construction would step by gradual intervals from that for the wooden floor on up to the fireproof floor. *BUT THIS IS NOT THE CASE.* The wooden floor, consisting of 2″ x 10″ joists spaced 16″ on centers, covered with rough flooring, building paper, and finished flooring, and lath and plaster below stands in a "cost-class" alone. In the New York area it is 45 cents per square foot. In the city where 3″ thick joists, instead of 2″ joists, must be used, it is 48 cents per square foot. For this reason, the greatest number of buildings are constructed with floors of this character, wherever they are allowable.

If it were not for the restrictions of the building code, requiring fireproof floor construction, the universal type would be the wood floor, unless some fireproof system was placed on the market that really proved to be almost as cheap. In fireproof buildings in New York City, the floor construction which is used, with but few exceptions, is the reinforced cinder concrete slab supported on steel I-beams. The reason why this type is selected to the exclusion of most others is that local conditions make it the cheapest. Hard-coal cinders are available and contractors who build these floors have so standardized their work that, at a very conservative estimate, all materials including steel and finished floor and plaster, and all labor, can be provided at 72 cents per square foot.

The one competing type of construction is the cinder block floor. In this system, hollow cinder or slag blocks are used as void fillers between four inch wide reinforced concrete beams that span from girder to girder, usually over a span of 20 feet. The steel beams used with the cinder concrete slab are done away with and only girders from column to column are set up. Such floors have the plaster applied directly to the bottom. In recent years more and more buildings in New York have used this floor construction, because the cost is nearly as low as that for cinder concrete slabs, or 74 cents per square foot, resulting from efficient field operations.

There are similar floors available using other units to fill the voids between the concrete beams, but none have shown competitive prices low enough to threaten the concrete slabs and I-beam construction, particularly when the speed of operation is considered. For example there is the "tin-pan" form made of sheet steel, which can be used between the concrete beams

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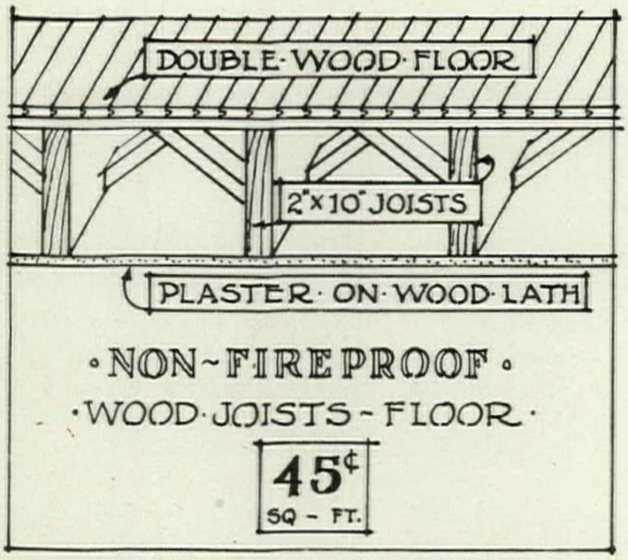


exactly the same as the cinder block, but the cost runs 76 cents per square foot, when the beams run one way only. In other parts of the country when local comparative costs are more in favor of this type of construction it is to be seen in general use.

The same is true of hollow terra cotta tiles when used as void filler blocks. Around New York, it does not appear so often, because it works out to a unit cost of 76 cents per square foot, in addition to not having all of the advantages of the other types of floor construction, which can show greater speed in installation.

At one time, floors constructed of steel I-beams with flat arches between, built of hollow terra cotta blocks, were the commonest in New York City, but the cinder concrete slab with its lower cost edged its way in. At the present time the terra cotta flat arch costs about 81 cents per square foot which is considerably higher than the concrete slab. Yet in other cities in the middle west, where hard coal cinders are not so easily available, the terra cotta block floor arch is very popular.

It can be seen from this that the unit cost of floor construction determines its adaptability to any locality, provided it meets the accepted standards of fireproof construction, namely that it resist fire for 2½ hours or more without serious damage.

One more item that deserves serious consideration in conjunction with the construction of floors is the matter of the ceiling underneath. In some types of buildings it is quite satisfactory to have the beams project down from the ceiling into the room; this applies particularly to commercial structures such as office buildings, hotels, garages, and so on. Where it becomes necessary to have a perfectly flat ceiling the type of floor construction used must take this matter into consideration before final choice is made, as the tables readily show greater savings available when proper selection is made for each individual problem.

A comparative study of the various types of floor costs follows, all prices based on New York City and vicinity:

I. NON-FIREPROOF

1. Consists of 2″ x 10″ joists of wood set 16″ o.c.; plaster on wood lath ceiling, finished floor on building paper and rough floor.

	Material	Labor
2″ x 12″—16″ o.c.	.051	.026
1″ x 3″ bridging	.004	.009
⅞″ x 8″ underflooring	.032	.017
Building paper	.006	.003
⅞″ x 2¼″ finish flooring	.122	.065
3-coat plaster on wood lath	.027	.076
Nails	.009	
Total	.251	.196=.447 cents

II. FIREPROOF FLOORS RATED AT 1½ HOURS RESISTANCE

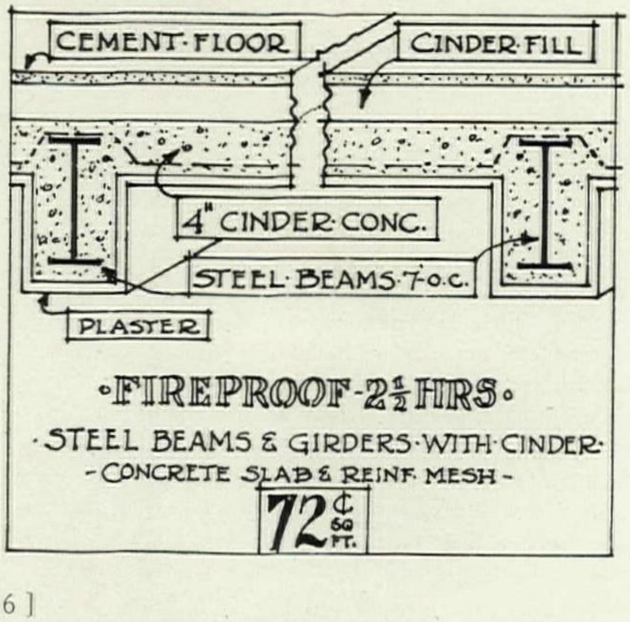
2. Consists of steel joists with open webs, set 2 feet on centers with 2″ thick reinforced slab above and 1″ cement finish; ceiling of metal lath and 3-coat plaster.

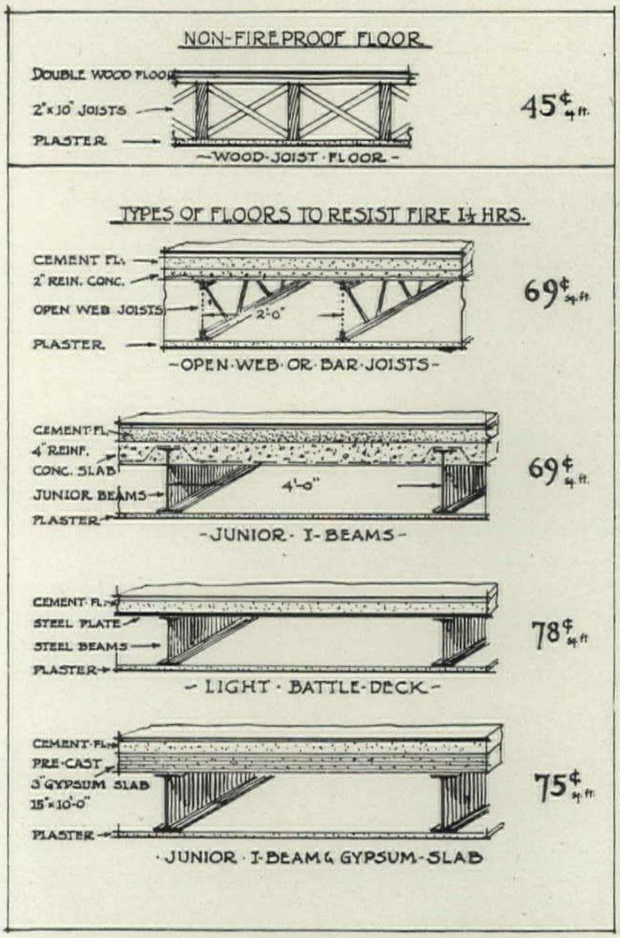
	Material	Labor
Steel joists	.12	.09
Furring	.03½	.02
2″ concrete slab	.06½	.04
Cinder fill	.03	.02
1″ thick cement finish	.03	.06
Metal lath and 3-coat plaster	.10	.08
Total	.38	.31= .69 cents

3. Light rolled steel joists, junior beam construction, with 2″ thick reinforced concrete slab above and 1″ cement finish; ceiling of metal lath and 3-coat plaster.

	Material	Labor
Steel beams	.11	.06
Concrete slabs 4″ thick—cinder	.13	.07
Cinder fill 3″ thick	.03	.02
Finish cement floor 1″ thick	.03	.06
Metal lath and 3-coat plaster	.10	.08
Total	.40	.29= .69 cents

4. Battle Deck floor "light" construction on structural steel, with 4″ cinder concrete slab above; ceiling of metal lath and 3-coat plaster.





	Material	Labor
Structural steel	.10	.05
Battle Deck	.22	.09
Cinder fill	.03	.02
1″ cement finish	.03	.06
Metal lath and 3-coat plaster	.10	.08
Total	.48	.30= .78 cents

5. Gypsum slab construction over junior I-beams, with cinder fill and cement finish; under side consisting of metal lath and 3-coat plaster.

	Material	Labor
Structural steel	.11	.06
3″ gypsum slab 15″ x 10′-0″	.19	.07
Cinder fill	.03	.02
1″ cement finish	.03	.06
Metal lath and 3-coat plaster	.10	.08
Total	.46	.29= .75 cents

III. FIREPROOF FLOORS RATED AT 2½ HOURS OR MORE RESISTANCE

6. Standard steel I-beam floor with cinder concrete slab between, plaster applied to underside of slab, 3″ cinder fill above and 1″ cement finish.

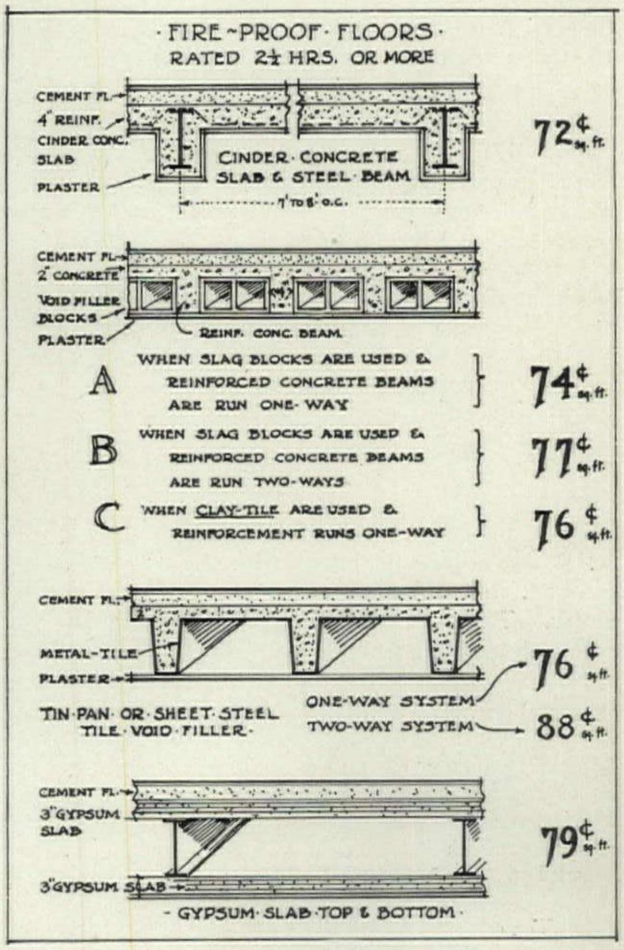
	Material	Labor
Structural steel	.15	.055
4″ cinder arch (inc. forms)	.18	.13
3″ fill—cinder	.03	.015
1″ cement finish	.03	.06
2-coat plaster (inc. beam)	.025	.045
Total	.415	.305= .72 cents

7. Slag block one-way beams between reinforced concrete beams which span from girder to girder in bays of 20 feet. Plaster applied directly to bottom, cinder fill and cement finish above.

	Material	Labor
Structural steel	.07	.035
Slag block	.11	.04
Reinforced steel	.04	.02
Cinder concrete and forms	.135	.07
Cinder fill	.03	.02
1″ cement finish	.03	.06
3-coat plaster	.03	.05
Total	.445	.295= .74 cents

8. Slag block two-way beams between reinforced concrete beams which span from girder to girder in bays of 20 feet. Plaster applied directly to bottom, cinder fill and cement finish above.

	Material	Labor
Structural steel	.07	.035
Slag block	.09	.04
Reinforced steel	.055	.025
Cinder concrete and forms	.155	.08
Cinder fill	.03	.02
1″ cement finish	.03	.06
3-coat plaster	.03	.05
Total	.46	.31= .77 cents



9. Reinforced concrete beam and slab construction. Plaster applied directly to under side of slab and beams, cinder fill and cement finish above.

	Material	Labor	
Reinforcing steel	.09	.045	
Concrete arches and beams (including forms)	.25	.12	
3″ cinder fill	.03	.02	
1″ cement finish	.03	.06	
2-coat plaster (including beam depth)	.03	.05	
Total	.43	.295	=.725 cents

10. Segmental terra-cotta arch, I-beams spaced 5′-0″ on centers running from girder to girder. Three-coat plaster applied to metal lath on ceiling below, cinder fill and cement finish above.

	Material	Labor	
Structural steel	.10	.05	
Terra-cotta arch	.24	.14	
Cinder fill	.03	.02	
1″ cement finish	.03	.06	
Metal lath and 3-coat plaster	.10	.08	
Total	.50	.35	= .85 cents

11. Flat terra-cotta arch, I-beams spaced 5′-0″ on centers running from girder to girder. Plaster applied directly to under side of slab and beams, cinder fill and cement finish above.

	Material	Labor	
Structural steel	.10	.05	
Terra-cotta arch	.27	.19	
Cinder fill	.03	.02	
1″ cement finish	.03	.06	
2-coat plaster	.02	.04	
Total	.45	.36	= .81 cents

12. Gypsum slab top and bottom construction with cinder fill and cement finish; under side two-coat plaster applied direct to gypsum.

	Material	Labor	
Structural steel	.10	.06	
Top 3″ gypsum slab 15″ x 10′-0″	.19	.07	
Bottom 3″ gypsum slab	.10	.07	
Cinder fill	.03	.02	
1″ cement finish	.03	.06	
2-coat plaster	.02	.04	
Total	.47	.32	= .79 cents

13. Metal tile and concrete slab one-way with reinforced concrete beams which span from girder to girder. Three-coat plaster applied to metal lath on ceiling below, cinder fill and cement finish above.

	Material	Labor	
Structural steel	.07	.035	
Reinforcing bars	.05	.02	
4″ cinder concrete (including forms and metal tile)	.16	.105	
3″ cinder fill	.03	.02	
1″ cement finish	.03	.06	
Metal lath and 3-coat plaster	.10	.08	
Total	.44	.32	= .76 cents

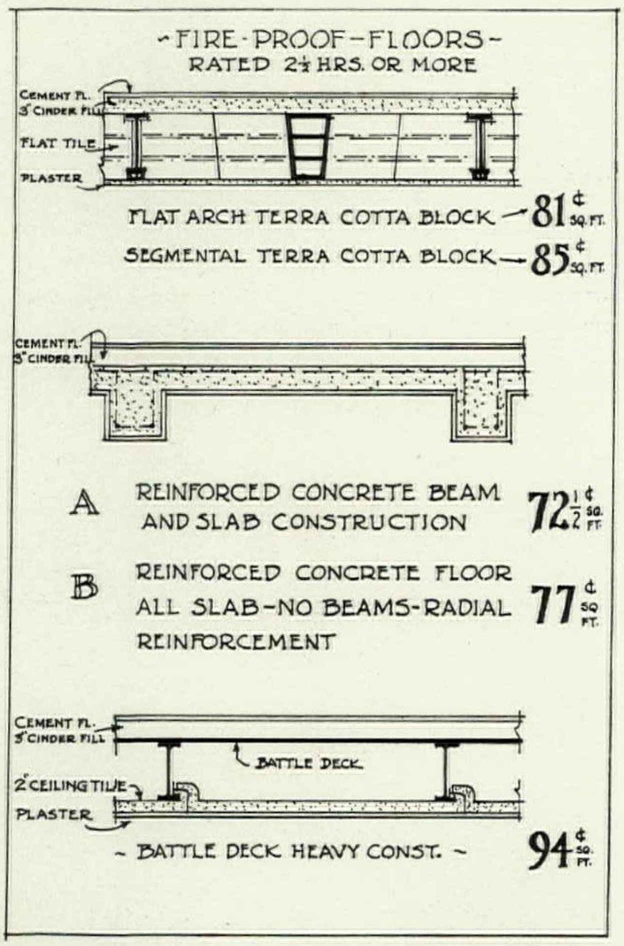
14. Metal tile and concrete slab two-way with reinforced concrete beams which span from girder to girder. Three-coat plaster applied to metal lath on ceiling below, cinder fill and cement finish above.

