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The AMERICAN ARCHITECT AND BUILDING NEWS

Regular Edition

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No. 1636

SUMMARY:

Pages 161-162

Important Publishers' Announcement—What Architects are doing and have done in Reinforced Concrete—The Artistic Expression of Concrete—The Automobile as a Promoter of Architecture and Architectural Fashions—The Appropriation for Boston's Art Commission cut down.—Actual Designing within the Powers of Art Commissions.

THE ARCHITECTURAL PROBLEM OF CONCRETE.....	163
ON THE ARTISTIC EXPRESSION OF REINFORCED CONCRETE: A SYM- POSIUM	163
THE IDIOMATIC USE OF CONCRETE.....	172
CONCRETE WALL AND FLOORS.....	174
REINFORCED-CONCRETE CONSTRUCTION	177
CONCRETE SURFACES	178
THE ARTISTIC TREATMENT OF CONCRETE.....	180
ENGINEERING ADVICE AS TO REINFORCED CONCRETE.....	181
THE TREATMENT OF CONCRETE SURFACES.....	183
THE DEFECTS AND VIRTUES OF REINFORCED CONCRETE.....	184
THE LITERATURE OF REINFORCED CONCRETE.....	185
A BOOK ON THE SAN FRANCISCO DISASTER	187

PLATES:

The Automobile Club of America, West 54th Street, New York: Eight Plates—Vaccine Laboratory and Stable for New York City Board of Health, Westchester, N. Y.: Four Plates—Administration Building of the George N. Pierce Co., Buffalo, N. Y.: Six Plates—Citizens' Bank Building, Los Angeles, Cal.: Two Plates—Building of the Eastman Kodak Co., West 23rd Street, New York, N. Y.: Three Plates—House at Port Antonio, Jamaica, W. I.—Holy Trinity Church, Havana, Cuba, W. I.: Six Plates—Merchants' National Bank, Newark, N. J.: Two Plates—Château des Beaux-Arts, Huntington, Long Island, N. Y.: Eight Plates—House of P. A. Rockefeller, Greenwich, Conn.: Three Plates—Episcopal Cathedral, Manila, P. I.: Four Plates—Episcopal Parish-house, Manila, P. I.—Herbivora Building in the Cincinnati Zoological Garden—House of D. Bacon, Esq., Ardsley-on-the-Hudson, N. Y.—House of R. Anderson, Esq., Cincinnati, O.—House of A. Kahn, Architect, Detroit, Mich.—U. S. Grant Hotel, San Diego, Cal.—Santa Fé Freight Depot, Los Angeles, and the Union Building, San Diego, Cal.

NOTES AND CLIPPINGS.

SOCIETIES, PERSONAL MENTION, ETC.

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Government approval of **ATLAS** WATER TUBE *BOILERS*



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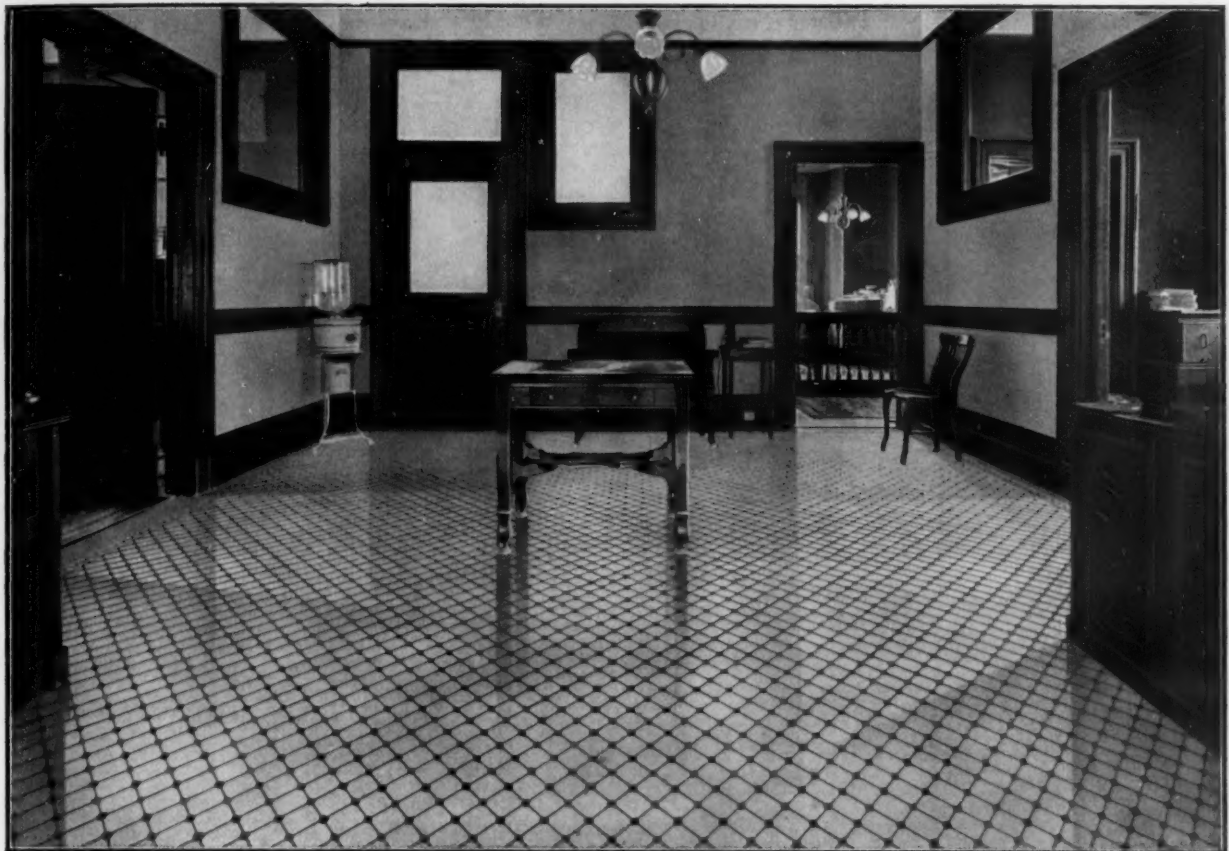
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Times Square

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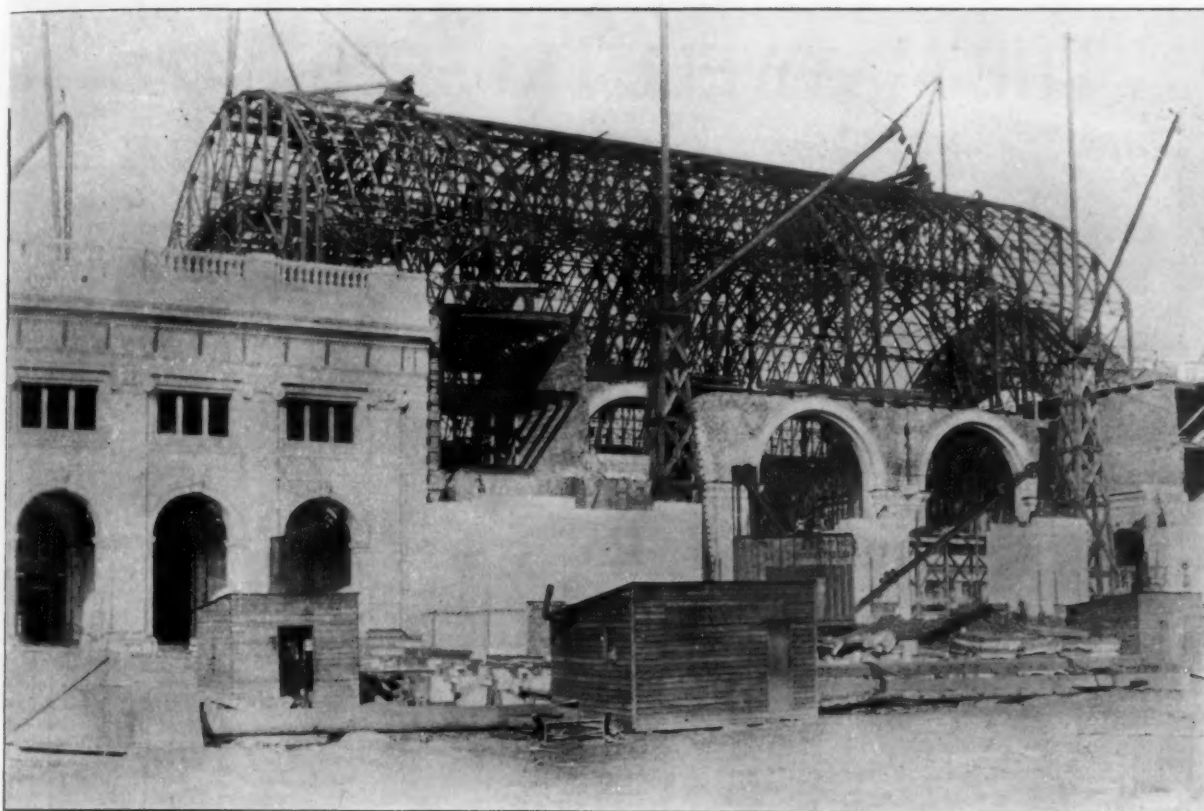
NEW YORK, 156 Fifth Ave.
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CHICAGO, 115 Adams St.

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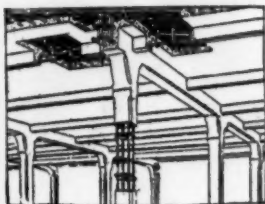
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first cost and maintenance), fireproofness, and finished results. Concrete is composed of cement, sand and broken stone in proper proportions, chemically united by use of water, and when the hard, granite-like substance thus obtained is reinforced with steel to give it needed elasticity, an ideal building material is the result.

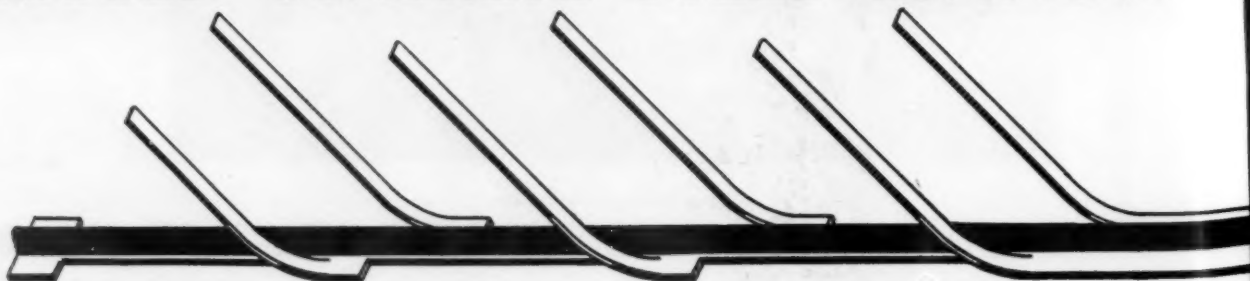
In England over 90 structures have been erected according to the Kahn System of Reinforced Concrete.

In the United States over 1,500 structures of various descriptions and type, from factory buildings, warehouses and hotels to bridges and viaducts have been built according to the Kahn System.