	Material	Labor	
Structural steel	.07	.035	
Reinforcing bars	.09	.045	
4″ cinder concrete (including forms and metal tile)	.19	.11	
3″ cinder fill	.03	.02	
1″ cement finish	.03	.06	
Metal lath and 3-coat plaster	.10	.08	
Total	.51	.35	= .86 cents

15. Radial reinforced slab consisting of 4″ concrete arch and concrete columns.

	Material	Labor	
Reinforcing steel	.09	.09	
4″ concrete (including forms)	.14	.12	
3″ cinder fill	.03	.02	
1″ cement finish	.03	.06	
2-coat plaster	.02	.04	
	.31	.33	= .64 cents
Add 20% for reinforcing extending into column construction			.13
Total			.77 cents

16. One-way clay tile construction, with cinder fill and cement finish above, two-coat plaster on ceiling below.



	Material	Labor	
Clay tile	.125	.08	
Reinforcing steel	.05	.025	
Wood forms	.07	.04	
Concrete	.09	.05	
Cinder fill	.03	.02	
1″ cement finish	.03	.06	
3-coat plaster	.04	.05	
Total	.435	.325=	.76 cents

17. Battle Deck heavy construction.

	Material	Labor	
Structural steel	.12	.06	
Battle Deck	.24	.11	
Cinder fill	.03	.02	
1″ cement finish	.03	.06	
Ceiling tile	.13	.08	
2-coat plaster	.02	.04	
Total	.57	.37=	.94 cents

Lack of space prohibits an itemized detailed estimate of each of the above, so we have limited ourselves in this connection to going into detail with the two kinds of construction most commonly used.

I.

WOOD JOIST CONSTRUCTION

(Price Per S. F.)

Average span assumed to be 16′-0″; construction—wood joists 2″ x 10″, spaced 16″ on centers, with bridging, live load of 40 lbs. per S. F., joists rest on exterior bearing wall; under-flooring of 1″ x 6″ T. & G. laid diagonally over floor joists, then layer of heavy building paper, on top of which is laid 13/16″ x 2¼″ face select oak flooring, scraped, and finished with stain and wax; underneath floor joists wood lath and three-coat plaster, hard white finish.

Floor Joists

Material—2″ x 10″—16″ o.c.=

$$\frac{2 \times 10}{12} \times \frac{3}{4} = \frac{5}{4}$$

$\frac{5}{4}$ F. B. M.=1.25 F. B. M.

10% added for waste—

1.25+.13=1.38

1.38 F.B.M. @ $37.00 per M.	$ .051	
Labor—Carpenter 1.38 x .012 hrs. per F.B.M.=.017 hrs. @ $1.50 per hour	.026	
		$ .077

Bridging

Material—on the assumption that there are 3 L.F. of bridging to each set, and that there are two sets to a 16′ span it may therefore be assumed that there are 3 x 2/16=6/16 or ⅜ L.F. per running foot of floor joist; bridging being 1″ x 3″ or ¼ F.B.M.= ¼ x ⅜=3/32 F.B.M. per L.F. beam—3/32 F.B.M. @ $35. M.=	.004	
Labor—a carpenter will set about 60 linear feet per hour or 15 F.B.M. 3/32 x 1.15=1/160 hrs. 1/160 hrs. @ $1.50 per hour—	.009	
		$ .013

Underflooring

Material—1 S.F. floor surface will require 1 F.B.M. plus 15% waste, or 1.15 F.B.M. 1.15 F.B.M. @ $28. per M.	.032	
Labor—a carpenter will lay 1000 F.B.M. of underflooring in 10 hours, or 100 ft. per hour 1.15 F.B.M. x .01 hours=.0015 hours per S.F. flooring. .0015 hrs. @ $1.50 per hour=	.017	
		$ .049

Building Paper

Material—1 S.F. plus 10% allowance for waste=1.10 S.F. @ .005c. per S.F.	.006	
Labor—approximately ½ cost of material	.003	
		$ .009

Finish Flooring

Material—allowance for waste using 13/16″ x 2¼″ face oak flooring is 33-1/3%; therefore 1 S.F. floor area will require 1.34 F.B.M. of flooring 1.34 F.B.M. @ $80. M.=	.107	
Labor—laying oak flooring a carpenter will take 2½ hours to place 100 F.B.M. which is 40 feet per hour (this includes scraping)—expressed in terms of decimals this is .025 hrs. per board foot 1.34 F.B.M. x .025 hrs. per B.F.=.0335 hrs. per S.F. @ $1.50 per hour=	.050	
Labor and Material—for staining and waxing—per S.F.	.030	
		$ .187

Lath and Plaster on ceiling below

Lath

Material—1.55 lath per S.F. @ $5.00 per M.=	.008	
Labor—lather will average 150 lath per hour; in terms of a decimal this is .0067 hrs. per lath 1.55 x .0067= .0104 hrs. per S.F. .0104 @ $1.50 per hour=	.016	

Plaster

Material for one square foot: neat—1.4 lbs. @ $14.00 ton.	.010	
Sand—.0014 C.Y. @ $1.75 C.Y.	.003	
Lime—.0017 bbls. @ $3.00 bbl.	.005	
Plaster of Paris—1 lb. @ $17.00 ton	.001	
Labor—		
Plasterer—.024 hrs. @ $1.50 per hour	.036	
Laborer—.024 hrs. @ $1.00 per hour	.024	
		$ .103

Nails

For floor joists—.06 lbs. per S.F. @ .04	.003	
For bridging—.01 lbs. per S.F. @ .04	.001	
For underflooring—.02 lbs. per S.F. @ .04	.001	
For finish flooring—.057 lbs. per S.F. @ .04	.003	
For wood lath—.015 lbs. per S.F. @ .06	.001	
		$ .009

RÉSUMÉ
(Cost Per S.F.)

Floor joists	$ .077
Bridging	.013
Underflooring	.049
Building paper	.009
Finish flooring	.187
Lath and plaster—lath .024, plaster .079	.103
Nails	.009
TOTAL	$ .447

II.

REINFORCED CINDER CONCRETE SLAB FLOOR CONSTRUCTION

(Price Per S. F.)

Average size slab assumed to be 20′ x 20′; construction steel frame office building, live load 70 lbs. per S. F. typical bay of four columns, two girders, two beams, and two junior beams; cinder concrete 4″ thick, 3″ cinder fill, 1″ cement finish, ½″ plaster ceiling below, and wire mesh used for reinforcing.

STRUCTURAL STEEL

5.1 lbs. @ $ .04 (labor and material)		
		$ .204

WOOD FORMS

Material—		
1″ x 4″ bracing 0.9 F.B.M. @ $28. M.	.025	
1″ x 4″ sheathing		
Wire—.1 lbs. per S.F. @ $ .07 lb.	.007	
Labor—		
Setting braces		
Setting sheathing		
HOURS		
Laborers .03 @ $1.00	.030	
Carpenters .04 @ $1.50	.060	
Labor removing forms—		
Laborers .03 @ $1.00	.030	

WIRE MESH

Material .74 lbs. per S.F. @ $ .04 lb.	.030	
Labor setting wire—lathers .005 hours @ $1.50 hr.	.008	

CINDER CONCRETE

Material—		
Cinders .017 C.Y. @ $1.50 C.Y.	.026	
Cement .022 bbls. @ $2.15 bbl.	.047	
Sand .007 C.Y. @ $1.75 C.Y.	.012	
Labor—		
Laborers' hours .028 @ $1.00	.028	
Mixer hours .0013 @ $1.25	.002	
Hoist hours .0013 @ $2.00	.003	
Foreman hours .0013 @ $1.75	.003	
		$ .311

CINDER FILL

Cinders—material .017 C.Y. @ $1.50	.026	
Labor—		
Laborers' hours .015 @ $1.00	.015	
Hoist hours .001 @ $2.00	.002	
Foreman hours .001 @ $1.75	.002	
		$ .045

CEMENT FINISH

Material—		
Cement .01 bbls. @ $2.15 bbl.	.022	
Sand .003 C.Y. @ $1.75 C.Y.	.005	
Labor—		
Cement finisher hours .03 @ $1.50	.045	
Laborers' hours .015 @ $1.00	.015	
		$ .087

PLASTER ON CEILING BELOW

Materials—two-coat job		
Neat 1.1 lbs. @ $14. ton	.008	
Sand .001 C.Y. @ $1.75 C.Y.	.002	
Plaster of Paris .12 lbs. @ $17. ton	.001	
Lime .0017 bbls. @ $3.00	.005	
Labor—		
Plasterer hours .013 @ $1.50	.019	
Laborer hours .013 @ $1.00	.013	
	$ .048	
Note—50% must be added for beam depths	.024	
		$ .072

RÉSUMÉ

Steel—structural		$ .204
Wood forms	$ .152	
Wire mesh reinforcing	.038	
Cinder concrete	.121	.311
Cinder fill		.045
Cement finish		.087
Plaster on ceiling below		.072
		$ .719

Editor's Note:—*This is the sixth article in a series by Messrs. Saxe and Walsh that has appeared in* PENCIL POINTS. *The first one, published in August, 1931, was entitled "Estimating is More Than Figures." The second in the series, "Removing the X from Excavations," appeared in September, 1931, and "Wasting or Saving Money in Foundations" was published in the November, 1931, issue. In February of this year "The Comparative Costs of the Walls of Country Houses" was published and in May, "Saving Through Careful Superintendence." The next article by Messrs. Saxe and Walsh will cover alteration jobs and will appear in an early issue.*

The Geometry of Architectural Drafting

21—Organizing the Orthogonals

By Ernest Irving Freese

Editor's Note:—*This article, which is copyrighted, 1932, by the author, continues the series begun in August, 1929. The last part heretofore published appeared in our May issue and began the discussion of orthogonal circles which is carried on below.*

In all, there are but twelve general problems dealing with orthogonal circles that are simple enough to meet the requirements of practical drafting. The general and applied graphical solutions of these twelve problems are recorded in the following twelve Figures numbered 193 to 204, inclusive: the solutions being based on the mathematically-provable properties and geometric relations of orthogonal circles heretofore set forth at Diagram "1" of Figure 182 in Part 20. All constructions to follow herein are original with the author. Each Figure states a geometrical problem, records its general solution, and instances one or more practical applications. All applications carry the same set of reference letters as the general solution, thus, in most instances, rendering the one short explanation sufficient and, moreover, clearly identifying the applications with the geometrically-stated conditions accompanying each particular problem.

All problems of circle construction contained in this Part have one requirement in common; namely, *to draw a circle Y, orthogonal to, or at right angles to, a given circle K,* under the certain other limitations or controlling conditions that are clearly stated for each one of the twelve problems. As far as practicable, the uniform nomenclature already established in Part 19

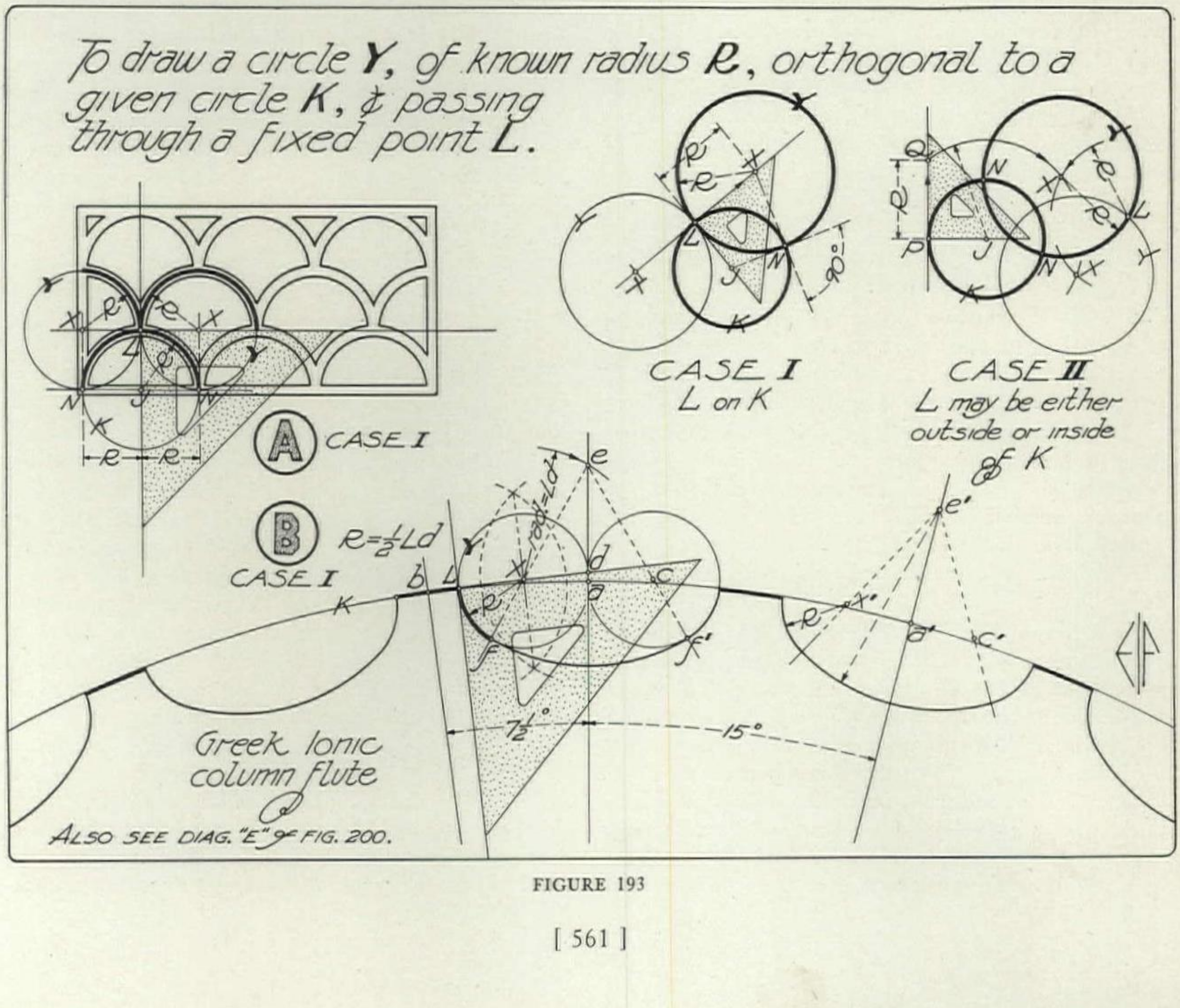


FIGURE 193

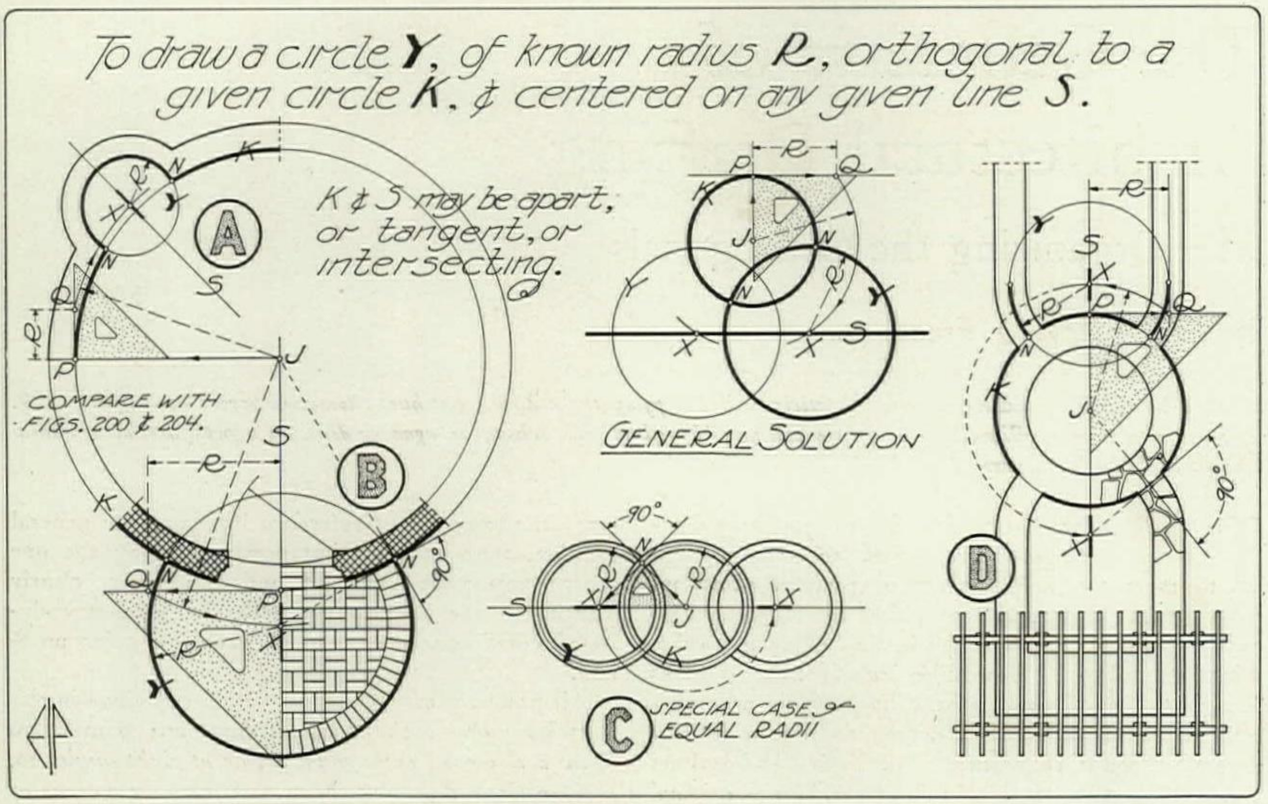


FIGURE 194

has been used in this Part, with the additional designations K and K' for the given circle, or circles, to which the required circle Y shall be *orthogonal*. Also, as in Part 19, you will find that, in many cases, more than one circle will exactly satisfy the stated *general* problem, but that the particular application makes it evident which of the circles is the required one. Now we can get going again:—

Figure 193:

CASE I. On a line drawn through L, and tangent to K, make LX equal to R.

CASE II. On *any* convenient line drawn tangent to K, make PQ equal to R. From the center J, with radius JQ, and from L as a center, with radius R, cross arcs at X, the required center of Y.

At Diagram "A," the fixed point L is the crown point of K; and the radius of Y is obviously known, being the same as the radius of the given circle K. An alternate method of laying out this simple geometric pattern has been shown in Part 20 at Diagram "1" of Figure 184. It is the groundwork of many differing designs.

At Diagram "B," the distance ab is 1/48th of the circumference K; and the distance bL, in classical proportions, is 1/40th of the radius of K. Whence, L becomes a fixed point on K; and the radius of Y becomes one half the then-known tangent-distance Ld, thus fixing X which is the required center of Y. Center C is, of course, symmetrical with X in respect to the center line of the three-centered flute. Center e is then easily found as indicated, from which the arc ff' is swung. To quickly transfer these three centers into position for drawing the cross-sectional contour of any other flute—in full size detailing, especially—do this: Draw a firm hard pencil line on a piece of tracing paper or cloth; make this pencil line exactly register with the radial upon which e is located; indent the tracing with the three centers e, X, C, and with the division-point a; then move the tracing into a position of registry with the next division-point, say a', and its corresponding radial; then indent the new centers e', X' and C' directly through the similar indented points of the tracing. And so on. The expedient is fast and accurate and of general application.

Figure 194:

On *any* convenient line drawn tangent to K, make PQ equal to R. From the center J, of the given circle K, revolve Q to cross S at X.

The above general solution applies regardless of the position of S, and regardless of whether S is a straight or curved line. In architectural drafting, however, S is almost invariably a straight line passing through the center J of K, as in all the applications here shown. When the given and required circles are of *equal* radii, the special solution is even more direct, as is shown at Diagram "C," and becomes identical with that shown as one of the tricks of the orthogonal "twins" at Diagram "1" of Figure 183 in Part 20.

Figure 195:

CASES I and II. Draw a line paralleling U at the perpendicular distance R therefrom. On *any* convenient line drawn tangent to K, make PQ equal to R. From the center J, revolve Q to cross the afore-

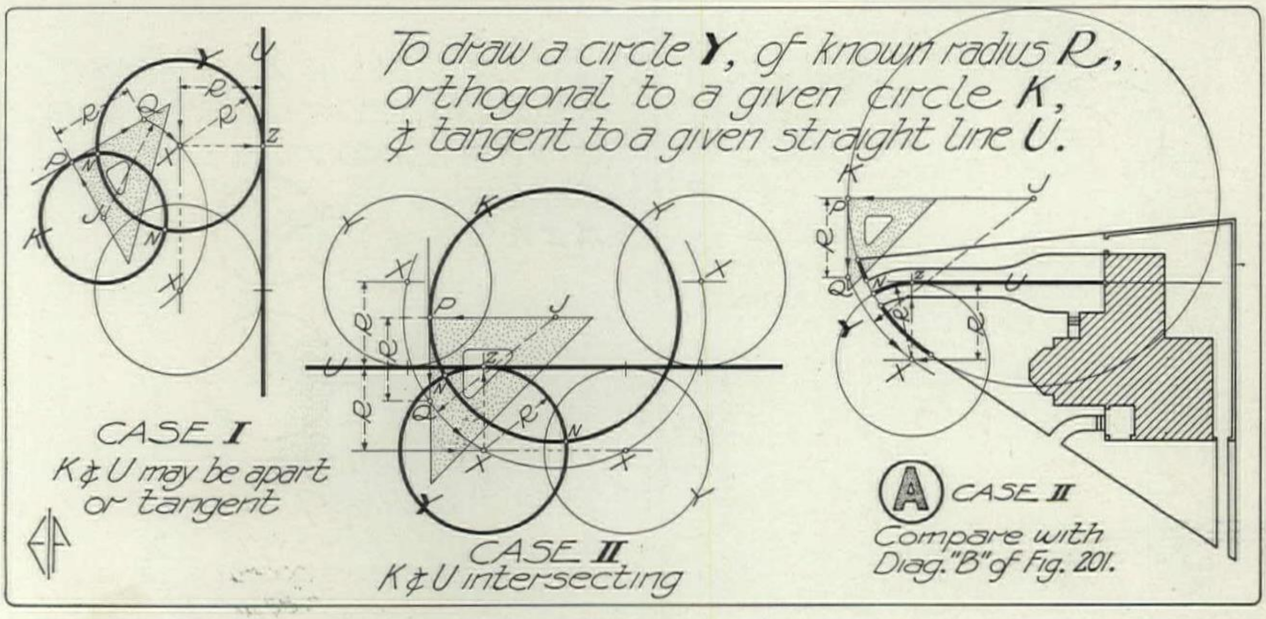


FIGURE 195

drawn locus at X, the required center of Y. Under CASE II note that four circles may be drawn, each of which will satisfy the imposed conditions of solution, but only one of which is usually required. In all cases, however, any one of the resultant circles meets the given circle *normally* at the intersection points designated as N; and the required circle comes tangent to the given circle at the projected point Z, the projector XZ being square with U.

In the application at Diagram "A," the center-line radius R, of the driveway, can either be taken as the minimum consistent with the proper operation of the car on the turn, or it can be assumed as any greater radius. The solution of the problem then results in the center line of the driveway meeting the curved property line at *right angles*—a desirable condition from every standpoint.

Figure 196:

On *any* convenient line drawn tangent to K, make PQ equal to R; and on *any* convenient line drawn through the center C of D, make $P'Q'$ also equal to R. Then, from the given centers J and C, and with radii JQ and CQ', respectively, cross arcs at X, the required center of Y. Note again, that the general construction may possibly yield four circles, all satisfying the general stated conditions of the problem, and depending upon the relative sizes and relative positions of the two given circles K and D.

In the application at Diagram "A," the radius of K is used as the radius of Y, that is, R equals half of the span S, as indicated. Under these fixed conditions, the full cusped foil $P'NZ$ will be possible only when the radius r, of the given circle D, is equal to or greater than 1.31 times the corresponding span S, as noted on the Diagram. Otherwise, point Z will fall *beyond* the crown point of the arch. When r exactly equals 1.31 times S, then the tangent point Z, which is the upper extremity of the full foil, becomes *coincident* with the crown point of the arch. For various other layouts of orthogonal cusping, see Figure 192 in Part 20, which Figure also exhibits a layout at Diagram "6" that is based on the construction here just discussed.

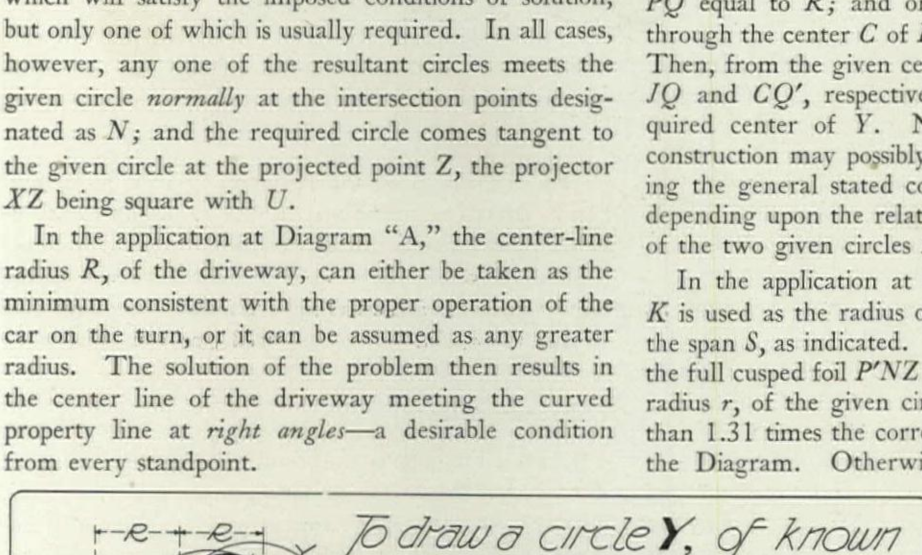


FIGURE 196

Figure 197:

CASE I. On *any* convenient line drawn tangent to K, make PQ

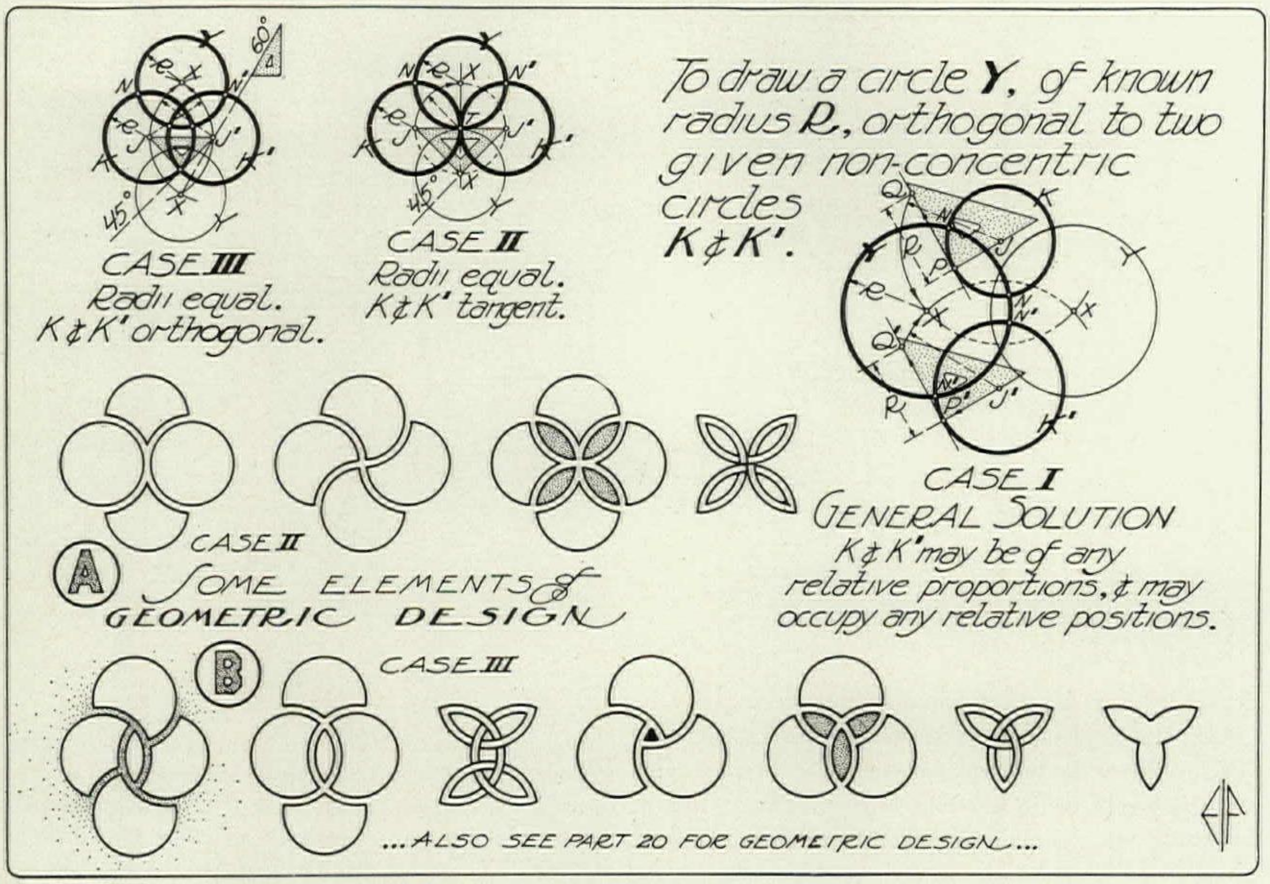


FIGURE 197

equal to R; and on *any* convenient line drawn tangent to K', make $P'Q'$ also equal to R. Then, from the given centers J and J', with radii JQ and $J'Q'$, respectively, cross arcs at the required center X.

CASE II. Make TX, square with JJ', equal to R.

CASE III. Here, X lies at the apex of an equilateral triangle whose base is JJ'. The two methods of locating X are made obvious.

CASES II and III of Figure 197 are exceedingly simple special solutions, and they are useful in the field of geometric design. The orthogonal "triplets" and "quadruplets" of Case III surely run the "twins" of Part 20 close seconds for championship as geometric acrobats! An almost never-ending series of motifs and combinations are resident in these equal-radius constructions; a few such elements being shown in the Figure.

The foregoing five problems, Figures 193 to 197, inclusive, together with all the problems set forth in *Part 19*, cover *all possible cases* of circle construction wherein the radius of the required circle is a *known* factor of the controlling or imposed conditions. Wherefore, in all other circle problems herein and hereinafter presented and solved, the radius of the required circle is *unknown*, hence, must be determined by the resultant construction. Since this Part deals exclusively with *orthogonal* circles, the next following seven problems are of the same type, though differing from the foregoing five in that the *radius* of the required circle must now be *found*:—

Figure 198:

Draw a tangent to K through any convenient point T thereon. From the center J, of the given circle K, revolve C to cross this tangent at Q. Then the distance TQ, which is here designated as r, is the *required* radius of Y. A circle Y, of this radius, swung from the given center C, will cross K at *right angles* at the two points thereon designated as N.