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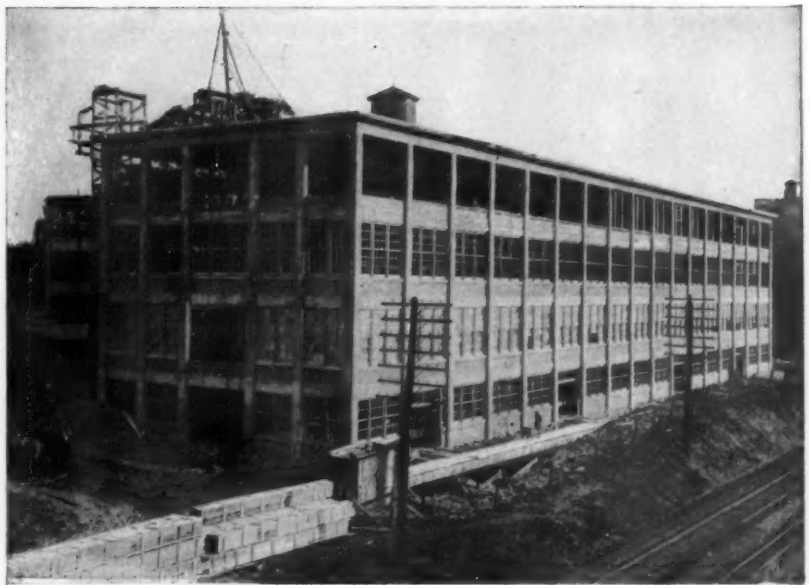
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J. R. Bowles, General Contractor
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The System with the Continuous Bond

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WASHINGTON: Rosslyn Supply Co., Colorado Building
PITTSBURGH: Houston Bros. Co., 32d Street and P. R. R.
CHICAGO: Clinton Wire Cloth Co., 30-32 River Street

COLUMBUS: Kyle & Dugan, 282 East Broad Street
ST. LOUIS: Hunkins-Willis Lime & Cement Co.
SAN FRANCISCO: L. A. Norris, 835 Monadnock Building
SEATTLE: L. A. Norris, 909 Alaska Building



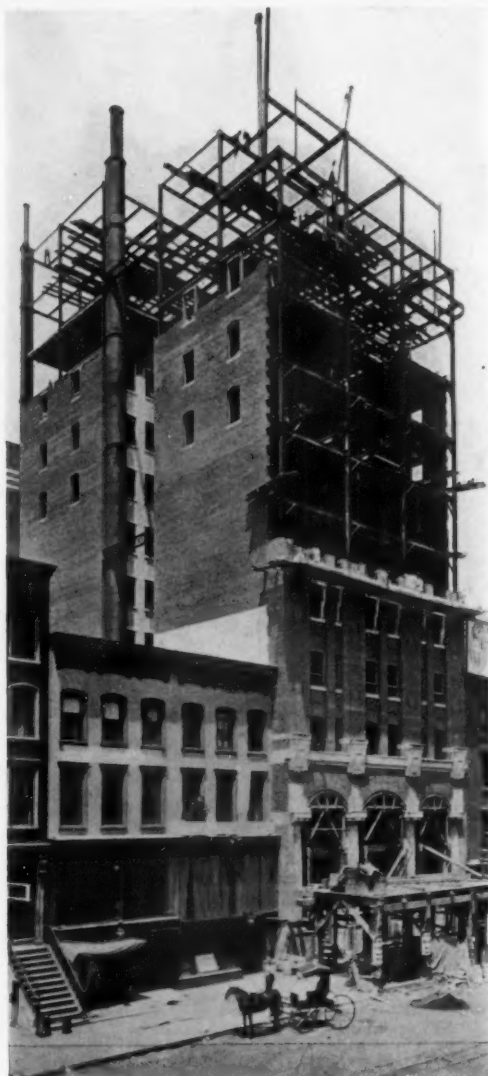
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The Hermitage, New York

R. D. Kohn, Architect
Chas. A. Cowan Co., Builders
Gollick & Smith,
Contractors for Fireproofing

The CLINTON FIREPROOFING SYSTEM

The System with the Continuous Bond

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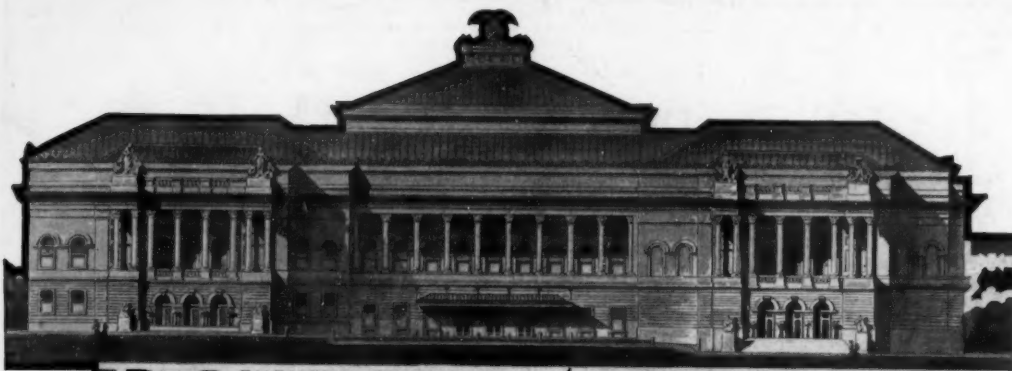
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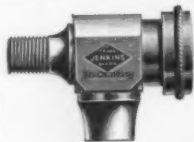
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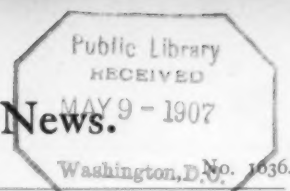
SOLE MANUFACTURERS

THE OKONITE CO., Ltd.
253 Broadway, New York

The American Architect and Building News.

Vol. XCI.

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CONTENTS

SUMMARY:

161-162

Important Publishers' Announcement—What Architects are doing and have done in Reinforced-Concrete—The Artistic Expression of Concrete—The Automobile as a Promoter of Architecture and Architectural Fashions—The Appropriation for Boston's Art Commission Cut Down—Actual Designing within the Powers of Art Commissions.

THE ARCHITECTURAL PROBLEM OF CONCRETE

163

ON THE ARTISTIC EXPRESSION OF REINFORCED-CONCRETE:

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163

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172

CONCRETE WALLS AND FLOORS

174

REINFORCED-CONCRETE CONSTRUCTION

177

CONCRETE SURFACES

178

THE ARTISTIC TREATMENT OF CONCRETE

180

ENGINEERING ADVICE AS TO REINFORCED-CONCRETE

181

THE TREATMENT OF CONCRETE SURFACES

183

THE DEFECTS AND VIRTUES OF REINFORCED-CONCRETE

184

THE LITERATURE OF REINFORCED-CONCRETE

185

A BOOK ON THE SAN FRANCISCO DISASTER

187

PLATES:

The Automobile Club of America, W. 54th St., New York: Eight Plates—Vaccine Laboratory and Stable for New York City Board of Health, Westchester, N. Y.: Four Plates—Administration Building of the Geo. N. Pierce Co., Buffalo, N. Y.: Six Plates—Citizens' Bank Building, Los Angeles, Cal.: Two Plates—Building of the Eastman Kodak Co., W. 23d St., New York, N. Y.: Three Plates—House at Port Antonio, Jamaica, W. I.: Holy Trinity Church, Havana, Cuba, W. I.: Six Plates—Merchants' National Bank, Newark, N. J.: Two Plates—Château des Beaux-Arts, Huntington, Long Island, N. Y.: Eight Plates—House of P. A. Rockefeller, Greenwich, Conn.: Three Plates—Episcopal Cathedral, Manila, P. I.: Four Plates—Episcopal Parish-house, Manila, P. I.—Herbivora Building in the Cincinnati Zoological Garden—House of D. Bacon, Esq., Ardsley-on-the-Hudson, N. Y.—House of R. Anderson, Esq., Cincinnati, O.—House of A. Kahn, Architect, Detroit, Mich.—U. S. Grant Hotel, San Diego, Cal.—Santa Fé Freight Depot, Los Angeles, and the Union Building, San Diego, Cal.

NOTES AND CLIPPINGS.

SOCIETIES, PERSONAL MENTION, ETC.

ANNOUNCEMENT.

THE publishers of the *American Architect* feel themselves indebted to architects the whole country over for the measure of success gained in the past two years through their recognition of the value of the improvements that have been effected in the publication. In order

to be in a position to continue these improvements and at the same time to attain the full business success which it is justifiable to expect, it has been thought wise to make important additions, particularly to the business staff, and to move to more commodious quarters in the Flatiron Building. The actual date of removal will soon be announced.

Mr. H. M. Swetland, president of *The Automobile*, Mr. G. E. Sly, formerly with *Power*, and Mr. J. T. Morris, of the *Municipal Journal and Engineer*, have acquired an interest and become directors. The ownership is now vested in the Swetland Publishing Company, of which H. M. Swetland is president, G. E. Sly and M. C. Robbins, vice-presidents, F. P. Burt, secretary, and J. T. Morris, treasurer.

FOR very many months the columns of the real-estate and building journals have teemed with announcements that "a reinforced concrete building was to be erected for Mr. Suchanone by Messrs. So & So, architects," and a good many people who like to be pessimistic have been plunged in a cheerful gloom when, in their mind's eye, they beheld all sorts of architectural enormities being carried out in unalterable forms after this newest of methods. But pessimists are not the only ones who are awaiting, with quite as much dread as impatience, to discover whether the early experimenters are going to discover and disclose the fact that the modern designers can evolve an individual and artistic expression which will signify to the onlooker that the building is of concrete as clearly as that other buildings are made up of brick, stone, wood or iron, or whether they have discovered for it only forms so gross and crude that it is obvious that the new method can hardly be accepted in good society, as it were, but can be used only for those buildings and sites where "beauty doesn't count." We know our readers will turn with much interest to the illustrations we have gathered for this issue, and we have a fancy that most will turn from them with a mixed feeling of disappointment and relief. If there is little here that declares itself to be concrete, so disguised is the substance of the building with veneerings of brick, stone or terracotta, yet it is a real relief to find that so many architects feel that, building being an expensive operation, they have not the right at present to use their clients' money in dubious experimentation at large scale.

THERE may be found elsewhere in this issue the contributed opinions of many architects as to what should, and may, be the proper artistic expression of a concrete building unveneered in any way, and we will not detract from the freshness of any of them by undertaking in this place to sift, compare and summarize the views expressed. The matter deserves the attention of every one, even of the busiest man or the man, mentally indolent, who likes to have his ideas predigested. But there are one or two points we think well to lay stress upon. In the first place, for buildings where beauty is expected to count, we think that the idea that reinforced-

concrete building methods are invariably going to prove more economical in first cost than any others should be abandoned. And this advice is all the more sound if the designer, remembering that concrete is a plastic material, undertakes to express this fact in his design by indulging in the use of fictile lines and contours, lines and forms that at the present are rather the tools of trade of those who affect the "Art Nouveau." Of course, if Portland-cement concrete alone is to be used, there is small chance of giving a very telling expression to the plastic nature of the mixture; but if the mixture for the walls be properly tempered so as to set slowly, or if the walls be heavily veneered with stucco or rough-cast, very effective and satisfying fictile expression may be devised. Finally, it must always be kept in mind that concrete, while a serviceable fireproofing mixture, is not itself fireproof, and that in certain positions it must be protected by other fireproofing, whose function it shall be to absorb into itself the inevitable disintegration due to impinging flame—or flame and water in alternation.

ARCHITECTS who do not chance to be afflicted with deafness and so, more than other people, have their lives at the chauffeur's mercy, have better reason than most people to regard with complacency the phenomenal expansion of automobile traffic in this country. It is true that the public records are cumbered with mortgages which show how recklessly men of meagre income have been willing to risk the homes of their wives and children rather than exert themselves to master the lust for speed, and it is true that a mortgagor is not likely to patronize architects. But it is also true that each automobile in the course of its career carries for its owner many guests who have not yet pledged their all for a too-costly vehicle, introducing them to unsuspected chances of home-making in their immediate neighborhood, and stimulating in them the desire that almost every man has to own a place of his own and build upon that place just the sort of dwelling-house that appeals to his domestic needs or æsthetic appreciation. The automobile craze is sure to be the direct cause of putting in the way of the younger architects many a pot-boiler.