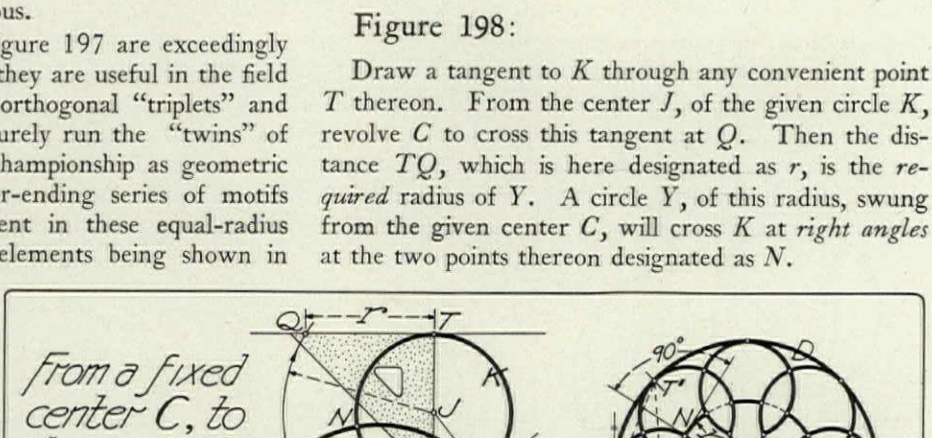


FIGURE 198

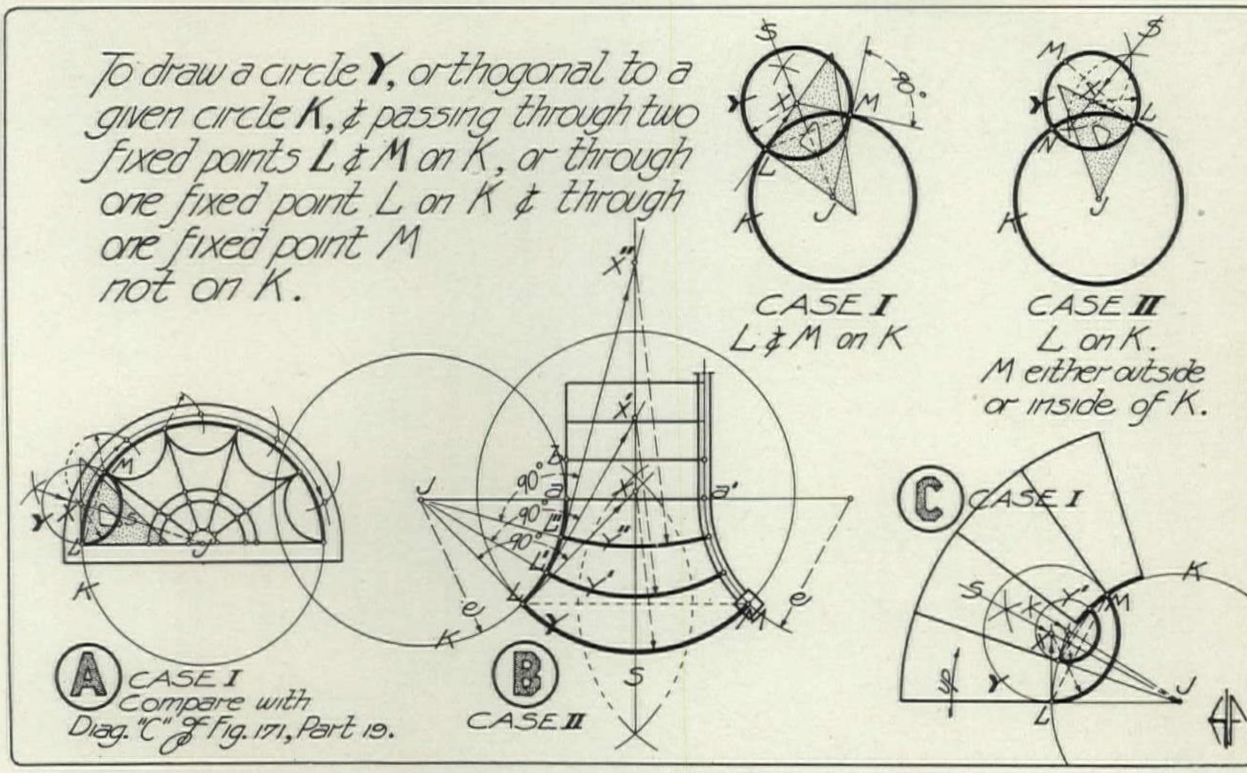


FIGURE 199

In the applied solution at Diagram "A," the given circle K is one of any number of equal orthogonal circles inscribed in any circle D. The method of accomplishing this inscription has already been covered in Part 20 at Figure 191, and forms no portion of the problem here stated, though, for the sake of completeness, the method will herein be repeated: Draw a tangent to D through the division-point T thereon; from T as a center, revolve C to cross this tangent at A; from the center C draw a line paralleling the imaginary line connecting the two consecutive division-points T' and T; then, from the same center C, revolve A to cross the last-drawn line at B. Then the projected line BT' locates J which is the center of K. This circle K then becomes the *given* circle of the general problem here first stated and solved, namely, *from a fixed center* C, *to draw* Y *orthogonal to* K. All right: do it. Next!

Figure 199:

CASES I and II. Draw the perpendicular bisector, S, of the imaginary chord LM. Project a line from L, tangent to K, to cross S at X. Under CASE I, note that the crossing of the *two* tangents projected from the K-points L and M, respectively, will *also* locate X. Whence, in both cases, XL or XM then becomes the required radius of Y, as indicated.

In the application at Diagram "A," the solution becomes identical with the general method of scalloping and fluting heretofore set out in Part 20 at Figure 191, the point L being the same in both Figures.

At Diagram "B," the solution determines the centers and radii of the curved riser-lines such that each will spring *normally* from the spaced-off fixed points L, L', etc., on the flared circular string K. Here, S is the center line of the flight, hence, S is also the common bisector of all required arcs, hence, all centers lie on this line, as shown, and are quickly located by lines projected perpendicular to the various radials JL, JL', etc. Remember: a tangent drawn through any given point on a circle makes a *right angle* with the radial drawn through the same point.

At Diagram "C," the bull-nosed risers are properly returned to a normal intersection with the circular wall line of the stair well.

Figure 200:

CASE I. On a line projected through L, tangent to K, cross S at X. Then XL is the required radius of Y.

CASE II. On a line drawn square with S, make LP equal to the known radius of the given circle K, which radius is here conveniently designated as r. Now cross S at X with the perpendicular bisector of the imaginary line PJ. Whence, XL is the required radius of Y.

At Diagram "A," the circular boundary lines Y, Y', and Y'', of the lower and upper basins of a cascaded fountain, are so determined that, at the fixed points L, L', and L'', said lines will spring *normally* from the wall-curves K and K''. The other applications at Diagrams "B," "C," "D," and "E," are easily recognizable, but some additional useful information is recorded in the application at "E," which it may be well to make more explicit:—

Let K, at Diagram "E" of Figure 200, be a full size portion of a column-circumference as laid down on the board for the purpose of detailing the fluting;

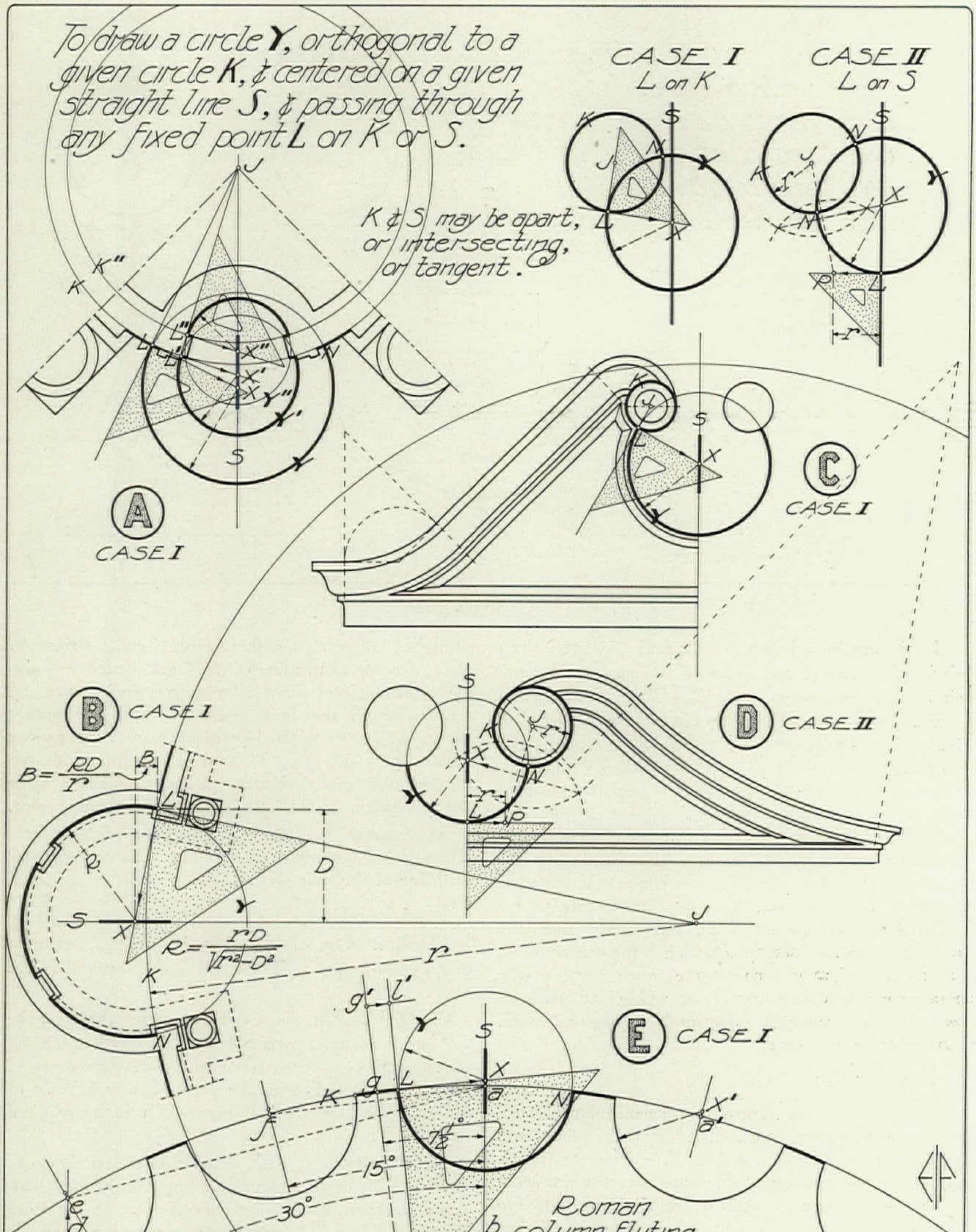

To draw a circle Y, orthogonal to a given circle K, & centered on a given straight line S, & passing through any fixed point L on K or S.
CASE I
L on K
CASE II
L on S
K & S may be apart, or intersecting, or tangent.
A
CASE I
C
CASE I
B
CASE I
$B = \frac{RD}{r}$
$R = \frac{rD}{\sqrt{r^2-D^2}}$
D
CASE II
E
CASE I
Roman column fluting
bd = ½ rad. of column
30°
15°
7½°
ALSO SEE DIAG. "B" OF FIG. 193.

FIGURE 200

and let S be the center line of a proposed flute. Make bd, on any line square with S, equal to half the radius of K. Then the projector de, paralleling S, precisely locates a point e removed 30 degrees from a, or two flute-spacings therefrom. And the perpendicular bisector of ea then locates f. And the perpendicular bisector of fa fixes g, which latter point on K is the center of the fillet. Now, in classical proportions, the width of the fillet is 1/20th the radius of the column. Hence, the distance gL is required to be 1/40th the radius of the column. Suppose this radius is 2′-10¾″, which is 34¾ inches. Make gg', on a radial line, equal 5¼ inches which, added to the column radius, makes the point g' exactly 40 inches from the center of the column. And 40 divided by 40 is 1. So, make $g'l'$, perpendicular to the radial, equal 1 inch. Now you can locate point L on K by a radial projected from the point l'; whence, gL is the required 1/40th of the column radius, since $g'l'$ is 1/40th of the assumed radius, and since, for such a relatively short arc, a tangent to same, limited by the same radials, is practically the same length as the arc. Now, having located point L, the center X of the flute is speedily found as per CASE I of the stated problem. Of course, at small scale, it is sufficiently exact, and more expeditious, to assume X at a; it is only in full-size detailing, and in actual execution, that the refinement here worked out is appreciable.

At Diagram "B," Figure 200, note that the dimensioning formulas are also given, since such figured dimensions will be required on the working plans. In the other instances, however, full-size detailing of the millwork ordinarily *obviates* figured dimensioning, but *all centers should be unmistakably marked on the details*—not carefully concealed as is more customary! It is even advisable, at times, to indicate on the details —especially on those drawn to *scale*—the *geometrical construction* for locating such centers.

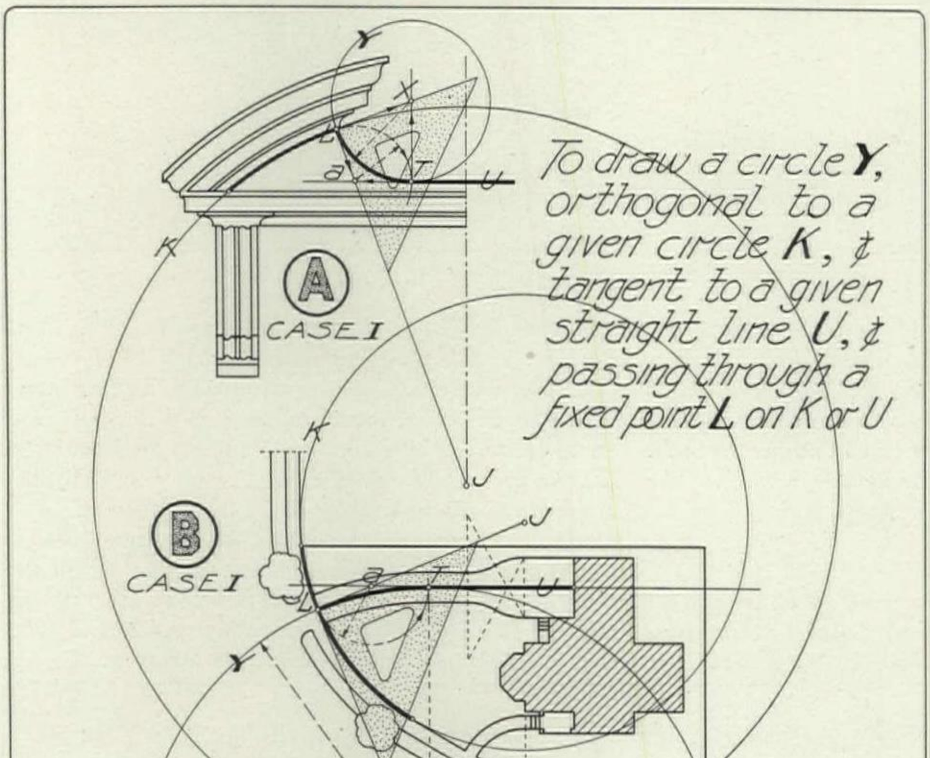


FIGURE 201

Figure 201:

CASE I. On the given line U, fix the point a collinear with LJ; and, from this point as center, revolve L to T on U. Now, a line square with U, projected from T, and a line tangent to K, projected through L, will cross at X. So there you are: XL is the required radius of Y. Note that two circles may be drawn, each fulfilling the *general* statement of the problem.

CASE II: Make LP equal to the radius r of the given circle K. Then cross the perpendicular bisector of PJ at X with a line from L projected square with U. Well, that's it again: XL is the required radius of Y.