THE automobile, moreover, is quite likely to have a very distinct effect on the architectural character of the buildings erected as summer "cottages" by the more wealthy. What do these "hill-climbing contests" mean? What is their use, if it be not, in part, to assure the future country gentleman that he may safely place his house upon a hill-top, no matter how steep the approach or how craggy the site? In the past, many a man, attracted by the situation and enamored of the view, has built an expensive house on a hill-top only to desert it in a year or two, after experience had shown how unendurable was the tedium and waste of time in crawling up-hill in horse-drawn vehicles. But now the automobile makes practically any height a good building site, and with that fact established will come a revival of the discussion of whether in a building designed for such a site horizontal or vertical lines should predominate, whether silhouette or mass should count; and, just as the bicycle-tours

through the valley of the Loire had much to do with creating the present fashion for the pseudo French châteaux sprinkled over the American country-side, so we may expect to find the automobile an active agent in the crowning of many a hill-top or craggy bluff with American adaptations of Rhenish castle or French *château fort*. Further, reinforced-concrete methods and materials lend themselves admirably, almost naturally, to the easy reproduction of the brute masses of castellated dwellings, and a contractor who would add heavily to his estimate, if obliged to haul building-stone to a hill-top site, will see that, with such easily divisible loads, and so readily handled, as broken aggregate and cement, he can figure teaming at a lower rate. It may be worth while for architects to be ready to meet a demand for castles, provoked by the ubiquitous excursions of automobile parties.

WE said recently that municipalities which benefited by the labors of Art Commissions valued these bodies in much the same way that they do their school-committees; and, in spite of what has just happened in Boston, we still believe the statement to be true. In Boston, the City Council a week or so ago, in passing the annual appropriation bill, cut the item covering the "office expenses" of the Art Commission from four hundred dollars to one hundred dollars. A peculiar feature of the situation is that the law that establishes the Art Commission directs that money for its "reasonable office expenses" shall be provided annually, and for some years the sum of one thousand dollars was so allotted. But the Commission, finding that this was more than was really needed, asked that only four hundred dollars be appropriated to its use. And now this has been reduced by three-quarters, in order that the City Council may have more funds for the "entertainments" in which the present city administration so likes to indulge.

A GOOD many people have thought it regrettable that Art Commissions have always hitherto been denied the right of initiative—a limitation of powers we trust may be universally observed. But it has occurred to us that a really strong and convinced Art Commission might, on occasion, come very close to being the actual designers, if not the conceivers, of the work they finally approve. All that would be necessary would be that the Commission should treat the authors of the designs submitted to their judgment as Richardson, for instance, treated his draughtsmen, as mere vehicles for registering his own ideas as verbally described and re-described when the first interpretation was found amiss. Of course, the ordinary Art Commission already works somewhat in this way; but, some day, some Commission will discover that it has been possible to effect such important changes—and for the better—that there is neither identity nor similarity between the accepted design and the original one, and then it will be a delicate matter to determine who is really the designer and deserving of applause and credit.

THE ARCHITECTURAL PROBLEM OF CONCRETE.

ONE among the many factors which have brought about the confusion of styles in present-day architecture has been the rapid development of new materials and processes of construction. It is an interesting and in some ways a singular fact that it is harder to change the currents of decorative than of structural design, although one would suppose the first more fluid and easier of alteration than the second, because dependent on the imagination, while building methods are the product of accumulated experience. The truth of the matter, however, is that decorative forms are the product of taste working upon a basis of tradition, while structural processes are largely the products of calculation. To solve in a satisfactory manner the problem of design upon a new structural basis is a more difficult and delicate problem than to design a new form of construction, because a satisfactory solution must meet the demands of a public taste which has been formed largely upon long-accepted canons. No one designer ever invented a successful new style: the styles that have lived have in every case been the results of a gradual evolution. Modern skeleton-construction is nearly twenty years old, but we are still seeking for a truly logical and artistic style of architectural design with which to clothe it. And now we are facing another problem in the adaptation to architectural design of the various systems of construction in concrete.

The three principal systems for the use of concrete are respectively those in which (a) it is used merely as a structural core, to be faced with brick, stone, tile or plaster; (b) it is moulded into blocks and used like stone or brick; and (c) it is used in the mass, being poured and rammed into moulds and presenting, on their removal, the uniform surface of a monolith. It is this last, this monolithic system, which presents to the architect the most difficult and novel problems.

The difficulties in the artistic treatment of monolithic concrete buildings relate to form, texture and color.

It is, of course, comparatively easy to fall back upon the traditions of stone architecture and cast the building in moulds formed upon the familiar elements of design—columns and arches, modillions and brackets, corbels and finials, tracery, pediments, niches, and what not. This is, however, neither logical nor satisfactory; for, apart from the difficulty of producing fine detail with detachable moulds, there is the fundamental objection that the material is wholly unsuited to reproduce many of these forms. Slender mullions and fine arrises in concrete are absurdities. The effects of the chisel upon the carved stone cannot be repeated in the concrete. Its texture and color are not those of stone. In short, the whole category of lithic forms by their character and suggestions belie the process of their production in concrete, and the building so shaped and decorated becomes a contradiction of itself, from top to bottom. Moreover, a lithic treatment forbids some of the most characteristic expressions and uses of the concrete; for one can span an opening with a reinforced-concrete beam of a length impossible with a stone lintel.

The nearest analogy to monolithic design in traditional and historic architecture is to be found in the plastered and stuccoed buildings of southern Europe. These present broad, flat surfaces without joints or strong projections, somewhat resembling a concrete wall. The so-called "mission architecture" of the Southwest offers suggestions which should be useful to the designer of a monolithic building. That style depends less upon architectural embellishments, and more upon mass, fenestration and the broad shadows of projecting roofs and deep recesses, than any other with which we are familiar. The plaster surfaces resemble somewhat those of the moulded concrete in general effect. The openings may be square or arched in form, as one may prefer for artistic results. But this style has rather narrow limitations. It would be difficult to adapt it to a huge city hotel or to a tall office-building or huge department-store. The steep roofs desirable in Northern climates do not harmonize with the style. It is evident that in large and complex buildings there must be many experiments and much invention and adaptation before satisfactory results will be secured. It is very easy, with so plastic a material, to throw all restraints of tradition to the four winds, with disastrous results. The extraordinary house of M. Hennebique in the suburbs of Paris may be cited as an example of a perfectly logical but absolutely hideous use of the material. Architectural freaks are not to be desired.

If one may venture a few suggestions based upon theory and not experience, it would seem desirable, in the first place, to insist that the designer must always keep in mind the two fundamental qualities of a moulded concrete edifice: the material is plastic, the building a monolith. Strong projections and the simulation of carving should be avoided in all the decorative detail; on the other hand, the soft and weak effect of too many rounded corners and of formless, "pudgy" swellings is equally undesirable. The strong shades and shadows should be produced by the structural masses and openings rather than by decorative details. But while stonework should not be imitated, and decorative forms peculiar to lithic architecture should be sparingly used unless greatly modified, this does not forbid a free use of suggestions and "inspirations" drawn from the traditional styles, carefully selected and adapted to the new material. The fundamental principles of architectural composition are as valid for concrete as for brick or stone.

The texture and color of concrete in the mass are serious obstacles to its general adoption for exterior architecture. How far these can be modified by coatings of cement specially treated, and by brushings, combings and toolings of the flat surfaces of the exposed concrete, only experiment can prove. But it will always be possible to break up certain parts of the surface, in spots, by panels, or borders, for instance, or by decorative surface-patterns stamped or moulded in the plastic material. Byzantine surface-incision and Moorish wall-decoration offer suggestions. Some of Mr. Louis H. Sullivan's delicate surface ornamentation which has proved so successful in stone and in terra-cotta, might be almost equally effective in concrete, with a little adaptation and simplification. But if concrete is ever to be extensively used in monolithic buildings of monumental size and importance, it will almost certainly not be without the aid of other materials. There is no reason why stone and terra-cotta should not be used for certain features where the contrast of their texture, color and decorative character with the concrete would be desirable. Inlays of ceramic tiles and of marble of various colors could be employed to introduce color and vivacity into the sombre deadness of the prevailing tone. Balconies, railings, crestings, cornices, eaves-soffits, and mullions of iron, bronze and copper would, also, always be available.

All the above suggestions, after all, appear to be summarized in the statement that monolithic concrete, *per se*, is an ungrateful and repellent material for exterior architectural effect; that it must be kept as flat as possible, the larger areas disguised or frosted by flat surface-ornament, and the general effect varied and brightened by accessory details executed in other materials.

Ancient Roman buildings offer no precedent for this problem. The so-called concrete of the Romans, though structurally fulfilling many of the same functions as modern monolithic concrete, was quite differently made, being composed of alternate layers of cement, mortar and small stones carefully laid by hand. Some of the smaller vaults seem to have been of almost pure cement, and to this day show the grain of the chestnut boards used as centerings or moulds. But the Romans always built up their "concrete" walls and piers between facings of brick; and the huge vaults of the Pantheon and some of those of the Baths of Caracalla were laid upon a complete inner shell of careful brickwork. The Assyrian palaces were built of soft unburned clay bricks which dried under the pressure of their own weight into uniform homogeneous masses; but these walls appear to have been for the most part faced with slabs of alabaster or limestone and flat enamelled tiles. The past offers no exact analogy to the problem under discussion, and its solution must be worked out by experiment, like all other æsthetic problems, under the guidance of common sense and good taste.

A. D. F. HAMLIN.

ON THE ARTISTIC EXPRESSION OF REINFORCED-CONCRETE.

[From Messrs. BACON & HUBER, Toledo, O.]

RESPONDING to your request in letter of 9th inst, for our views regarding the possibilities of artistic effects in reinforced-concrete:—

We assume that the lack of artistic effect, so far produced by use of any concrete blocks manufactured up to present time, places these out of consideration.

The real beautifying of reinforced or poured concrete is a

subject yet so new to all that no one can cite except from a limited experience, and a judgment based upon a general practice and observation of kindred matters.

We have given this subject some study in a quite general way, a little of it practical, and find that, many times, easy means present themselves of beautifying square or round columns, specially designed capitals, entablatures, bases, or panels; also window-caps, belts, string-courses, raised panels, water-tables, etc. These results can be accomplished by specially prepared wood forms, by a combination of sheet-zinc or other thin metal and wood, or by sheet-metal entire; in either case, the forms, when desired, can be made detachable without injury, and not very expensive—and the product smoothed or repaired where necessary.

For unbroken surfaces, sometimes unavoidable in large buildings, we have occasionally recommended the inner face of wood forms to have a beveled strip planted on and placed so as to leave a sort of V-joint at regular intervals, and left rough and of sufficient depth so that a subsequent thin dressing of coarse sand and cement put on with a float, before the surface is yet dry, may agreeably add to the effect.

A quite pleasing rough effect for large and entirely unbroken surfaces may also be produced by the use of the carpet float, and the coarse mixture applied very thin to the wet or unseasoned surface, as soon as forms are removed. The uses of the carpet, or other float, on exposed concrete surfaces, may be extended to great advantage generally, if applied with skill and judgment.

[From Mr. DONN BARBER, New York, N. Y.]

THIS is a pretty broad subject, though a very interesting one. It cannot be disputed that the use of concrete has a unique and proper field artistically as well as constructively. It should not, however, be forced to compete with other materials, nor should there be any attempt to make concrete imitate other materials either as to finish or design. Some charming things have been done in stucco and it would seem that the same general styles of architecture and surface-finish which have been used in stucco work could be realized in concrete.

There are certain forms in Italian architecture, and also in the so-called "mission" style, where concrete may be used not only effectively but sensibly. A few "don'ts" might be in order, and at the same time helpful. Don't try to imitate stone or brick, or stone forms, such as arches, lintels or Classic orders. The architectural details of design and composition should show that the material used is concrete; it should be allowed to stand for itself. Contrast of surface can be secured by means of shadows or deep reveals in window or door openings, and other apertures. Elaborate cornices and moulded belt-courses, and the like should be avoided. Sharp edges or horizontal edges are hard to obtain and anything less than a right-angle makes the removal of forms difficult. Greek frets and like *motifs* of flat decoration can be easily realized and even made very effective. Relief work, where necessary, can be applied in stucco on cement properly bonded with metal into the structure. This work, however, should be free from heavy overhang and from excessive weight. Large expanses of plain wall, long lines of pilasters or other architectural *motifs* usually associated with stone are almost impossible of satisfactory treatment in concrete. Colored tiles and bricks and terra-cotta can be embedded in the concrete or attached thereto by very simple processes. Copper can also be used in connection with these colored surfaces, or by itself, without much fear of discoloration by rust after the forms are removed. In the impress that is left by the forms can be cleverly managed all sorts of surface texture by building the reliefs on the forms where incised ornament is desired either in diaper pattern or running bands. This can be easily realized by nailing the reverse of the *motif* desired to the wooden form.

Bronze or painted pressed metal can, of course, be used to give color and ornamentation. Concrete surfaces can be treated after the forms have been removed by picking, hammering or chiseling. The sand-blast can also be used; all of these producing different effects according to what is desired.

Some of the later and more modern German work which does not lean too much to the "Art Nouveau" forms might offer inspirations which are capable of realization. The important thing, of course, is to design within the limitation of the manufacture of the material itself. The general composition will, of course,

be affected by the constructive possibilities of the material and any adornment should be studied entirely from the point of view of its individual possibilities.

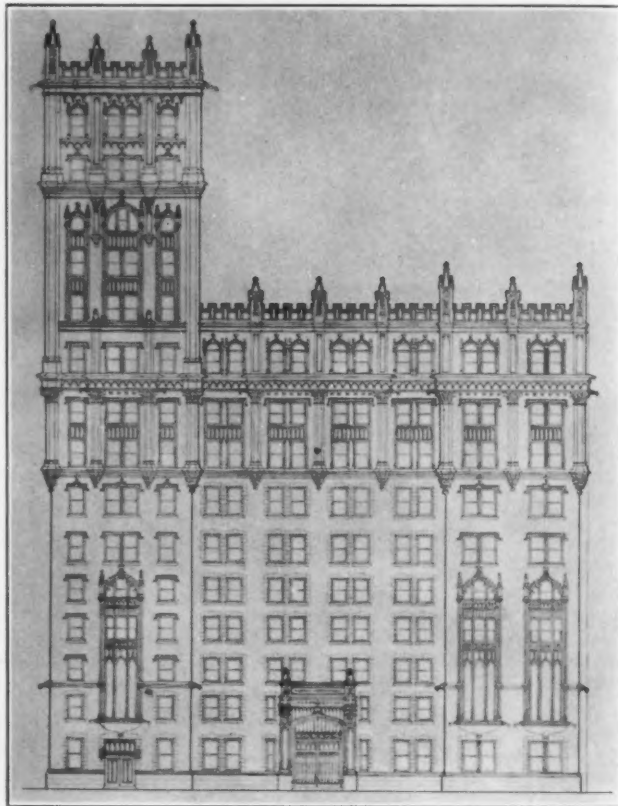
We are too prone in this country to use one material as a substitute for another. Our markets abound in imitation marble, imitation stone, imitation wood, in fact, imitation everything. Sound logic and a modicum of common sense as applied to artistic design in concrete is certainly capable of producing some very new, characteristic and interesting results.

The use of concrete has evidently come to stay, but we should not throw every other material to the winds for the consideration and exclusive adoption of this fad, irrespective of the type and character of the building proposed. Concrete has a definite use just as any other building material has, and it should be employed when the logic of the situation and other affecting circumstances dictate its use.

[From Mr. LOUIS DE COPPET BERG, New York, N. Y.]

CONCRETE was used—and used intelligently—by the French a century ago. In Eastern countries and in other warm climates—for centuries—it has been approximated by their heavy "mud" dwellings, the walls being as much as a yard or more in thickness, both to keep out heat and resist earthquake shocks. But with us the use of concrete is comparatively recent, but making astounding progress.

We have used it in floors for a decade or two, in various ways, but now we are beginning to use it as well for columns, walls, in fact every part of a building; making practically monolithic constructions. We are enabled to do this by the fact that we can now supply to concrete the necessary tensile strength, by introducing wrought-iron, or steel, reinforcement, whether by means of exceptional shapes, wires, twisted iron or steel; or



GRAIN EXCHANGE.

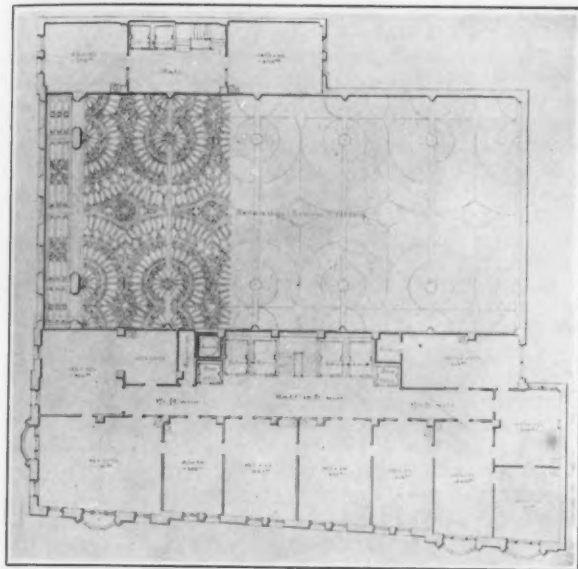
iron or steel artificially stretched to reduce its primary elongation, etc.

There is no question that the future construction of a majority of our American buildings spells CONCRETE REINFORCED, and with the biggest capitals at that.

With this upheaval in constructional methods, naturally arises your question: "How shall we treat concrete artistically?" In other words, shall we hide it, or boldly acknowledge it in our designing?

A properly designed building should not only be pleasing to the eye, but should announce to every beholder, through its design, the object or use of the building, and similarly—I claim—the nature of its construction.

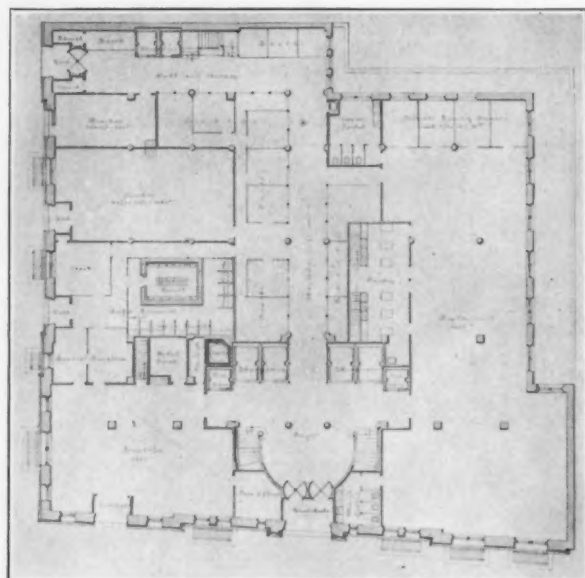
Of course, we can build reinforced-concrete buildings, with so and so many inches left off the front, and anchors sticking out, ready to receive the "applied" design of the architect. But that



EXCHANGE FLOOR: GRAIN EXCHANGE.

is not the question—I take it—but how to make concrete, itself, æsthetic.

My own idea was conceived from an experiment in Canada, at Ottawa, some ten years or so ago, when the expert of a certain concrete-construction company did not show up on time, and there being no time to waste, I undertook to carry out the concrete construction without the expert; the reinforcing steel having previously arrived. I used planed pine boards, and through fear that the water would be absorbed from the concrete,



ENTRANCE FLOOR: GRAIN EXCHANGE.

I had the boards watered, and the first layer was put in in the way of cement, rather than concrete; then the concrete was put in as is customary, in the usual proportions. When the boarding was removed I noticed that every grain of the pine could be seen in the concrete. This led me to think of the possibilities

of cement concrete finish on the front of a building; though at the time we were hardly thinking seriously of concrete wall construction.

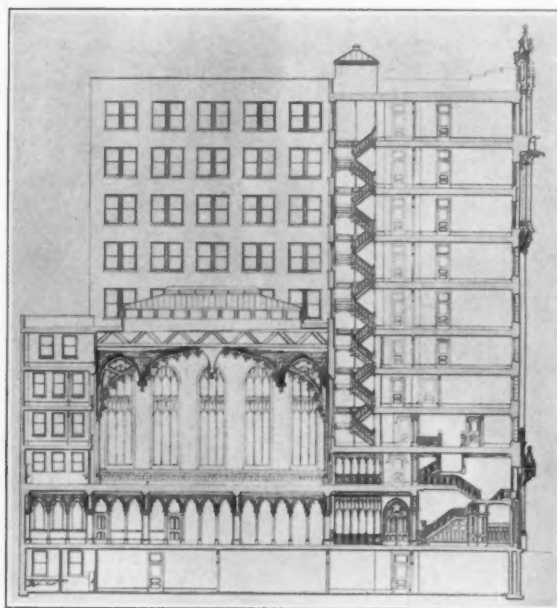
Now, this leads up to the very question which you ask: it is my opinion that we can get a fine concrete, practically almost cement, finish on a concrete wall, which will answer every truthful design, acknowledge the construction behind it, and at the same time be æsthetic. My idea is to keep back the solid construction one or more inches, as may be necessary, finishing it to properly roughened-up, or cross-sawed boards, so that the ultimate finish will take a good hold; then to pour in, in the way of a liquid cement, a very fine liquid concrete as a face finish. In some parts using moulds which will make the ultimate finish, in other parts putting wire, or other anchors to receive the applied finish, which can be cast in similar cement, or fine concrete work.

I send you some drawings prepared by me for a Canadian company which are intended to be executed entirely in concrete work, with such a finish as I have described.

My proposition is to make the pinnacles, corbels, dentils, in fact, all the ornamental work, of very fine concrete, almost, you might say, cement work, and apply them to the building, securing them with dowels or anchors.

The idea is to build up the wall with its roughened surface, story by story; then to set the moulds for the outside work, pouring in the finer stuff for the finish, where not applied. Concrete work will lend itself very readily to applied ornamentation of any kind.

As firmly as I believe that concrete is the future construction,



SECTION: GRAIN EXCHANGE.

I also believe that it will lead to more intelligent designing, designing that will be in keeping with the object of the building and its construction.

There can be no objection to the use of inlaid work on concrete fronts, such as rough-pointed stones, marbles, etc., or the smoother mosaic or glazed tinted tiles, or similar materials for spandrels, panels, etc., but I believe that architects should be truthful above everything when designing, and not use thin ashlar and other devices, to mislead the tenant as to the value of the wall.

I believe that concrete construction and its decoration—naturally applied—will lend itself to almost any design or style of architecture, excepting possibly the very heavy modern French Renaissance with its tremendous projecting mouldings, tremendously emphasized by the size of the buildings, over and above its original Greek models. To be sure, these projections might be reinforced by iron construction, but even then the shrinkage would probably make it impossible to carry them out practically. But, honestly, I think this loss would be a gain to the beauty of the decorations of our city.

Now, as to color. Shall it be painted? By no means! If you want the natural color, use steel brushes in cleaning down to remove such gloss, or sweat spots as may appear. Or, better yet! color your exterior fine concrete with cement finish, and do it in this way: In place of gravel or sand, use finely ground and various-colored terra-cottas and bricks in the mixture, and proportion them as you would in painting a water-color, or an oil so as to offset the green-gray effect of the cement and bring out the color effect you desire.

[From Messrs. CARRERE & HASTINGS, New York, N. Y.]