At Diagram "A," the limiting conditions are clearly evident. At Diagram "B," a desirable tree—or a fire-hydrant, or a whatnot — governs the fixation of point L. For the purpose of figured dimensioning, a careful *scaling* of the resultant radius XL, of Diagram "B," will here be sufficient — to the nearest inch, say. On the job, this radius would then be laid off on the tangent line LX. And the *direc-*

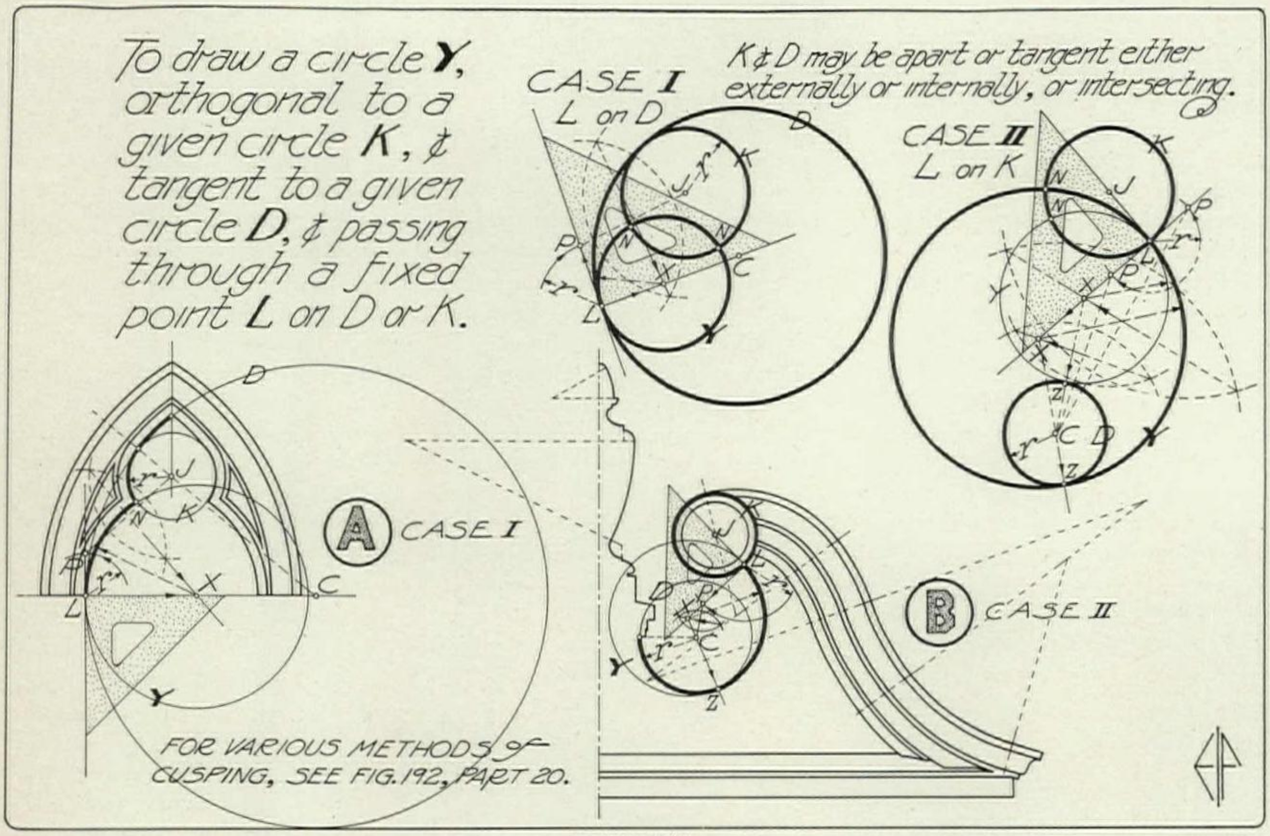


FIGURE 202

tion of this tangent line could easily be determined without recourse to the remote—and probably inaccessible—center J. How? Well, like this: Place two stakes as far apart as practicable on the arc of the lot line, each stake at the same taped distance from L. Then strike LX *paralleling the line established by the two stakes*. Do you know why?

Figure 202:

CASE I. On a line drawn through L, tangent to D, make LP equal to the radius r of the *other* given circle K. Now cross the radial LC at X with the perpendicular bisector of the imaginary line PJ. You have found XL, the required radius of Y.

CASE II. On a line drawn through L, tangent to K, make LP equal to the radius r of the *other* given circle D. Then cross this same tangent at X with the perpendicular bisector of PC. Again, you have discovered the required radius of Y: it's XL again! But you'd better make sure which of the two possible circles you need—for XL of one is not the XL of the other. In other words, the XL of the other is the other XL. Now you can probably understand why such a simple problem can appear so involved.

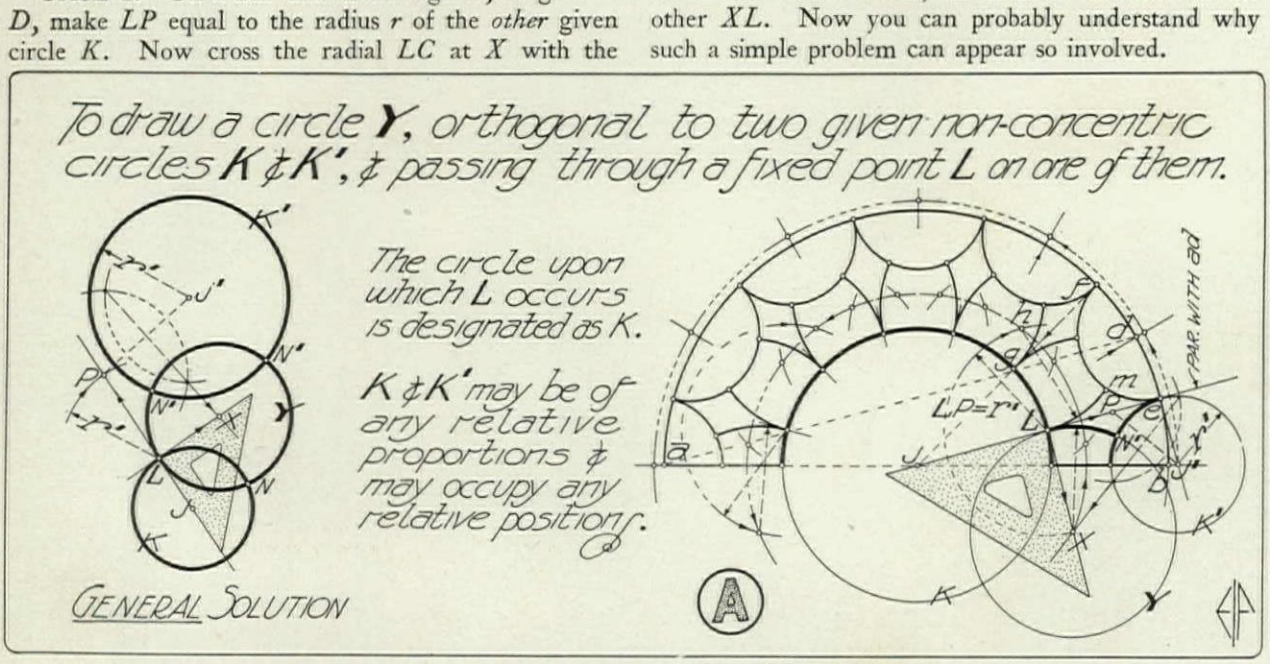


FIGURE 203

Figure 203:

On a line passing through J, make LP equal to the radius r' of the *other* given circle K'. Then draw another line through L, and *tangent* to K. Cross this tangent at X with the perpendicular bisector of PJ'. Then XL is the required radius of Y. In the fan light at Diagram "A," all information is given for the complete layout, only a portion of which is an application of the general problem here stated. Center J' is controlled by the location of the division-point e; and the radius of K may be any desirable one.

Figure 204:

From the center J, of the given circle K, project a line square with the bisector S to cross U at the point a. From this point as center, revolve b to T on U. Project TX square with U. Whence, XT is the required radius of Y. Now suppose you want to continue this line of orthogonal circles under the same conditions stated in the Figure. Easy! From the crossing N, draw a prolonged line directed to the vertex d. Then, since this point is the *center of similitude*, all other intersection-points N', N'', etc., of succeeding inscribed orthogonal circles, will lie on this line Nd or on dN prolonged. Also, using one set, *only*, of the two sets of similar reference letters having aJ in common, XN' will parallel JN; and $N'X'$ will parallel NX. But NX is square with JN. Hence, $N'X'$ is square with XN'. In other words, by repeatedly projecting one locus at *right angles* to the preceding one, both being limited by the bisector S and by the line through N and d, you can go on forever inscribing such circles within this angle, and in either or both directions, without drawing another construction line.

In the application at Diagram "A," K is the given line of a circular wall within the rectangular limits established by the tangent lines U and V. The applied solution then yields the circular exhedra line Y, springing at *right angles* from the circular wall line K, and just fitting into the angle formed by the structural lines U and V: thus not only conserving the otherwise wasted space, but conserving it to the maximum possible extent consistent with good design and the principles of good construction. The mathematical formula for computing the required radius R is given with this application, since this dimension will be required on the working drawings. Take particular note, however, that the recorded *geometric* layout is perfectly *general* regardless of the magnitude of the angle at d; whereas, the dimensioning formula applies only when, as here shown, this angle is *90 degrees*. As a matter of fact, for this *particular* case, a somewhat more direct method of locating X geometrically is also available; namely, project a 30-degree line from J to cross K at N, and then project a 60-degree line from N to cross S at X. In other words, for a 90-degree angle d, the angle bJN becomes exactly 15 degrees; hence, the radius R becomes equal to the trigonometri-

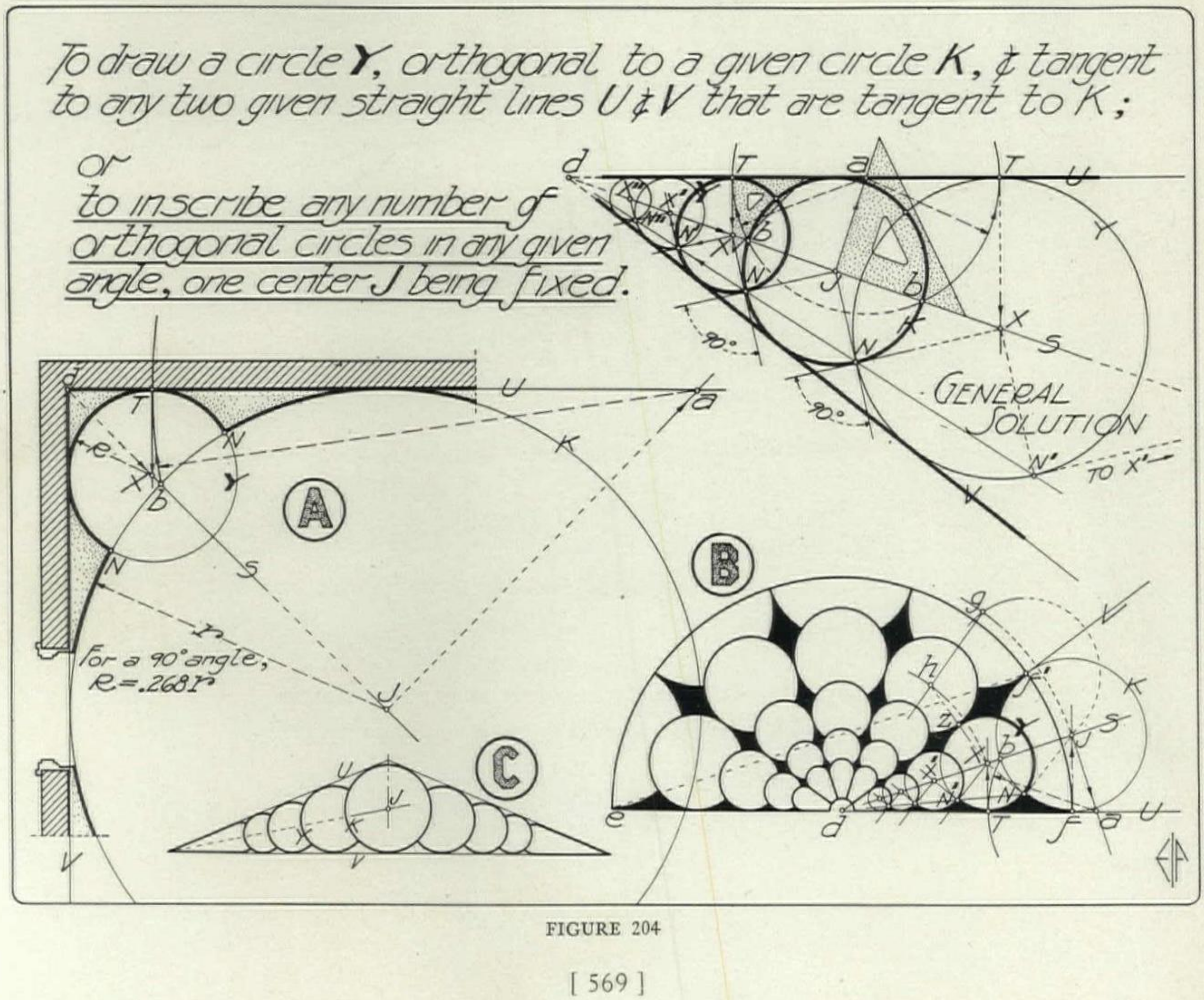


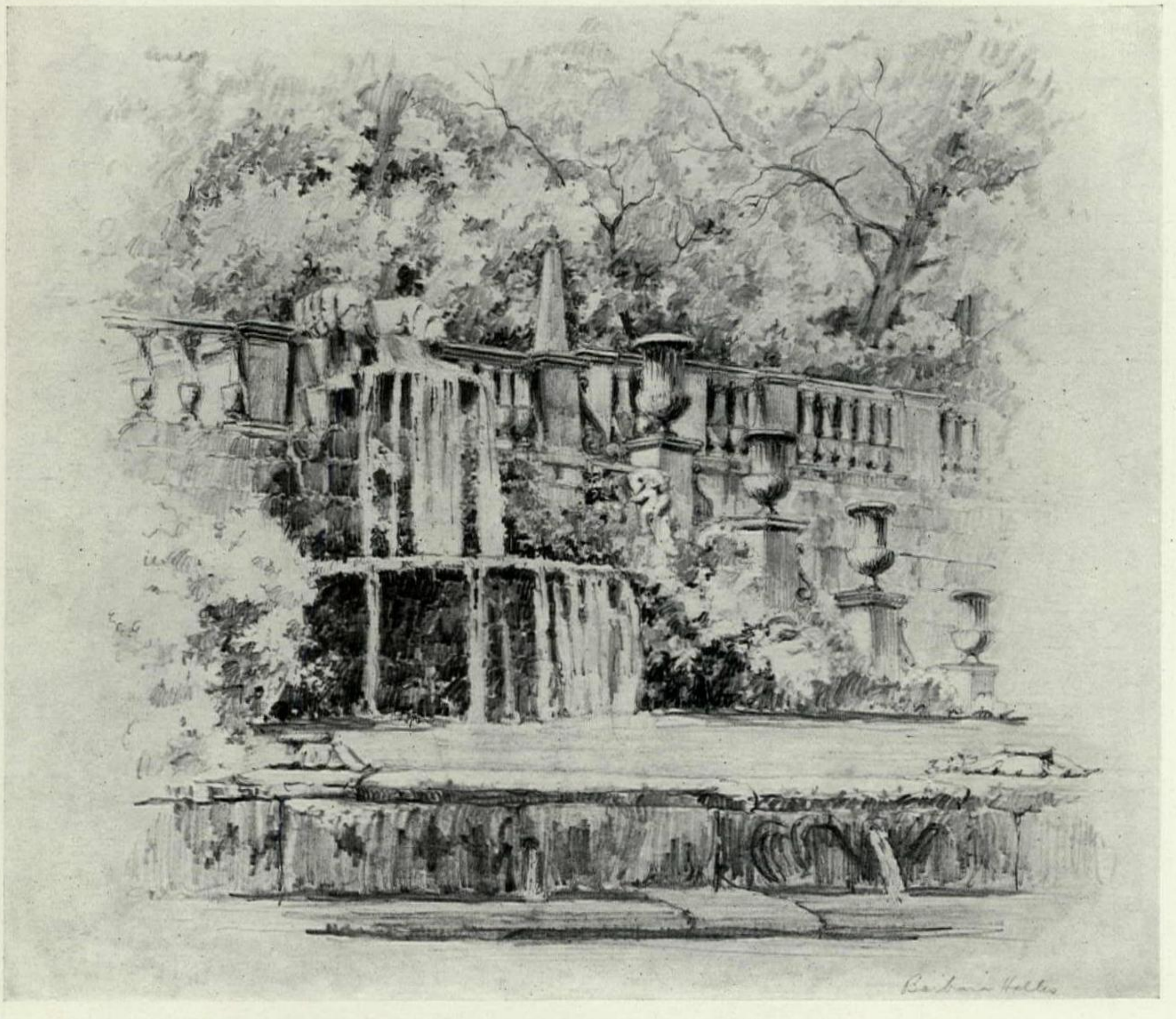
FIGURE 204

cal tangent of 15 degrees multiplied by the radius *r*, as the formula there given shows. (The trigonometrical tangent of 15 degrees is 2 minus the square root of 3, or, practically, the decimal .268 as given.)

The other two applications of the problem stated and solved in Figure 204 are but faintly indicative of the innumerable ways in which this new geometric construction may be put to work. Its basic property, a discovery of the author, is this: the tangent distance from point *a* to the tangent points of the adjoining inscribed orthogonal circles, is exactly equal to the distance *ab*, as indicated by the circle described from point *a* as center.

Figure 204 here finishes all problems dealing with "circles at right angles."