We have really given very little study or thought to the use of reinforced-concrete, excepting as a structural material, but from such examples as we have seen and such consideration as we have given the matter, it would seem to us that the material is tractable. If used with discrimination and judgment on logical lines of construction, with the introduction of other materials for decorative purposes, whether stone, terra-cotta, brick, tile or stucco, and especially, in view of the coldness of the material, if color is properly used and distributed in the ornamentation, we believe it to be susceptible of application and development on artistic lines.

This is best shown in the Blenheim Hotel at Atlantic City, N. J., which has many points of interest. The difficulty with this material is that it should be used in an ingenious rather than an artistic manner; also that it should be applied in imitation of stone rather than as a distinctive material with its distinctive characteristics.

We feel, on the whole, that this material is only adaptable to utilitarian buildings or commercial buildings, and picturesque schemes, but in no way fit for the more serious monumental or classic buildings, whether of a public or private character.

We would be interested in the application of this material in a building like the Ponce de Leon Hotel. We would not think of it, however, for any building within the metropolitan district, excepting strictly industrial or commercial buildings.

[From Mr. GEORGE CARY, Buffalo, N. Y.]

THE architectural expression of reinforced-concrete, like that of the skeleton construction, is bound to be masked or covered unless the concrete construction is shown on the façade as part of the design.

The structural lines may be shown in the veneer, whatever the material for the exterior treatment. This may be done by emphasizing the constructional lines in the exterior treatment. If there be no visible roof or no reason for projecting cornice, the flat factory-like appearance can readily be overcome by the treatment of flat lines, flat panels or color-effects.

The Saracens, Etruscans and Egyptians understood the logical treatment of building better than most architects of to-day. Why do so many architects feel the necessity of a galvanized-iron or cheap projecting cornice, when the object is neither to shed the rain nor shield the windows below from the sun? They feel it is a necessary "architectural effect," when an effect much more logical and practical might be secured by the band or flat decoration.

If the aim be to show the concrete structural lines on the exterior, let the boxes, into which the concrete is poured, be patterns or dies that can be used again, as the plasterer uses his moulds again and again.

Unless a contractor has his own forms and tools, the concrete construction will not be an economical means of construction. The cost of making a mould or die of glue is not great when these same ingredients may be used over and over again, as each architect differs his design.

Concrete treated from sculptural moulds has at a distance the effect of stone and is far less costly than veneering the concrete with any building material.

[From Mr. THEODORE M. CLARK, Boston, Mass.]

IN and about Boston the most satisfactory concrete walls are those finished with a coat of cement rough-cast. This suits the comparatively rough character of the material, and gives a texture well adapted to the large surfaces of walls cast in plank moulds, or laid up with building-blocks. Whether it may not, in future, be possible to devise a better finish is an open question. Personally, I incline to the belief that the most promising outlook for the artistic development of concrete construc-

tion lies in the direction of a revival of what is popularly known as "stucco" architecture, but with the difference that our moulded and cast work, instead of being executed in lime and plaster, precariously attached to greasy brickwork, can be in La Farge cement, or perhaps, in the white Portland cement which is promised us before the present season is over, and attached so firmly to the concrete beneath as to form practically one body with it. Among architects, "stucco" is almost a term of reproach; yet about nine-tenths of the Italian palaces, including many masterpieces of Palladio, Sansovino, Scamozzi, Alessi and the other great architects of the Italian Renaissance are executed in stucco; and, in the hands of the German architects, particularly in and about Munich, Frankfort and Dresden, stucco, often treated with color or sgraffito decoration, has given some of the most charming modern buildings in Europe. With the resources that our cement industry now affords, we should be able to follow these examples very successfully. Where a smooth finishing coat is to follow, all necessity for lining the moulds with cloth, to prevent the joints of the boards from showing in the wall, or for trowelling the faces and arrises, or patching up at completion, vanishes, and the rougher the surface of the concrete wall, the better the finishing coat will adhere to it. For running mouldings, a smoother and "fatter" mixture than any now in current use would be desirable, but the cement manufacturers could probably give directions for making such a mixture; and concrete that can be carved as easily as stone is already available, where something better than cast ornament is needed. We know from innumerable Italian examples what beautiful columns and pilasters, with their capitals, bases and entablatures, and what an endless variety of window dressings and other ornaments can be made with stucco, on a foundation of rough masonry; while, for those who like novelty, a suitable cement mixture, which can be applied in rough masses to a wall, and subsequently carved, would enable us to imitate, and perhaps improve upon, the present pretty French fashion, of lavishing festoons and garlands of flowers and low-relief figure sculpture on the outside of buildings.

[From Mr. HENRY IVES COBB, New York, N. Y.]

CONCRETE and reinforced-concrete construction are being abused and used in many places where they do not belong, just as skeleton framing has always been. Each construction is most admirable for its legitimate purposes, but there are a lot of engineering absurdities going up.

[From Mr. GUSTAVE W. DRACH, Cincinnati, O.]

REINFORCED-CONCRETE construction has gone beyond the experimental stage with us here in Cincinnati. I myself have built a large number of buildings using reinforced-concrete in a great many different ways. I have constructed some very heavy warehouses with brick bearing-walls and reinforced-concrete floors, beams and interior columns. I have built some, using a reinforced-concrete skeleton frame filled-in with brick curtain-walls just as you would in a steel-skeleton frame. I have also put up several buildings where the entire front, columns and decorations were of cast concrete. I have built spans from 20 to 65 feet long carrying a live load of from 200 to 600 pounds per square foot.

Several of the other architects here have also used reinforced-concrete treated in various ways architecturally; all of them have been quite successful. We have not had a single failure here in Cincinnati.

We find that the work can be done as rapidly as any other method of construction, more economically than many other methods and with more permanent results.

It is important that the reinforcement be properly designed, and, of course, very important that it be properly executed. The execution of the work needs very close inspection.

I think that very shortly this method of construction will be better understood by architects and engineers generally and will undoubtedly come into general use.

[From Messrs. ELZNER & ANDERSON, Cincinnati, O.]

REPLYING to your letter of April 8, asking for some ideas on the artistic treatment of reinforced-concrete, we beg to enclose copy of a paper [See page — of this issue.] written by our Mr. Elzner on this subject, which was read at the late convention of the Association of Cement Users, Chicago, in January.

[From Mr. J. J. FLANDERS, Chicago, Ill.]

I RECEIVED your letter, in which you request an expression of ideas on reinforced-concrete, at a time when I am in the position of the "man who attempted to build a house from ideas obtained from foolish journals which tell how to do impossible things and ridiculous stunts in the home building line."

Some attention had been given to the subject of concrete, in a limited way, in its use for foundations, walls and floors, when circumstances led to its use in the construction of a residence for myself. One of the arguments which induced the decision was its economical cost compared with other materials, an argument which experience showed was as reliable as the statements concerning the limited tons of fuel consumed in some house-heating plants before installation, when winter's trials demonstrate the unreliability of the maker's figures.

The decision to enter into the project of building a concrete house was not made without due consideration, but as the difficulties met with are not a part of this letter, they will be passed without mention.

The concrete-block architecture, which I am convinced has undeveloped merits, did not appeal to me and was dismissed from consideration, and mixed concrete, reinforced and built in forms, was decided upon. The exterior walls are of hollow structure, 12 inches wide, formed of two 3-inch walls with a 6-inch void between. The 3-inch walls are reinforced by steel verticals and horizontals, suitably placed and united to each other, forming a metal lattice in the center of the concrete. The walls were anchored to each other by metal ties so that a stable wall was obtained with the minimum of material. The interior floor-supporting walls were single, built of 4-inch thick concrete, reinforced in a similar manner to the exterior walls. The metal reinforcement was such that fissures in the monolith, by reason of the placement of new to old material or by unequal adjustment, were avoided.

The appearance of the walls when the forms were removed was a subject of concern, and investigation and thought were expended to obtain what was hoped would be an artistic effect that would show its birthmarks not too obtrusively.

Crushed limestone, from the size of a pea to a hazel-nut, with torpedo gravel formed the aggregate for the concrete. In the cement was used a minor percentage of hydrate of lime and the mass was mixed automatically in a continuous proportional machine mixer, coming out from the mixer very wet. On removal of the forms, this mixture gave a wall-surface which showed the irregular sizes of the crushed stone, and as none of the pieces was larger than would pass through a $\frac{3}{4}$ -inch mesh, there were no large voids in the surface. It was difficult to prevent the workmen tamping the concrete too much, for as the mass was placed very wet in the forms it was only necessary to work it to place with a light metal rod to settle it. Using weighted tamp tools brought the particles of sand to the surface and resulted in a smooth surface next the dressed boards which was not desired, but which could not always be avoided because of lack of experience and care of the workmen. The columns and capitals supporting the veranda roofs were cast hollow, in sections, and when hard set in position in the building. The concrete for these was formed of torpedo sand and cement without crushed stone. The surface of the columns was of a smoother texture than the walls of the house and has an appearance resembling sand-finished plaster. No attempt at ornate or moulded courses was made.

A part of the wall-surface was trowel-plastered with neat cement to give contrast and relieve its monotony. These troweled surfaces are horizontal band-courses on the building and frames around the window openings. The variety obtained from this treatment is pleasing both in form and color contrast, while it is comparatively an inexpensive treatment.

[From Mr. J. H. FREELANDER, New York, N. Y.]

I REGRET that I have not been able to give more time to the consideration of the subject of artistic treatment of reinforced-concrete. The subject is extremely fascinating, and there is much to be said, it seems to me, on the decorations and exterior concrete surfaces.

In regard to the general color, I believe it best to apply same after the finished cement coat has been trowelled, and not to attempt to mix it with the cement beforehand. In this way an infinite variety of shades can be obtained. An occasional bit

of colored terra-cotta, sparingly used, greatly enhances the effect of cement and concrete treatment.

[From Professor A. D. F. HAMLIN, New York, N. Y.]

PROFESSOR HAMLIN's views will be found incorporated in an article, "The Architectural Problem of Concrete," elsewhere in this issue.

[From Messrs. HORGAN & SLATTERY, New York, N. Y.]

It may be assumed that reinforced-concrete construction has passed the experimental, and is now in the trial stage.

The reinforced-concrete work done through this office, we may say, has been uniformly successful, owing, we believe, in a great measure, to the rigid testing of cements, careful inspection of materials, and constant and close supervision of the mixed materials, as deposited in the forms.

Granting that the problem is properly designed, the quality of cement and the degree of supervision exercised are the prime elements of success.

We designed, we believe, the first reinforced-concrete structure in New York City, about seven years ago, situate on the pier at the foot of East Sixteenth Street, to be used as a Bacteriological Laboratory for the Willard Parker Hospital.



BACTERIOLOGICAL LABORATORY, EAST SIXTEENTH STREET, NEW YORK.

In our opinion it is feasible to so design a reinforced-concrete structure as to obtain an artistic effect equal to a stone treatment. The mass can be made to appear monolithic, by omitting any imitation of stone treatment, and letting it show as though it were designed in plastic material, and not in imitation of stone or stucco treatment.

Large moulded cornices can be cast as the building is erected, and small ornamental work may be applied after completion of the shell.

It would seem that distinct color treatments, a modification of the "scag" method, could be arrived at by the use of stains in the cement mortar, plastering the stained material against the forms to a thickness of, say, one inch, before the body of the shell is filled in. We have attempted this on a small scale in a country house, and it has been fairly successful.

The field is a new one, and the possibilities of color treatments are apparent; but some experiments in practical application will be required on the part of architects bold enough to assume the risk.

[From Mr. GEORGE KELLER, Hartford, Conn.]

To your request of recent date I can not offer much in reply. I built the first building in New York City, for which a permit was issued by the Department of Buildings, that complied with the requirements for the "fire-proof class" of buildings.

While preparing the design I consulted with the Hennebique and the reinforced-cement companies and learned from them that it is much more economical to build curtain-walls of brick than of reinforced-concrete, while, on the other hand, it was much more economical to use reinforced-concrete for the struc-



STUCCO AND MOSAIC COLUMNS IN THE NAPLES MUSEUM.

tural part of the building than if the usual skeleton-steel system were adopted. This determined me to use reinforced-concrete only for the posts, girders, stairs, floor and roof slabs, so that none of the reinforced-concrete was exposed to view on the exterior, though the construction was visible in the interior.

I doubt if as good an architectural effect, artistically speaking, can be produced for the same outlay of money, by using reinforced-concrete as by using the usual building stones and bricks, in the present stage of this system. Probably, in time, this disadvantage will disappear, after workmen have had more practical experience in the application of a decorative surface to the material.

From time immemorial, where buildings were of concrete or baked clay, they have been faced with a coating of stucco, glazed

or unglazed tile, porcelain, colored marbles, mosaic, or terracotta. The porcelain pagodas of China, the tile-faced remains found in Assyria, the walls and columns coated with mosaic embedded in cement to be seen in Pompeii, Rome and elsewhere in Italy, are examples. In Italy many of the façades of the cathedrals and churches are encrusted with mosaic and beautiful marbles, as may be seen in Orvieto, Verona, Rome, etc.



COURTYARD OF THE PALAZZO VECCHIO, FLORENCE.

If I were commissioned to design a building entirely of reinforced-concrete, I would probably wish to have a large part of the surface of the exterior treated polychromatically, using glazed or unglazed tile, colored terra-cotta, marbles or mosaic. The doors, windows and other openings would be spanned either by straight lintels or girders, the arch being suppressed as in the Parthenon. If the roof were visible, either sloping, pyramidal or domical, it would be covered with glazed tile, a beautiful example of which is to be seen in the dome of Dr. Parkhurst's church on Madison Avenue. The Ducal Palace in Venice, Giotto's Tower, the Palazzo Consiglio in Verona, and the before-mentioned Cathedral of Orvieto are fine examples of the use of color. A beautiful treatment, recalling the Giralda in Seville, would be to employ surface ornament arranged in panels, and of either cast cement or terra-cotta. In order to give variety to the design and remove the severity of the horizontal lintels, the heads of the openings might be filled with perforated ornament or lattice-work suggested from the Alhambra or other Arabic sources. I am aware that the office of the Hennebique Company in Paris and other buildings in Europe have the exterior showing the cement finish, but the color is bad, and a finer effect could be had at less cost than the modeling and casting of the applied ornament involved, by the use of tile or terra-cotta and for a little more expense beautiful marble inlay or mosaic might be employed.

[From Mr. ADIN B. LACEY, Philadelphia, Pa.]

THE answer to your question, "How best to treat reinforced-concrete when an artistic or architectural effect is sought," in my opinion, is that it is better to clothe the reinforced structure with other materials, the same as a steel structure is covered. The natural color of cement or concrete is not artistic; and while in Germany they have found a method of coloring it, as witnessed in the German exhibit at the St. Louis Exposition, it has not yet to my knowledge been done here satisfactorily. Further, the great absorption of moisture by concrete is against its use externally. This, as I am given to understand, has been overcome by the addition of hydrated lime to the extent of 15 per cent. of the weight of the cement used in the mixture.

[From Messrs. LORD & HEWLETT, New York, N. Y.]

WE do not feel that we have any very interesting opinion to express at the present time in regard to reinforced-concrete construction.

We believe that most interesting work can be obtained by the use of concrete in block form, but, up to the present time,

we have seen no reinforced-concrete construction which has been sufficiently perfect to make possible the satisfactory carrying out of any architectural design, no matter how satisfactory the design itself may be.

[From Messrs. MAURAN, RUSSELL & GARDEN, St. Louis, Mo.]

We are in receipt of your inquiry, which interests us exceedingly. We agree with you that, up to the present time, architects in general have been more concerned with structural difficulties than with the study of a logical use or expression of this construction in the matter of architectural design. We cannot bring ourselves to believe that concrete should be clothed with a veneer of any sort, in just the same way as our steel skeletons have been covered, but rather that it should be used as a structural material which can also be made acceptable in design with some combination of flush panels or patterns made of brick or tile set in the concrete, which might be used on the exposed structural concrete—possibly bush-hammered to lend interest.

In a few days we will send you a drawing which we have just prepared for a commercial building designed after this fashion. The piers and lintels of the first story being covered completely, for practical reasons, with glazed brick in two colors while, above, piers and lintels are left exposed and the panels under windows are faced with the same enamelled bricks worked in patterns. We must admit that in working out this design we are still groping for a true expression of materials under consideration.

[From Mr. W. G. MITCHELL, San Francisco, Cal.]

I THINK it is Ruskin who says that "a building only begins to be architectural when something is added which is not absolutely indispensable." In this I agree. The architectural reaches beyond the utilitarian, and if in reinforced-concrete we are to confine ourselves to anatomical lines, posts, girders and floor-slabs worked out by formula, I do not see that we are to get anything much more interesting than the steel frame of the skeleton-construction type. Structurally, in my estimation, reinforced-concrete admits of greater possibilities than any of the materials hitherto used in the art of building, for on account of its cohesive strength, its capacity to withstand compression and its monolithic character, it can be used as a vertical post, horizontal beam or slab, and, furthermore, projected as a cantilever in a manner which perhaps is only possible with wooden construction. But Portland-cement concrete has an ugly color and must be covered with some surface other than its own.

The beauty of stone lies not only in the color it possesses and which all artificial substitutes fail to equal, but also in the endless variety of color from stone to stone, giving the whole a charm compared to which all artificial compositions imitating stone are lifeless. This brings us to the conclusion that an imitation of stone in concrete is not a rational solution.

First, then, I look to the plasterer's and modeler's art to embellish a reinforced-concrete building. The post, the arch, the lintel, the projecting balcony, the overhanging cornice, the groined ceiling and above all the dome are eminently suited to the material; but for the artistic finish of these we must look first to the plasterer and modeler. Where the building has not to be all windows I look for beauty to great, smooth surfaces of tinted plaster with, at the window and door openings, embellishments in rich examples of the modeler's art applied to the surface after the structural part has been completed. The whole tinted in some of the many tones that they apply so successfully in Mexico to their stucco buildings, ranging from pale blue and delicate green to the pinks of the sea shell and the stronger tones of orange and the like, or the whole brilliant in the white of the pearl or the restful white of ivory, or partly colored or decorated with bands and stencils. Where money is more plentiful, the flat surfaces may be covered with colored tiles.

In my experience I recall only one successfully treated building of this character; it is in the city of Mexico; the tiles are blue, orange and white, or mosaic (marble or glass) or slabs of marble may be successfully used.

The idea to be shaken off is that the architect is to be tied down to the least concrete that will do the work in safety. If owners will agree to pay only for that they cannot hope to get anything at all presentable, not to say beautiful, in reinforced concrete.

The stucco of Italy and Spain show that beauty is not inconsistent with the use of this material, but we must remember all the time that Portland-cement concrete or plaster is about the ugliest material used in all the builders' art. If you can afford nothing more, give it a coat of whitewash.

If structural lines only are to be allowed, the buttress and tracery of the Gothic suggest themselves as possible solutions.

[From Messrs. MORGAN & WALLS, Los Angeles, Cal.]

REINFORCED concrete is a structural material the same as steel, and we see no reason why it cannot be masked and treated, the same as we would a steel building, with terra-cotta, brick, stone, or any other material that the architect may choose to use. We have used terra-cotta on the exterior of our buildings where reinforced concrete is used structurally in precisely the same manner as when steel has been used, and pressed brick or stone can be used in the same manner, being supported on ledges and thoroughly anchored, the same as we would handle a steel structure.

Of course, if one wishes to study economy and honest expression of construction he can finish the concrete direct, carrying out any order, or any other architectural decorative features that he may wish to incorporate in the building. The architect has just as much scope in the treatment of a reinforced-concrete building as he has in a structural steel building. Cost is the only thing that curtails him in any treatment that he may desire to make of the building. It is less expensive and perhaps fully as effective treated wholly as cement, all moulds and other enrichments being cast or run in cement.

[From Mr. D. H. PERKINS, Chicago, Ill.]

THE easiest way to answer your question and tell how to use concrete is to tell how not to use it.

In my opinion it is not desirable to use it as anything but concrete. It should never be used in cast blocks to imitate stone. Above all the Classic orders and ornaments which are characteristic of stone and of the chisel should not be cast or moulded in concrete. I believe that this material should be used in large unbroken surfaces as roughly as possible, with no attempt at a "slick" finish.

The best work that I have seen has a surface made of large pebbles or large broken stone which, if the building is large, may be in pieces as large as small egg-coal. If a smoother material is desired for trimming window and door openings, it is easy to insert pressed-brick, cut-stone or terra-cotta.

In your question you ask for an expression as to how best to treat reinforced concrete when an artistic or architectural effect is sought. In general, reinforced concrete is used for floors and columns and has nothing to do with the artistic effect of the exterior of a building.

When concrete is used in large wall-surfaces I would regard it simply as masonry and not a question of reinforced concrete.

If, on the other hand, an office building is to be erected and the piers must be small, I believe the best method is to conceal it entirely, and place cast-iron or bronze frames around all openings and fill in from one frame to the next with mosaic, tile or thin terra-cotta set in pattern, allowing the surface to be entirely decorative rather than structural in effect.

[From Mr. W. L. PRICE, Philadelphia, Pa.]

REPLYING to your recent request, would say that I have written an article on the subject of "The Possibilities of Concrete Construction from the Standpoint of Utility and Art," for the American Association of Portland Cement Manufacturers, in which I said about all that I have to say in that regard at the present time. The Association doubtless would be very willing to provide inquirers with a copy of the paper in question.

[From Messrs. RENWICK, ASPINWALL & TUCKER, New York, N. Y.]

LIKE many other architects we are greatly interested in reinforced concrete, but have never used it in construction of a building, beyond the foundations. We have used it in a number of instances in the country for walls and pergolas and enclosures, and have made several plans to be carried out later. We consider it the coming material for building, but think it is still in its infancy in its mode of construction and that it will take some

time to solve this question. Of course frost, which prevents its use in extremely cold weather, is against it, but we have a great deal of faith in it.

[From Messrs. ROGERS & MAC FARLANE, Detroit, Mich.]

We have tried three times to write an answer to your letter in reference to the "architectural treatment of reinforced concrete," and each time the letter when read meant nothing.

The question is entirely too broad for an answer.

Reinforced concrete is a matter of construction, like steel, and if we are ever to give an expression to reinforced concrete as such this expression can only be gradually put into concrete form, and I do not believe we will ever be able to give a special architectural treatment to this construction any more than we have been able to give a special treatment to steel construction.

It would seem rather fitting to give such a building an exterior cement finish, though we can see no special reason why concrete columns and beams should not be encased in stone, brick or terra-cotta. In this latter case, of course, there is no real concrete expression. Why try?

After all a concrete building really results in flat surfaces, which must be decorated without great projections.

Personally we prefer flat pilaster treatment as being within the limitation of concrete workers, and yet such a treatment leaves a broad field for individuality of design.

[From Messrs. ROSSITER & WRIGHT, New York, N. Y.]