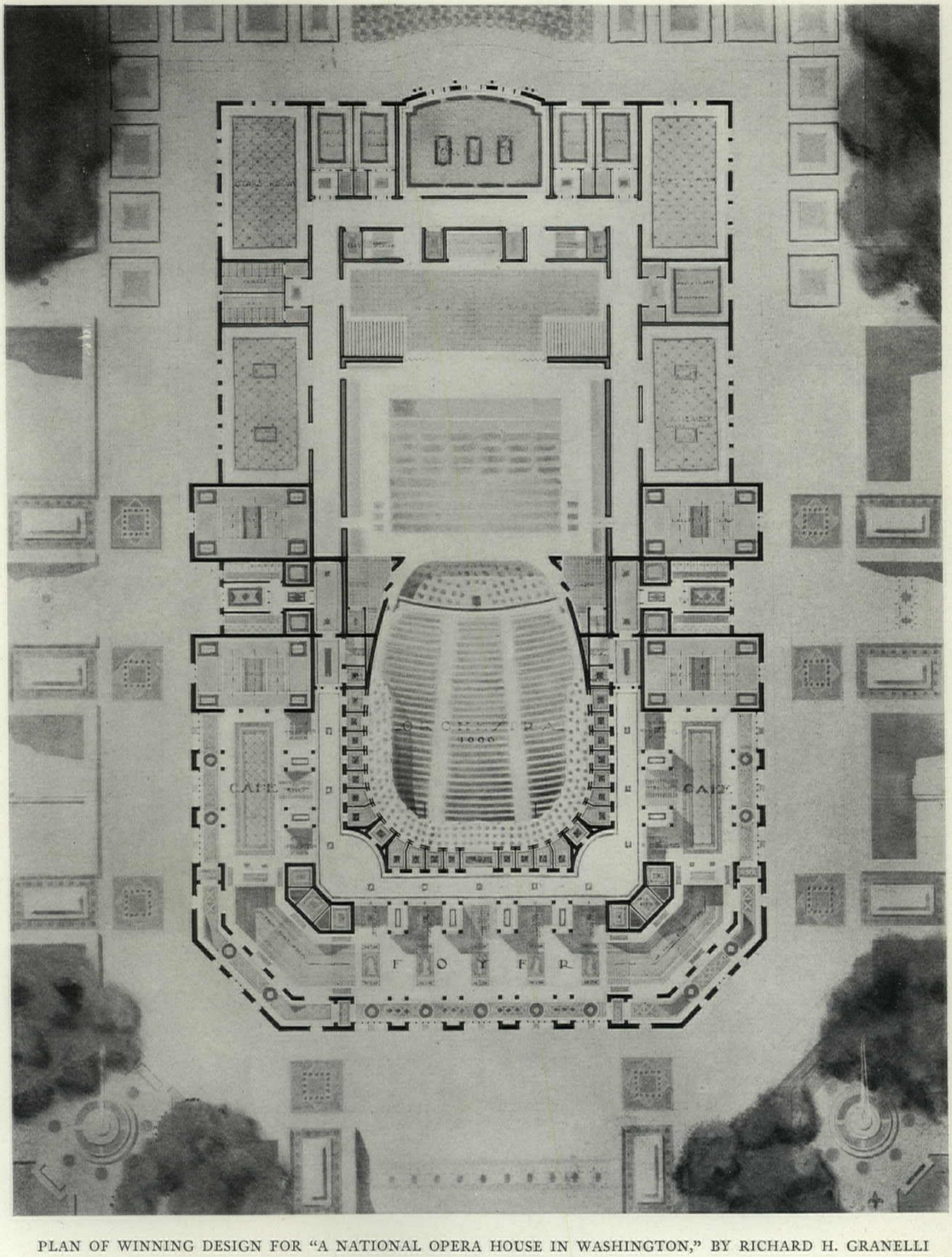
Part 22, following, records "Some Short-cuts with the Triangles," and some equally short-cutting methods of dimensioning pertinent thereto.



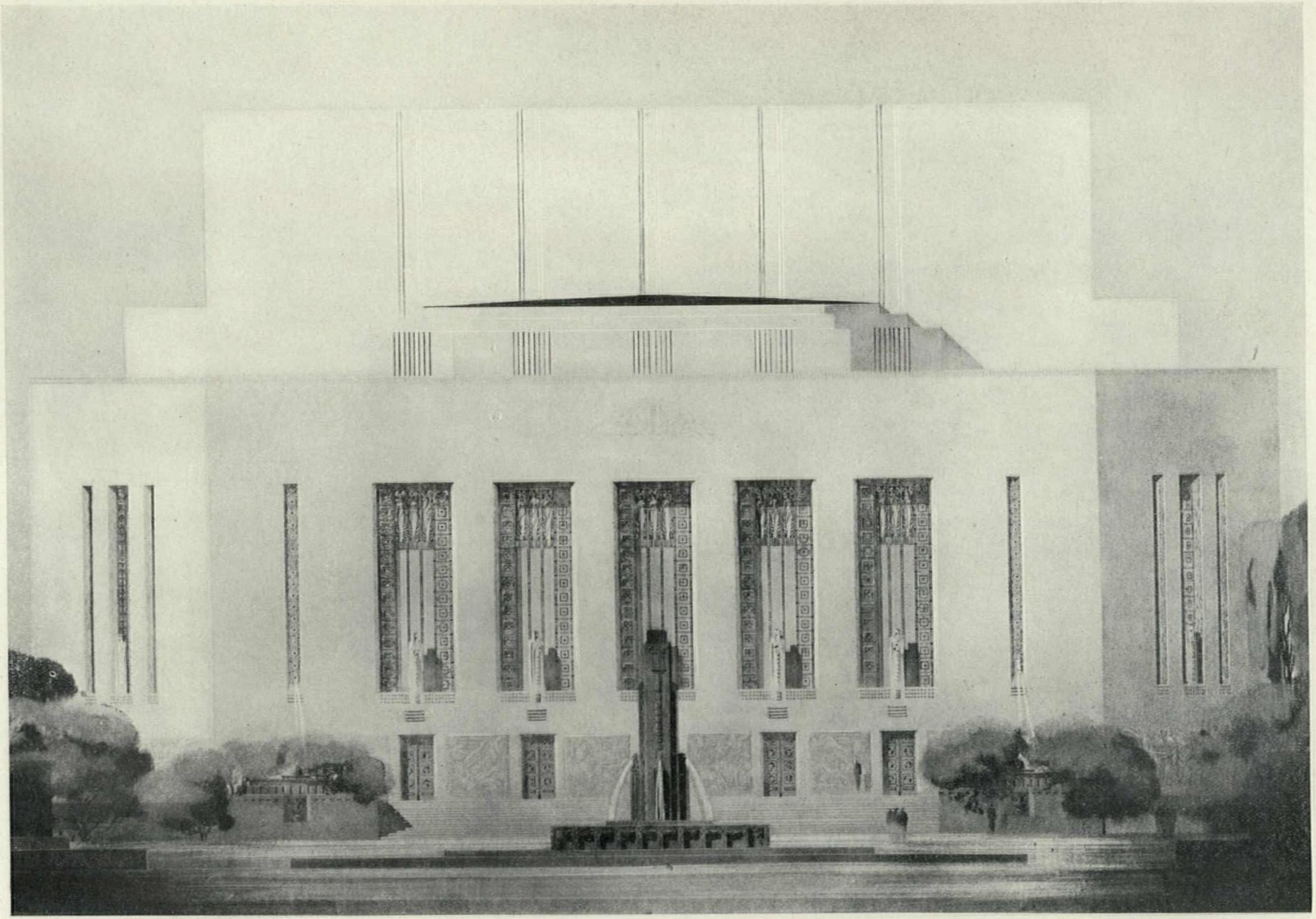
VILLA D'ESTE—FROM A PENCIL DRAWING BY BARBARA HOLLIS

THIRD YEAR WORK, CAMBRIDGE SCHOOL OF LANDSCAPE ARCHITECTURE

Paris Prize in Architecture, 1932



PLAN OF WINNING DESIGN FOR "A NATIONAL OPERA HOUSE IN WASHINGTON," BY RICHARD H. GRANELLI
COMPETITION FOR THE 25TH PARIS PRIZE OF THE SOCIETY OF BEAUX-ARTS ARCHITECTS



ELEVATION OF PRIZE WINNING DESIGN FOR "A NATIONAL OPERA HOUSE IN WASHINGTON," BY RICHARD H. GRANELLI

COMPETITION FOR THE 25TH PARIS PRIZE OF THE SOCIETY OF BEAUX-ARTS ARCHITECTS

THE 25TH PARIS PRIZE COMPETITION

The judgment of the drawings submitted in the competition for the 25th Annual Paris Prize in Architecture was held on June 23rd, 1932. In accordance with the ruling of the French Government, the winner of this competition is received into the First Class of the Ecole des Beaux Arts without the necessity of taking the admission examinations.

The scholarship amounts to $3,600 and entitles the winner to study abroad for two and a half years. It is open to all citizens of the United States under 27 years of age. In the first eliminative competition there were 580 entrants; this number was reduced to thirty for the second competition and to eight for the final preliminary. Four of the eight final contestants were selected to present their solutions at large scale and, from them, one was selected for the 25th Paris Prize.

The subject of the final competition was *A National Opera House in Washington.* The program stated: "The building which forms the subject of the present program is to serve the National Capital, presuming a future population of about 1,000,000 persons. It will be partially supported by wealthy subscribers and possibly by an appropriation from the Federal Treasury; but provision is to be made for a large music-loving public. The building is to be placed in a public park, the space being unlimited, but while there shall be no curtailment of any element that will contribute to the excellence of the building for its special purpose and while the gala and social side of the representations to be held in it are to have every opportunity for development, extravagance in planning the structure, particularly in useless inflation of the cubical contents, is to be avoided. Nevertheless the competitors must bear in mind that this will be one of the most important buildings in the city; a center for social gatherings devoted to music. Therefore, it must be beautiful as well as dignified, an appropriate place in which to enjoy the most moving of the arts.

"The auditorium is to seat 2,500 persons with not over 1,000 on the orchestra floor. The remainder of the audience is to be accommodated in two or at the most three gallery levels. Provision shall be made for 25 boxes each to seat six or eight.

"In the design of the landscape setting of the building, provision must be made for ample parking space. The building, situated on slightly rising ground, will terminate an important avenue of approach from the city and those portions of the park about the building may be designed with terraces, fountains, appropriate sculptural groups, etc. Convenient access for the service, and parking space for the cars of the singers must be provided."

The winning design was submitted by Richard H. Granelli, of New York, a pupil of Lloyd Morgan who himself had won the Paris prize in 1921. Mr. Granelli's plan showed a knowledge of technical requirements of opera house building. The design also showed actual knowledge of construction. The elevation is well presented and well rendered and the design is simple and includes details that are interesting. The arrangement of the galleries to provide good sight lines, shaping of the auditorium to insure good acoustic quality, the freedom of circulation in the distribution of the public from the entrances to the seats, and a well thought out traffic plan are the salient factors of the winning design.

Max Abramovitz of Columbia University and Theobold Holsopple of the Catholic University of America were placed second and third, respectively. Their designs were commended by the Jury and it was recommended that their schools, if possible, finance their study abroad, so that they may avail themselves of the further recommendation that they be admitted to the First Class at the Ecole des Beaux Arts.

The Jury of Award was composed of the Committee on the Paris Prize, namely, Joseph H. Freedlander, Chairman; Arthur Ware, Henry Richardson Shepley, Ely Jacques Kahn, Chester Aldrich; and William F. Lamb, Archibald M. Brown, Ralph T. Walker, John V. Van Pelt, Otto R. Eggers, Egerton Swartwout, R. Doulton Stott, Lansing C. Holden, and C. C. Zantzinger.

RICHARD H. GRANELLI

Richard H. Granelli, winner of the 1932 Paris Prize was born in New York, September 15th, 1906. He is a graduate of Patrick Henry Junior High School.

He entered the office of Schultze and Weaver as office boy in 1924. Mr. Schultze recognized his rare ability and encouraged him to study at night, taking history, free hand drawing, and mathematics.

His Patron, Lloyd Morgan, returned from Europe and came to the office of Schultze and Weaver in February, 1926, and formed an Atelier for the young men doing Beaux-Arts work.

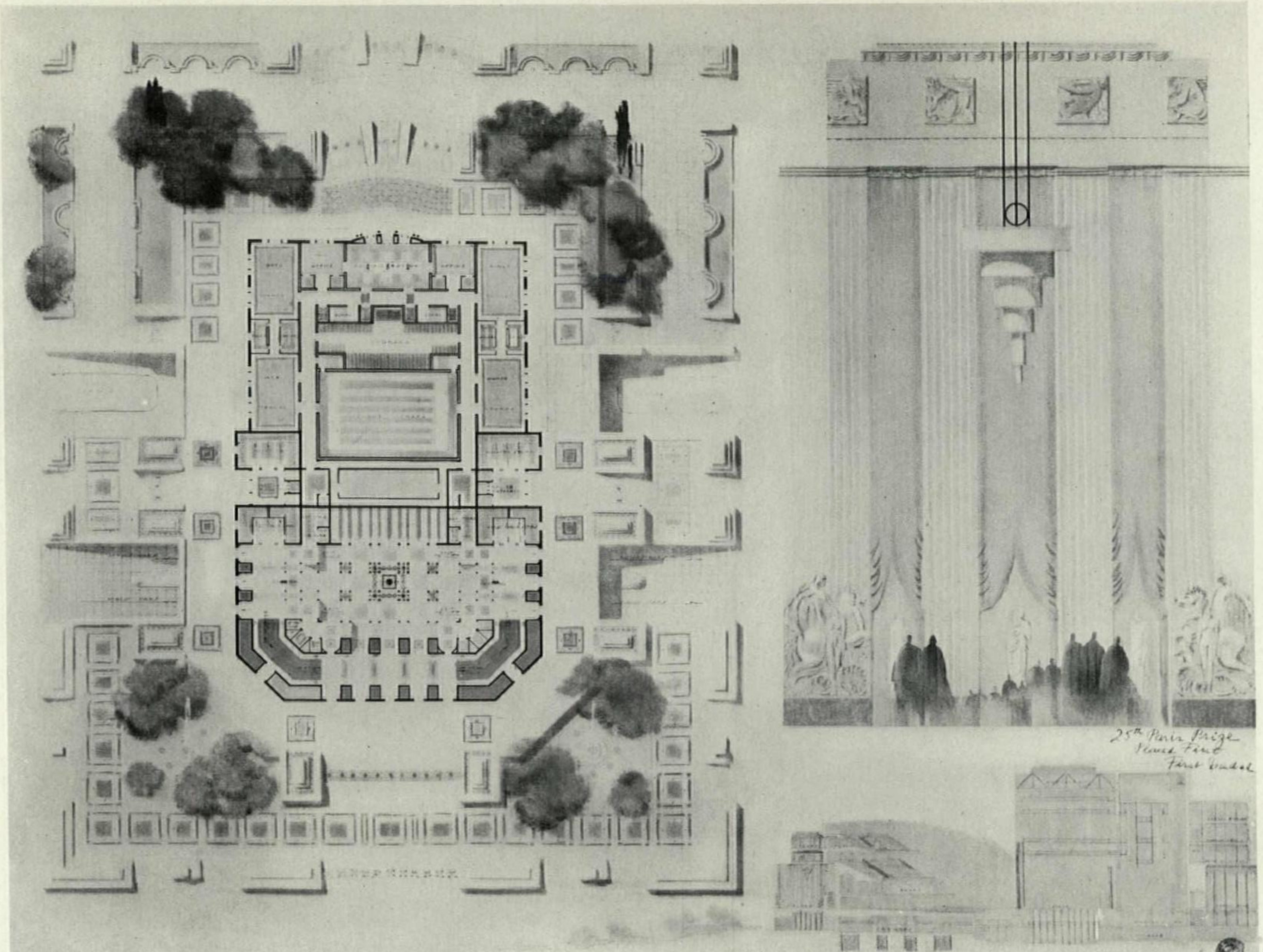
Mr. Granelli made rapid strides in his Atelier and last year he was awarded five consecutive medals on Beaux-Arts projets, which has never been accomplished before, thereby winning the Walter Hopkins Scholarship, which took him to Fontainebleau for three months, where he enjoyed the study given there. Before leaving for Fontainebleau, Mr. Granelli was notified that he was the winner of the Princeton Prize in Architecture, but it was impossible for him to accept this offer, much to his regret.

On his return from Europe, he was offered a position as designer with Reinhard and Hofmeister, which he accepted. During this time he trained on 24 and 36 hour sketches in the Atelier and he was selected the winner and presented with another first medal, making a total of six consecutive medals on six consecutive Beaux-Arts problems (3 first medals and 3 second medals).

Mr. Granelli wishes to express his appreciation to Mr. Schultze and Mr. Weaver for their encouragement and sacrifices to help him get an architectural training.