The great trouble concerning architectural and artistic effects in reinforced-concrete construction is the lack of competent and skilled mechanics to execute the work. In country work, for example, it ought to be possible to-day to build fireproof houses of concrete and they could be made to express the very best kind of simple and direct architectural style. Broad masses of wall-surface, simple roof lines, an accurate and logical reflection of the plan in the design will produce charming houses in concrete. Simple mouldings, enrichment of window and door openings and color applied to walls are all to be employed with most promising results. But where are the intelligent contractors and workmen to do this work? We have found it very difficult to find any except in the cities where the price is prohibitive for country work. In the city you can get the work done, but there are few contractors even there who understand the work. Five years hence it will be different. We ought by that time to have an educated class of workmen capable of doing ornamental work of all kinds in cement, and the cost of executed work should be such as to encourage the use of fireproof and permanent construction. When that time comes we look for a great improvement in the architecture of all average construction. Even in the hands of ignorant and unskilful architects design will be improved, for "features" must give way to straightforward construction and it will be more and more difficult to construct ornamentation. Furthermore the art of properly ornamenting construction will revive, for with the use of rigid material must come a fuller realization of the fundamental truths concerning artistic adornments. Imitation of stone or brick construction is not likely to be attempted in concrete, when it becomes economically possible of universal application to all ordinary structures. There is more probability of correct design within the necessary limits of the use of the material. Rich color effects, the use of mosaics and proper ornamentation of structural design are to be looked for, culminating possibly in a more distinct and differentiated style of architecture.

[From Messrs. SAXE & ARCHIBALD, Montreal, P. Q.]

We have constructed no buildings with reinforced concrete in its entirety, not that we have anything against the system as a system of construction, but we are decidedly against the present method pursued in carrying out the work, *viz.*, the preparing of plans by the engineers of some of the reinforced-concrete systems and the later handing over of the work to contractors often ignorant of the construction. That is the reason we have turned down several propositions in our city, and as far as we can judge it is the reason why there are so many collapses in reinforced-concrete buildings.

[From Messrs. SOMERVELL & COTE, Seattle, Wash.]

In discussing the artistic treatment of reinforced-concrete construction, the term may be taken to stand for two separate sys-

tems in so far as expression of material is concerned. The first, where the columns, girders and floors alone are of reinforced concrete, is amenable to the same artistic laws which govern any system of decorated skeleton-frame construction, as the constructive members may be assumed to take the place of steel.

In the second phase, where the exterior walls as well as the constructive members are of concrete, the problem of exterior decoration admits of no such latitude of treatment. Here the wall itself should be expressed by a plastic quality in the design—the possibilities of which are as yet in their infancy.

The greatest objection so far encountered in exterior cement finish is the lack of life and color incident to this material, and every effort should be made toward the discovery of a substitute which will be susceptible of a permanent range of colors by admixture of pigments—and at the same time be impervious to the weather and sudden changes of temperature. Should such a material be found, and no doubt it will be found, the problem of true expression will rest on the individuality and ingeniousness of the designer. In this connection there is no reason why tiles of plain or varied pattern should not be considered as appropriate material, provided, however, that they be plainly treated as tile incrusts in the surface of the wall. This opens up a range of design of unlimited scope in composition and color and may, when developed, tend to relieve our thoroughfares of their present lack of interest.

Some of the secessionists in design have already accomplished very good pioneer efforts in the direction indicated, and no doubt the time will gradually arrive when a new style, founded absolutely on truthfulness of expression, will supersede the present crude attempts to treat a cement construction as though it were of steel or masonry.

[From Messrs. STONE, CARPENTER & SHELDON, Providence, R. I.]

We have yet to see reinforced concrete used in any way to produce an architectural or artistic effect and have not had occasion to use it where either was necessary, although there have been times when we should have been glad to use it, if we could have had any confidence that raised or depressed patterns, horizontal or vertical sinkages or satisfactory surface-texture could have been secured. We have never yet seen any work done with a good, straight and continuous arris or uniform surface, free from pits and exposure of the coarser particles of the concrete. The surface of the Harvard Stadium, which was pointed with compressed air tools, is the most satisfactory surface that we have seen.

We are seekers after just the kind of information desired by you, and shall be glad to learn from others that which we ourselves do not know how to perform.

[From Messrs. STURGIS & BARTON, Boston, Mass.]

As a partial answer to your enquiry we enclose working drawings of the Manila cathedral. This building is executed entirely of concrete, with the exception of the roof. The dome was designed for reinforced concrete originally, but on account of the expense this was dropped.

[From Professor RUSSELL STURGIS, New York, N. Y.]

Your communication of the 8th is before me, and is of the most interesting character. I am only sorry that my own experience as a practising architect came to an end before the introduction of reinforced concrete as a material easily accessible. I have had no practical experience with it whatever.

In common with other students of the fine art of architecture, I should fear that any attempt to build in monolithic or solid masses would be ruinous to external effect, and equally so to the larger and more interesting interior design. In architectural work much charm results from the slightly irregular surfaces—one stone, one brick, one block of terra-cotta offering a slightly different angle to the rays of light from that offered by another unit of the wall. A column of marble or limestone is far more beautiful with a shaft made up of many rather small drums. Again, the slight differences in color are invaluable, and the beauty of a rough brick wall is greater than that of a wall of face-brick, chiefly because the divergence in hue and even in tone is considerable.

If we are to substitute for the old masonry walls new walls cast in a single block, then we must consider what the Greeks

did with their work when it had been made to look monolithic by being covered with stucco. They built of soft stone habitually, and covered their surfaces with hard and perfect plastering of some kind; but this they did as a preparation for brilliant polychromy. That, indeed, would be supportable! That, indeed, we could face without shuddering! If some one would build a monolithic church, having first considered very carefully the effect of brilliant color and the pattern with which he proposes to decorate his church, then, indeed, we should rejoice to follow his experiment!

We can hardly hope for that, however; and as long as pseudo-Roman colonnades are the only things desired by architects, we must hope that concrete will not replace stone for the artistic parts of our buildings.

[From Mr. LOUIS H. SULLIVAN, Chicago, Ill.]

My experience with reinforced concrete, by trend of circumstances, has been rather limited, and confined almost entirely to floor-slab work; thus, while I have investigated its constructive possibilities with considerable care, I have considered its artistic treatment only in a figurative sense. I have scarcely a doubt that it will lend itself to effective exterior treatment, especially, perhaps, in the way of inlays or mosaic effects, provided the scheme of the building is designed in the beginning for such results. Reinforced concrete, like all other material, it should be obvious, must be designed in accordance with its essential nature, and I have no doubt that if this is taken as a basis extremely interesting and varied results might be obtained. This, of course, is but a general statement of my views, on general principles. I have long desired to execute some effective exterior work in this material, but the opportunity not having presented itself, I cannot, of course, discuss the matter in detail.

[From Mr. J. E. TOURTELLOTTE, Boise, Idaho.]

I HAVE tried various methods to get an architectural effect in reinforced concrete, and have succeeded partially. I think the common effort of the concrete-block manufacturers to produce an imitation rock-face, such as is obtained by pitching off the face of sandstone in the ordinary manner, is the reason architects, as a rule, are so prejudiced against concrete stone.

No one can cast concrete to imitate a surface obtained by natural splitting or breaking. I have, in my practice, obtained very satisfactory results by casting the lintels, sills or arch-stones, as the case may be, and then having the workmen pitch them off after the concrete was partially hardened, in the same manner as is done in pitching face of stone to obtain a pitched rock-face. Ordinarily smooth or rigid surfaces, using light colored sand in the proportion of (1) of cement to (1) of sand, afford the best effects. We, in our section, have very white sand and a light-colored cement, so that we get a silver-gray color, and the surface, if a very good job is done as per above, resembles terra-cotta in appearance, so nearly that it would take a close inspection to distinguish the difference.

I have seen good results obtained for large flat surfaces, like the side of a house, for instance, by painting the forms with some cheap elastic paint and sanding on same with coarse white sand and using the facing against form of (1) sand to (1) cement mixture, not too wet; after forms are removed, cleaning off surface with a hose. This process gives a soft natural sand-finish, similar to the surface of No. 2 sandpaper, uniformly coarse and of an even color.

I do not believe in plastering over reinforced concrete for exterior work, as, in the majority of cases, the coat will get loose from the concrete and look shabby. Making vertical ridges in the form by using sand and paint, and making ridges while same is soft, and stripping the forms with $\frac{3}{8}$ -inch square strips to mark joints wherever you wish them, and filling these joints with cement mortar, pointing with a concave tool, makes a nice appearance, resembling tooled stone laid up in cement mortar.

I think that very smooth surfaces should be avoided in this material, as it looks pasty and cheap. Uniformly rough surfaces are to be sought. Finish the surface obtained by the use of the form instead of plastering over afterwards.

Beware of a sloppy mixture for facing. Color should be light, to suit me.

[From Mr. MORRISON H. VAIL, New York, N. Y.]

How best to treat reinforced concrete when an artistic or

architectural effect is sought depends very largely upon the special conditions of each individual case, just as with any other material. However, there is one rule that should always be observed and that is the frank and undisguised acknowledgment of its nature, refraining from all attempts to imitate other materials. The failure to observe this rule has been the real stumbling-block more often than anything else. Throwing aside all attempts at imitation and frankly and freely adopting the peculiar properties of concrete opens up a large variety of effects adaptable to artistic design. Concrete is an extremely plastic material and can be easily wrought into form and surface appropriate and sympathetic with the style of architecture or the class of structure in question. It would be just as great folly to attempt to lay down hard-and-fast rules for the treatment of concrete surfaces as for the adoption of architectural styles, and it would seem quite natural to select an entirely different surface treatment for a building of Classic design from that for one of Mission design. A highway-bridge with formal surroundings should have quite different treatment in this respect from a country-road bridge with woodland surroundings, in order to attain the best results, although both may be of the same size and general shape. And yet the concrete surface is easily made to harmonize naturally and artistically with all these different conditions. With a very little special preparation and extra labor the surface may be varied, from the perfectly smooth and even face of straight cement and fine white sand to the rugged, yet uniform, face of the coarsest broken rock or gravel brought out more prominently by washing before it has fully hardened. All the gradations between these two extremes are possible, each with its own texture and effect. How natural and effective the bold, rough finish on a simple arched bridge over a woodland brook, with the nestling brush, the clinging vine and the winding, foliage-bound road! and again, how appropriately and harmoniously the clean, sharp, fine-grain effect of the smooth finish, combines with the pure Classic design. The plasticity and the great variety of surface-finish possible with it, make it easily adaptable to almost any taste or idea of artistic design. However, its artistic effects especially appeal to me in garden or landscape architecture, in half-timber design and in buildings in the "Mission" style. The coarser grout, carefully screened to even size and thoroughly washed, so as to give clean, bold relief, is particularly pleasing in the architectural features of landscape work, such as bridges, terrace balustrades, garden-walls, etc. In half-timber work the texture of the finish should vary somewhat with the size of the structure and the broadness of the general design, but should never approach the insipidness of a plaster effect. With the Mission style the surface should always have the even grain and texture of the coarse sand or fine gravel which so pleasantly relieves the broad, plain spaces. These surfaces are obtained by thoroughly flushing the selected material against the face form, removing the form at the proper time and washing the smaller particles from the surfaces with water. This exposes the character of the aggregate and the uniformity of mixture which thus govern the final effect, although it depends somewhat upon the extent of the washing. There are other methods of treatment which employ steel brushes, rubbing with wooden or stone blocks, the bush-hammer, muriatic acid, etc., but I believe that the washing method described is the most satisfactory. The forms should be properly prepared for this work so that the faces may be readily exposed and the form supports should be placed far enough from the wall surfaces to permit free access to the entire face. The most desirable treatment for the interior surfaces of reinforced-concrete structures would be, first, a thorough water-and-stain-proof coating and then plastering with Keene's cement for the walls and ceiling, with tiling for the floors. For roofs, tile or asphalt on reinforced concrete give the most desirable results.

[From Mr. EVARTS TRACY, New York, N. Y.]

Mr. Tracy's views and suggestions may be found expressed at some length in an article elsewhere in this issue, "The Idiomatic Use of Concrete."

[From Mr. C. HOWARD WALKER, Boston, Mass.]