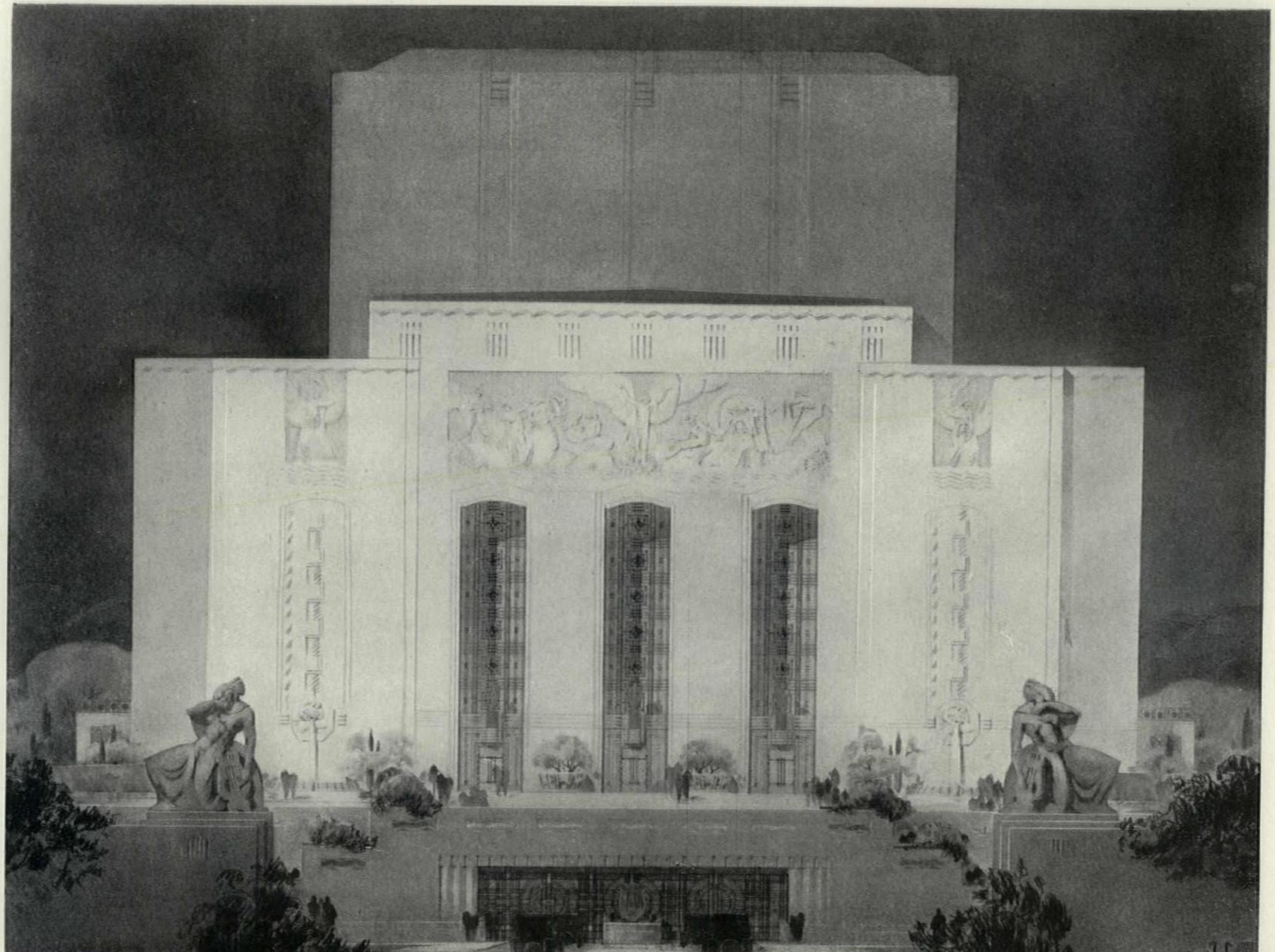
Mr. Granelli wishes also to express his sincere gratitude to his Patron, Lloyd Morgan, under whose guidance and tutelage he has done all his Beaux-Arts work, as he feels his interest, constant help, criticism, and encouragement have been the inspiring factors in his success. Lloyd Morgan won the Paris Prize in 1921—his Patron was Frederic C. Hirons. Besides having his Atelier, Mr. Morgan has taught architecture at Yale University and New York University and is a junior member of the firm of Schultze and Weaver.

Mr. Granelli also wishes to thank his atelier men, who so faithfully stuck by him during the project.



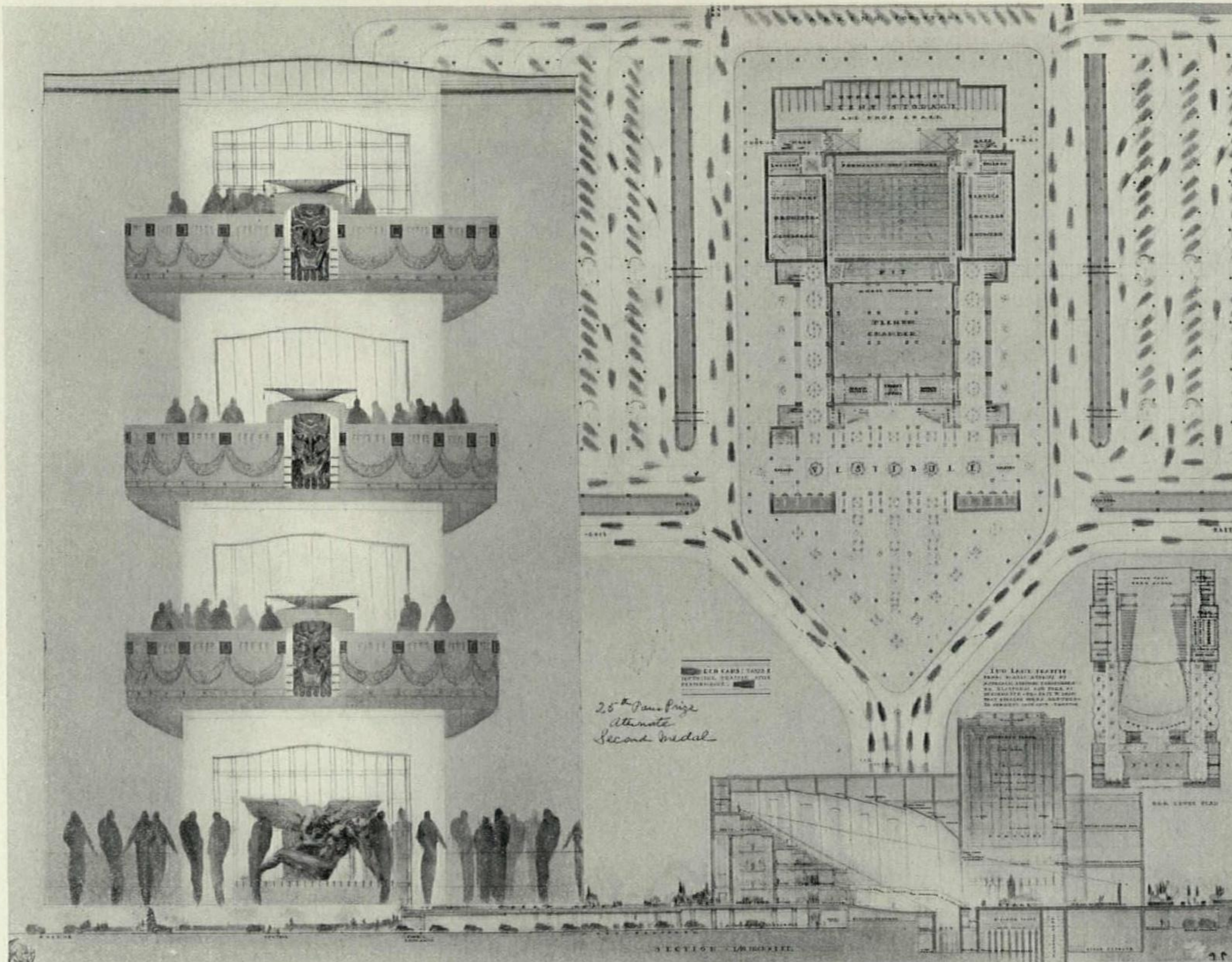
SECTION, PLAN, AND DETAIL OF PRIZE WINNING DESIGN FOR "A NATIONAL OPERA HOUSE IN WASHINGTON," BY RICHARD H. GRANELLI

COMPETITION FOR THE 25TH PARIS PRIZE OF THE SOCIETY OF BEAUX-ARTS ARCHITECTS



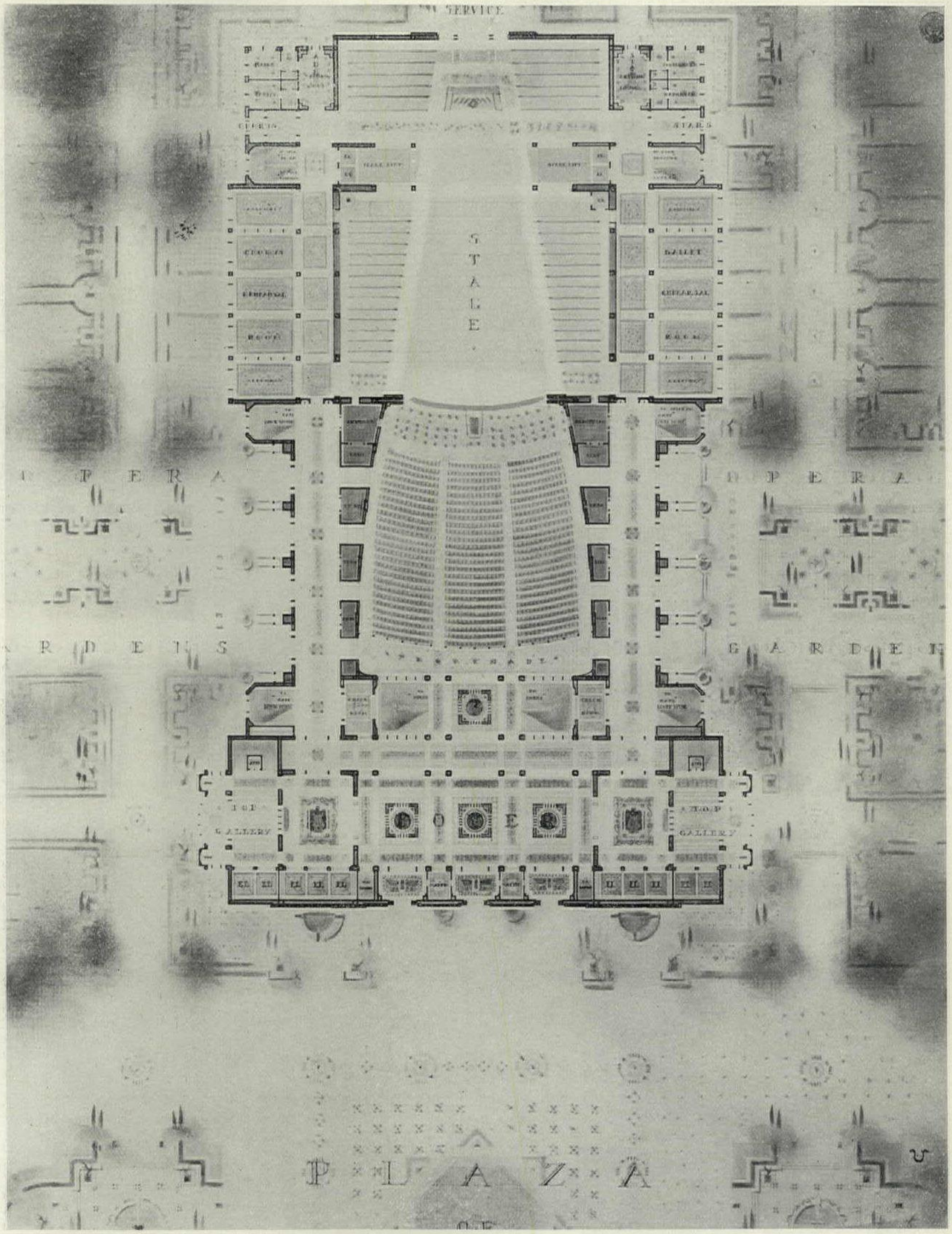
ELEVATION OF SECOND PRIZE DESIGN FOR "A NATIONAL OPERA HOUSE IN WASHINGTON," BY MAX ABRAMOVITZ

COMPETITION FOR THE 25TH PARIS PRIZE OF THE SOCIETY OF BEAUX-ARTS ARCHITECTS



SECTION, PLAN, AND DETAIL OF SECOND PRIZE DESIGN FOR "A NATIONAL OPERA HOUSE IN WASHINGTON," BY MAX ABRAMOVITZ

COMPETITION FOR THE 25TH PARIS PRIZE OF THE SOCIETY OF BEAUX-ARTS ARCHITECTS

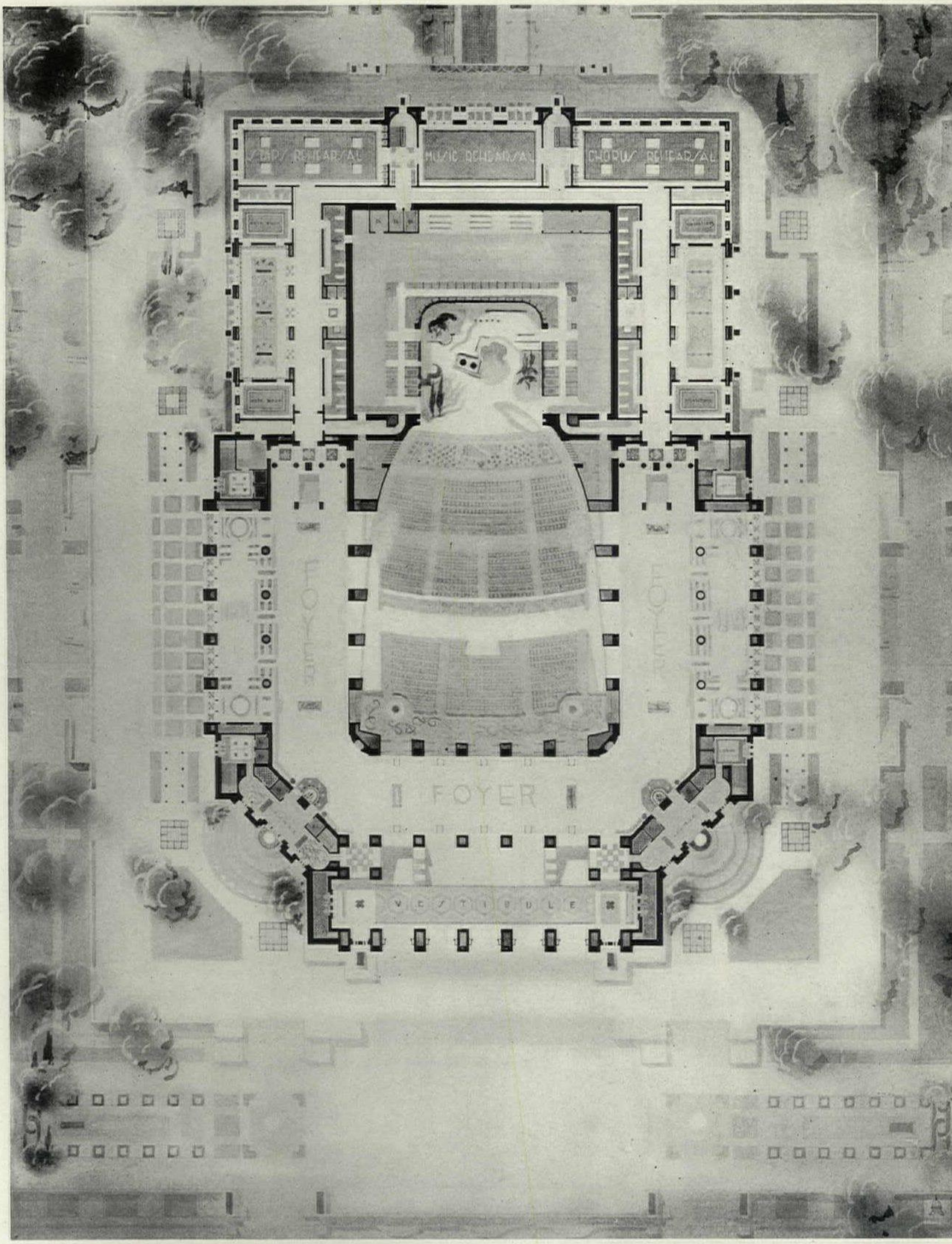


PLAN OF SECOND PRIZE DESIGN FOR "A NATIONAL OPERA HOUSE IN WASHINGTON," BY MAX ABRAMOVITZ

COMPETITION FOR THE 25TH PARIS PRIZE OF THE SOCIETY OF BEAUX-ARTS ARCHITECTS

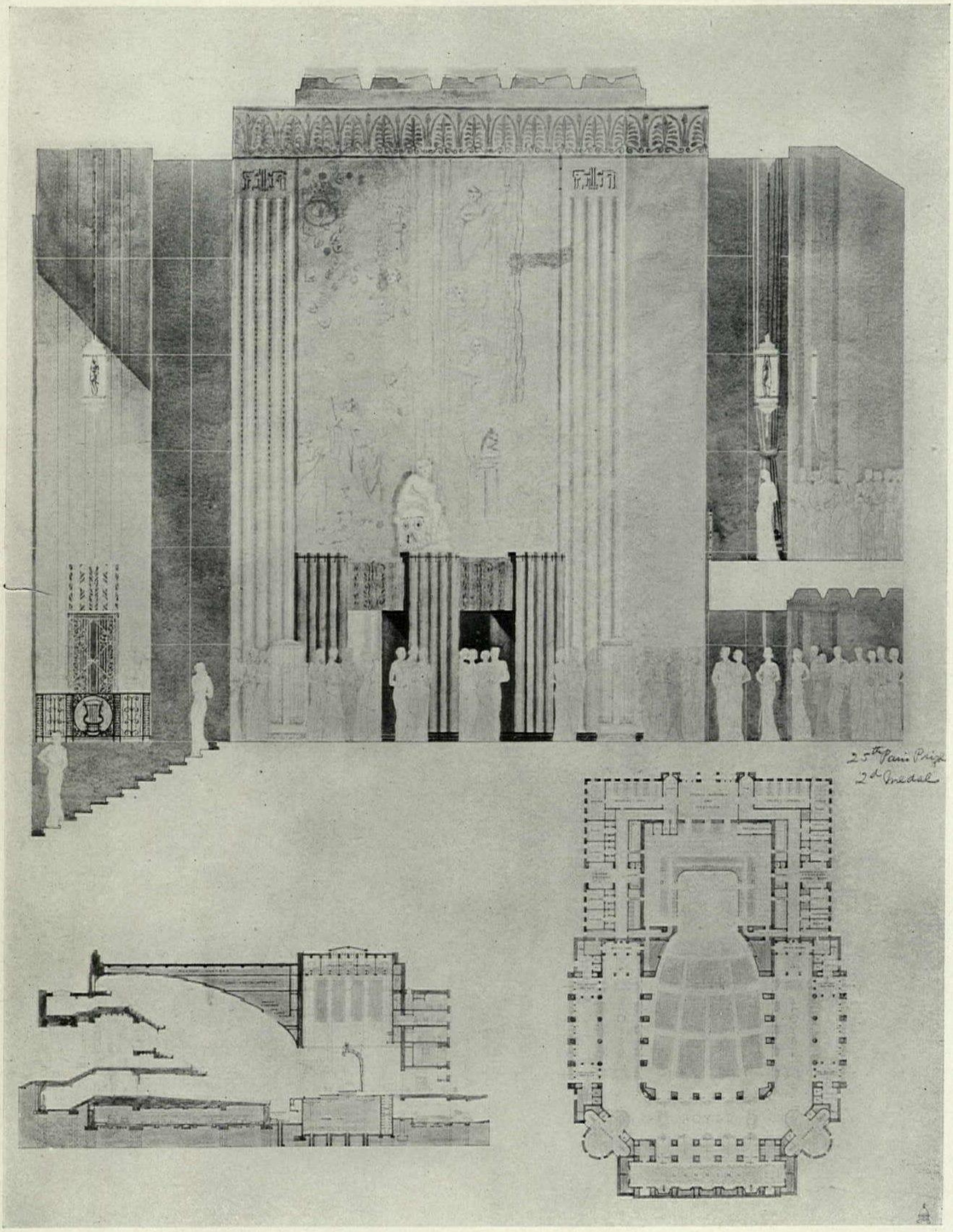
ELEVATION OF THIRD PRIZE DESIGN FOR "A NATIONAL OPERA HOUSE IN WASHINGTON," BY THEOBOLD HOLSOPPLE

COMPETITION FOR THE 25TH PARIS PRIZE OF THE SOCIETY OF BEAUX-ARTS ARCHITECTS



PLAN OF THIRD PRIZE DESIGN FOR "A NATIONAL OPERA HOUSE IN WASHINGTON," BY THEOBOLD HOLSOPPLE

COMPETITION FOR THE 25TH PARIS PRIZE OF THE SOCIETY OF BEAUX-ARTS ARCHITECTS



SECTION, PLAN, AND DETAIL

THIRD PRIZE DESIGN FOR "A NATIONAL OPERA HOUSE IN WASHINGTON," BY THEOBOLD HOLSOPPLE

COMPETITION FOR THE 25TH PARIS PRIZE OF THE SOCIETY OF BEAUX-ARTS ARCHITECTS

This department conducts four competitions each month. A prize of $10.00 is awarded in each class as follows: Class 1, sketches or drawings in any medium; Class 2, poetry; Class 3, cartoons; Class 4, miscellaneous items not coming under the above headings. Everyone is eligible to enter material in any of these four divisions. Good Wrinkle Section: a prize of $10.00 is awarded for any suggestion as to how work in the drafting room may be facilitated. No matter how simple the scheme, if you have found it of help in making your work easier, send it in. Competitions close the fifteenth of each month so that contributions for a forthcoming issue must be received by the twelfth of the month preceding the publication date in order to be eligible for that month's competitions. Material received after the closing date is entered in the following month's competition.
The publishers reserve the right to publish any of the material, other than the prize winners, at any time, unless specifically requested not to do so by the contributor.

THE PRIZES for this month have been awarded to:

Class I—C. H. Williams, Chattanooga, Tenn.
Class II—Allan Kazunas, Berwyn, Illinois.
Class III—No Award.
Class IV—Carl Schaefer, Toronto, Canada.
Good Wrinkle—H. Schultheis, Slaterville Springs, N. Y.

TO OUR CLIENTS—GOD BLESS 'EM

By Allan Kazunas

(PRIZE—*Class Two—July Competition*)

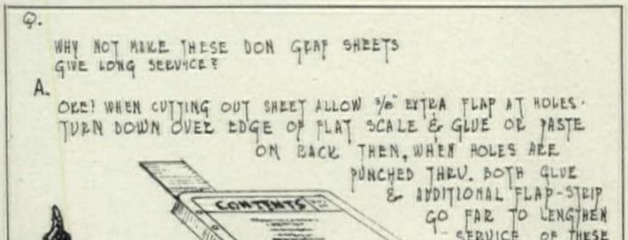
We drink a toast in India ink,
No matter how meagre the job,
Be it skyscraper, mansion, building expansion
Or designs for a modern door-knob.

You may pester us all with "suggestions"
With all of our plans disagree,
But as long as you give us some business,
We toast you—A fee is a fee.

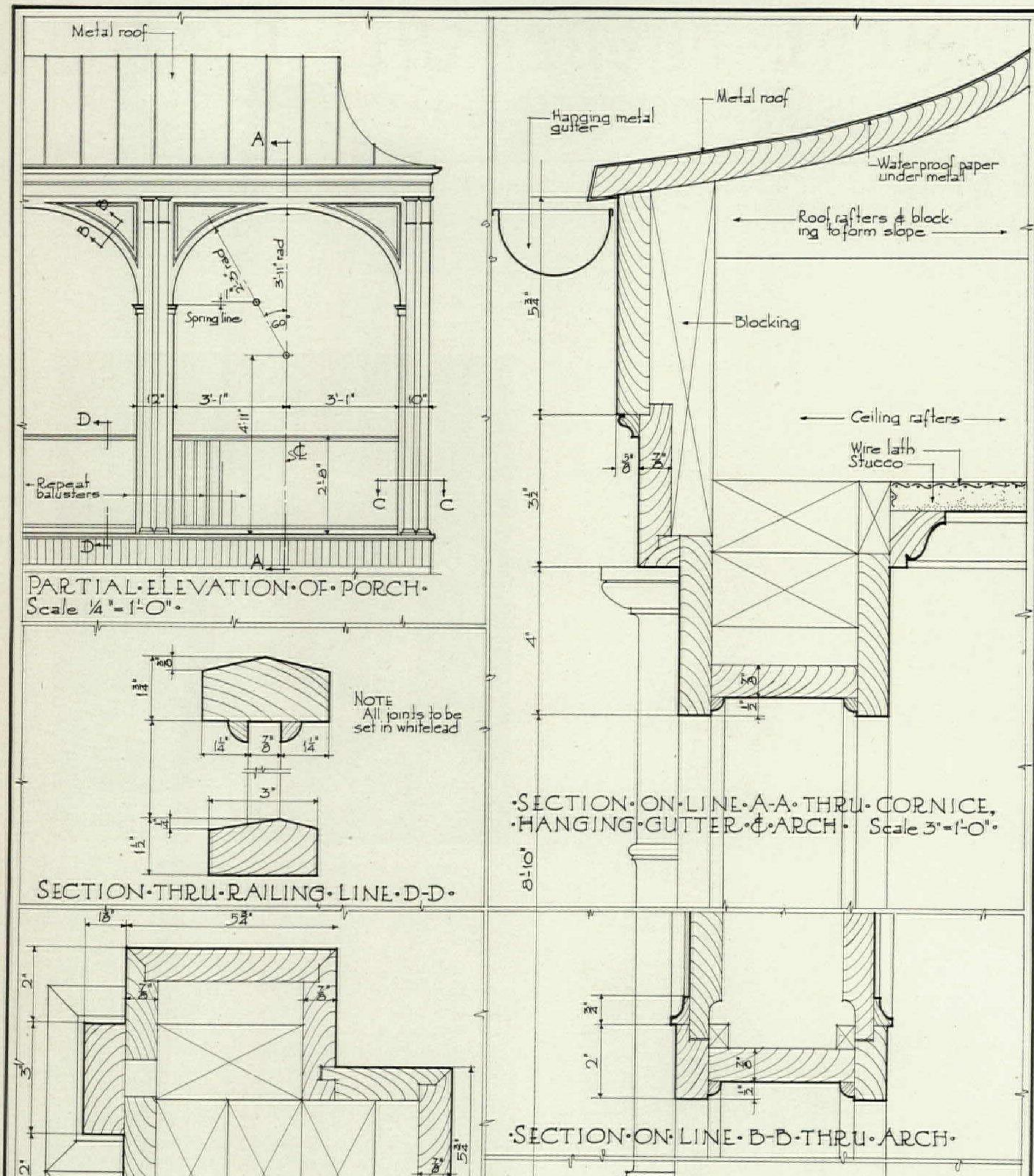
WOOD BLOCK PRINT BY CARL SCHAEFER
(PRIZE—*Class Four—July Competition*)

LITHOGRAPH PENCIL DRAWING BY C. H. WILLIAMS
(PRIZE—*Class One—July Competition*)

LOUIS E. JALLADE, while at lunch at the Architectural League in New York the other day, was being kidded by the gang because he had a little job in the office for "an office and administration building in a cemetery." He came back at them by saying, "Well, I may have an office building in a cemetery but most of you fellows have a cemetery in an office building."



SUBMITTED BY HENRY SCHULTHEIS
(PRIZE—*Good Wrinkle—July Competition*)



PORCH DETAILS—DRAWN BY PHILIP G. KNOBLOCH

ELDORADO

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The Master Drawing Pencil

Berkshire Trees

No 8

YELLOW PINE large WHITE PINE small
Staccato, sharp, strokes. Nothing soft.
Jet blacks and clean whites. Same technique for both trees. Pencils HB - 2B - 3B and 5B used, also lots of pressure.
Shadows on trunk give depth
Silhouette of masses more important than light and shade

Next month: Hawthorn tree illustrated

Send for samples of ELDORADO *to the* JOSEPH DIXON CRUCIBLE COMPANY, *Dept.* 167-J, Jersey City, N. J.

SERVICE DEPARTMENTS

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PERSONAL NOTICES. Announcements concerning the opening of new offices for the practice of architecture, changes in architectural firms, changes of address and items of personal interest will be printed free of charge.

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THE MART

Fred H. Elswick, Rush, Ky., has for sale *The Georgian Period*, by William Rotch Ware. Three volumes in perfect condition, price $40.00, postpaid.

Lulu C. Long, 710 3rd St., N. E., Canton, Ohio, has the following copies of PENCIL POINTS for sale: June to December, 1921; January to April, and June, November, and December, 1922; 1923, 1924, 1925, 1926, complete; January, 2 February, March, and April, 1927; and March, 1928. Also copies of *The Architect, Architectural Record, Architectural Forum, American Architect, The Bricklayer, Through the Ages, Western Architect*, and *Architektonische Rundschau.*

Ollivier J. Vinour, 1283 Morningside Drive, N. E., Atlanta, Georgia, would like to purchase reliable books on wood floorings, parquetry, and wood mosaic panelling, at reasonable price.

M. & M., PENCIL POINTS MART, has for sale all copies of PENCIL POINTS from July, 1920, to June, 1928, inclusive. Price $50.00.

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F. H. K., c/o PENCIL POINTS MART, has for sale the following books: Prentice, *Renaissance Architecture & Ornament in Spain*; Pugin, *Examples of Gothic Architecture*, 3 Vols.; Shaw, *Details of Elizabethan Architecture; Domestic Architecture of France—XII to XVI Century*; Esquie, *Vignola*; *T-Square Club American Competitions, 1907 and 1908*; Cram, *English Country Churches; English Country Houses, Modern French Architecture, Gardens Old and New*; *The Architectural Reprint*, Vol. II, 1902, and Vol. III, 1903; *The Architectural Annual*, 1900 and 1901; Sturgis, *A Dictionary of Architecture and Building*, 3 Vols.; Meyer, *Handbook of Ornament*; Nieuwbarn, *Church Symbolism*; Parker, *Glossary of Architecture*, 3 Vols.; Pugin, *Ornamental Gables.*

Harry B. Copeland, 46 Cornhill, Boston, Mass., has 51 numbers of *The White Pine Series of Monographs* for sale.

John H. Phillips, P. O. Box 2405, West Palm Beach, Fla., would like to purchase a set of I. C. S. textbooks of the complete architectural course, at a reasonable price.

William Helburn, Inc., 15 East 55th St., New York, would like to purchase the following: *The Architectural Forum* for 1929, 1930, and 1931, at $2.50 per year; *The Architectural Record* for 1929 and 1930, at $1.50 per year; PENCIL POINTS for 1929 and 1930 at $1.50 per year. Copies to be complete and in good condition.

L. W. Williams, 110 Morningside Drive, New York, would like to obtain Vol. 2, Numbers 1 and 6, of *The White Pine Monographs.*

Morris Sanford Company, Cedar Rapids, Iowa, has for sale a complete set of the *Architectural Review* (American issue), January, 1901, to July, 1921, inclusive, bound in nine covers, almost perfect. Price $45.00.

Eugene Dietzgen, 103 Park Ave., New York, has a few copies of the May and June, 1932, issues of PENCIL POINTS for sale.

PERSONALS

W. LYELL FAWCETT, ARCHITECT, has opened an office for the practice of architecture at 157½ Lochiel St., Sarnia, Ont., Canada.

RALPH W. WILLIAMS, ARCHITECT, has opened an office for the practice of architecture at 204 Washington St., Salisbury, Md., and would like to receive manufacturers' samples and catalogs.

P. A. NYHOLM AND F. S. LINCOLN, ARCHITECTURAL PHOTOGRAPHERS, have dissolved their partnership. Each will conduct a separate business at the same address, 114 East 32nd Street, New York; Mr. Nyholm in Room 303, and Mr. Lincoln in Room 501.

LEWIS LAMM, JR., ARCHITECT, 26 Eliseo, Mexico, D. F., would like manufacturers' literature, especially information on hospitals.

DOMINICK F. CAPUCIATI, ARCHITECT, 34 Village Street, Deep River, Conn., would like to receive manufacturers' literature and samples.

JOHN M. SCHAPER, ARCHITECT, has opened an office in the Central Trust Bldg., Jefferson City, Mo., and would like to receive manufacturers' samples and catalogs.

WM. CLEMENT AMBROSE, ARCHITECT, has moved his offices from 605 Market Street to 244 Kearney Street, San Francisco, Calif.

MAX MICKNOVITZ, ARCHITECT, has moved his office from the Ingalls Bldg. to 1700 Fountain Square Bldg., Cincinnati, Ohio. He would like manufacturers' literature.

JOSEPH DISTEFANO, JR., ARCHITECT, 122 Auburn St., Medford, Mass., would like to receive manufacturers' catalogs for his file.

WARREN A. KOERNER, ARCHITECT, 2315 W. Monroe St., Chicago, Ill., wishes to receive manufacturers' literature and samples for a new file.

MARTIN C. PARKER, ARCHITECT, has moved his office from Roswell, N. M., to 214-15 Builders Exchange Bldg., Santa Ana, Calif., and would like to receive manufacturers' literature.

EMPLOYMENT SERVICE ITEMS WILL BE FOUND ON PAGE 30, ADVERTISING SECTION