CONCRETE used as a covering is a cast material, set in forms or matrices prepared for it, and has not the quality of wrought or cut work. If built in blocks, it has the character of an inferior artificial stone, of texture inferior to most of the natural stones,

and giving the same impression of strength that is associated with stone construction; but when used as a covering to iron it is devoid of joints, loses entirely the expression of stone architecture and becomes similar in effect to plastering. As it has a thicker body than paint, it manifestly conceals the structural skeleton and covers joints and minor details with one continuous thick coating.

It is, in its molecular character, similar to stone and is readily made to resemble stone, yet it should, if possible, have its individual character announced. It conceals the iron and does not give evidence itself of the strength which lies behind it. The first consideration in designing in reinforced concrete should be the avoidance of marked stone characteristics, such as the joints, tooled surfaces, quoins, corbels, etc., peculiar to stone architecture; the next should be an attempt to reinforce apparent weakness in spans, columns, etc., by lines or mouldings which give the suggestion of the strength of the concealed iron, *i. e.*, horizontal lines in the beams, vertical lines in supports. Apart from this the surface should be without joints, and if texture is desired, it should be of cast or stamped patterns, not imitative of stone cutting. The fact that concrete is easily broken at exposed sharp angles would suggest that all corners or mouldings likely to receive wear should be softened and rounded, rather than left crisp and sharp. Also, concrete can be used as a bed as well as for a covering, and the insertion of pieces of detail in tile, faience, glass or mosaic as ornament is more readily done in a concrete structure than in one of stone and is more consistent with the material. In fact, oriental architecture of plaster and stucco is much more analogous to concrete structures than is the architecture of wood, stone, brick or veneers of stone. Ornament upon concrete surfaces should be cast or stamped. If cast ornament is used, it should not imitate stone or wood carving, but be distinctly modeled work applied or set in. Concrete surfaces should be granulated surfaces without the impression of tooling. It is difficult to realize the strength of iron in structure if it is overlaid by materials which have greater body and consequent apparent solidity, and it is equally difficult to associate strength with slender columns and beams of concrete. So, it is important in design in concrete that the structural factors should be indicated and that surfaces in concrete should manifestly be curtain-walls or panels. A suggestion for treatment occurs in the framing of woodwork, but in that case joints show while in concrete work they are not evident. Champfered corners, coves and undercut mouldings employed to avoid superfluous material are all characteristic of concrete structure. In many cases all structural features may be unexpressed and the concrete remain in unbroken surfaces, merely as a covering. Such cases occur when openings are small in area compared to surfaces and when there is no expression of column and beam structure. Treatment of this character in no way indicates the iron and is negative rather than positive in character, but has the advantage of the broad and extensive unbroken surfaces which are so desirable in architecture. It is, therefore, a matter of choice whether the iron structure should be indicated or ignored, and the choice is governed by the necessity of announcing the iron, to give the impression of strength. The two varieties of concrete architecture are the type which is best represented by a pavilion treatment, and the type which is merely a concrete surface pierced with openings, and with ornament either set in or built up on the surfaces. As cracks from uneven shrinkage occur in broad concrete surfaces, the division of these surfaces into panels either by the insertion of other material, such as tile or marble strips, or terra-cotta, as frames to panels, or by incised lines, to give play for shrinkage, offers a further suggestion for surface treatment.

Concrete has not sufficiently fine character in appearance to make it essential that its own surface or texture should remain untouched, and it can therefore be painted, equally with iron or inferior woods, to give it an even color and an improved appearance. If finished with a fine stucco coat, it is an admirable background for polychromatic treatment, but all attempts to mix color with the concrete itself produce little more than crude combinations of lifeless neutral colors. Its prevailing natural tone is a neutral gray, which is colorless even in its shadows, and which is an excellent foil to rich and intense color, but is comparatively uninteresting in itself. Therefore it either requires a better surface than the material, such a surface to be obtained

by stucco or paint, or it requires vivid, intense contrasts to give it life. These contrasts may be in its details or in its environment, and concrete buildings are much more attractive in a suburban setting of trees and lawns than they are in association with buildings of a nobler material in the streets of a city.

[From Messrs. WYATT & NÖLTING, Baltimore, Md.]

WE feel that such material and method of construction is capable of being treated "with artistic and architectural effect" in a manner showing the distinct individual character of the material and methods employed in its use. We do not feel that any imitation of stone or brick material (or any other material used in blocks) is desirable, but that any method naturally resulting from a moulding process in the mass, such as low, flat-relief ornamentation, not undercut, and an elastic freedom in the form of openings, not suggestive of the pure arch or lintel construction, is admissible, and that an effect of broad and plain wall-surfaces, in contrast with certain other portions in rich ornamentation, is one to be aimed at. This form of reinforced construction appeals to us strongly as having possibilities of very varied and excellent artistic effects, as well as being admirable as to lasting construction, when properly carried out.

We do not infer that you would expect any suggestions as to indicating by surface treatment the interior metallic reinforcement in combination with the concrete itself.

THE IDIOMATIC USE OF CONCRETE.

THE structural use of reinforced concrete has, in the past few years, become an economic fact of the greatest importance. No other material has, in the history of the human race, so completely proved in so short a period that "necessity is the mother of invention."

The limited supply of lumber and the increasing cost of steel have demonstrated that a curtailment of industrial building must be looked for in the immediate future, unless some form of construction less costly than steel frame, less liable to destruction by fire, with its heavy annual tax of insurance, should be found. And so, within a decade, reinforced concrete has arrived and fulfilled certain structural conditions within such a short space of time that it seems to have burst on us almost as Minerva sprang, full-formed, from the head of Jove.

Concrete, plain or reinforced, has its limitations from a structural standpoint, and these limitations are rigidly marked; but it retards the ruthless destruction of our forests, it lengthens the life of our iron mines, and permits us to live commercially more in the future and less in to-day.

So much for the commercial and industrial side of concrete, very little in fact; but what I write is not from the standpoint of an economist or an engineer.

The rude shelter which man first made was for protection, and to best enable him to longest continue the struggle for existence. We have not, as yet, entirely passed that period of development, but we are entering on a stage where concrete as a structural material forces itself upon us as designers, and as everything which is useful is good, and good construction, truly expressed, cannot be bad, our problem is simply to find what is the true expression of concrete.

We cannot write in a new language without a knowledge of its grammar and its idioms. Concrete is as idiomatic as stone or steel, or wood, and the first lesson is: concrete is not stone, nor steel, nor wood, and we cannot paraphrase it in terms of either.

Concrete is a plastic material, and, when used as a bald imitation of something else, notably blocks in imitation of stone, though produced with the strength of chilled steel, and at a cost of one cent per cubic foot, is nothing less than immoral, and any architect of education and feeling who will consent to use it in such form is, I believe, without an immortal soul.

From the artistic viewpoint, concrete is governed by three laws: the first is the law of mass and proportion (and all the laws of construction are comprised in this); the second is the law of detail and texture; and the third is the law of color.

This last law includes the combinations of other materials with concrete in their proper and appropriate forms.

Of the first, it is useless to write here. If one knows how to arrange his composition with a truly proper and entirely artistic understanding of mass and proportion he knows more than most

of us. If he does not, the beginning of understanding is far behind.

Of the second, concrete detail is detail commensurate with the method by which it is produced, and by the limitations of the craftsman by whom it is carried out—in this case the laborer, with wheelbarrow, shovel and tamping-bar.

Why try to imitate the mouldings of marble, or wood, or metal in a mixture with three-quarter-inch aggregates, as we too often see attempted?

In concrete, we should not strive to analyze our substance further than the materials which we place in the mixer. As well set the goldsmith to work producing jewelry from granite. So let your details be large, bold.

Your reinforced-concrete structure, if it be truly a reinforced-concrete structure, is a monolith—the name itself suggests boldness, strength, dignity. Do not, then, belittle it with trivial detail.

Of texture much may be said. I do not think I put it too strongly when I say that the textural surface of concrete, as generally used, more than any other single consideration, has prevented architects from using it.

The surface left from the ordinary rough plank forms, with a wet mixture, simulating every knot and fiber of the wood, is only surpassed in ugliness by one other surface, which is that left on the careful and expensive "job" where the greatest care is taken to have forms made of dressed boards carefully matched, oiled, and sometimes even given a coat of hard plaster.

one way, which is simple and inexpensive. This is done, first, by a careful selection of aggregates, with due regard to both size and color, using rock, marble and crushed hard-burned brick, and second, by an early removal of forms and scrubbing the cement from the surface of the concrete.

Where extremely heavy loads are put on the structure, this method cannot be used in its simplest form, as it necessitates a too-early removal of forms; but in ordinary work and resi-

dences it is eminently successful. The surface of the concrete is played on by a hose, and at the same time scrubbed with a heavy wire brush, thus leaving the aggregates projecting from the mass about three-eighths of an inch.

This serves several purposes: first, the dead color of the cement gives way to a sparkling, live texture and color; second, no marks of forms are visible, and third, temperature cracks, which, although of

no structural importance, are very unsightly, if they occur, are back from the face of the aggregates and are invisible. This surface, surprisingly beautiful in texture and color, has been obtained at a cost of one cent per square foot.

Lastly, the law of color. Many a building is pleasing to the eye, whose beauties might be greatly enhanced by a proper use of color. I do not intend to write a dissertation on the theory of color, but simply to state some methods of adequate addition of color to concrete structures.

First, you cannot successfully color concrete with artificial



HOUSE OF E. CHANDLER WALKER, ESQ., WALKERVILLE, ONT.
Albert Kahn, Architect.



HOUSE OF E. CHANDLER WALKER, ESQ., WALKERVILLE, ONT.
Albert Kahn, Architect.

This usually leads the unsophisticated observer to enquire why such an imposing wooden building, or bridge, as the case may be, was painted such an ugly color. Such surfaces may at comparatively great expense be dressed and tooled, but then we simulate another material. We give it a surface belonging to stone; either we mark artificial stone joints, attempting to complete the deception, or we omit them, and give a fictitious stony surface to areas which, from their size, are palpably impossible to be stone.

Texture may be had, I have found in my own practice, in

pigments. They are as fatal to appearance as the aniline dyes which have too largely prostituted the weaves of Oriental rugs, and last even a shorter time.

Color your concrete proper by a judicious selection of aggregates. You will be surprised at the range of color to be obtained from different rocks, marble, stone dust and sands from different localities.

Dull-glazed terra-cotta can be used with wonderfully satisfactory results, as exemplified in the Marlborough-Blenheim Hotel at Atlantic City.

The so-called Moravian tiles seem to be own-cousins to concrete, and to blend in their texture and colors more harmoniously than any other material which I know. Their soft colors, which are burned through them, are of an absolutely homogeneous tone, and with skilful disposition in placing them one cannot go far wrong in their employment for giving a very throb of life to a well-designed concrete building.

As with terra-cotta, brick may be delightfully and properly associated with concrete, using it for piers, quoins and arches, and employing concrete for curtain-walls.

Truly, concrete is here as a reality and demands a hearing from architects as well as engineers. The engineers have accepted their problem and solved it.

Shall we be less courageous or successful?

EVARTS TRACY.

CONCRETE WALLS AND FLOORS.

ARCHITECTURE is the art of building. It may be a fine art, if beauty is one of the points studied. Beauty has a natural basis in utility. Utility depends mainly on economy. Hence, if this art is in a high state of perfection, the buildings will be beautiful and will be economically constructed.

It hardens quickly in the shape imposed by surrounding conditions.

Its plasticity when very fresh allows the introduction of steel rods to distribute the setting shrinkage.

It has practically the same coefficient of temperature change as steel, so that there is little danger of separation of concrete and imbedded steel from such cause.

It is high in compressive strength, especially per unit of cost.

Its plasticity when fresh and its shrinkage during hardening give it a firm grip on imbedded steel, so that the latter may be profitably introduced to increase the low tensile strength.

most careful workmanship in mixing, placing and compacting the concrete and installing the reinforcement.

Shrinks slightly during the hardening process.

Is low in tensile strength.

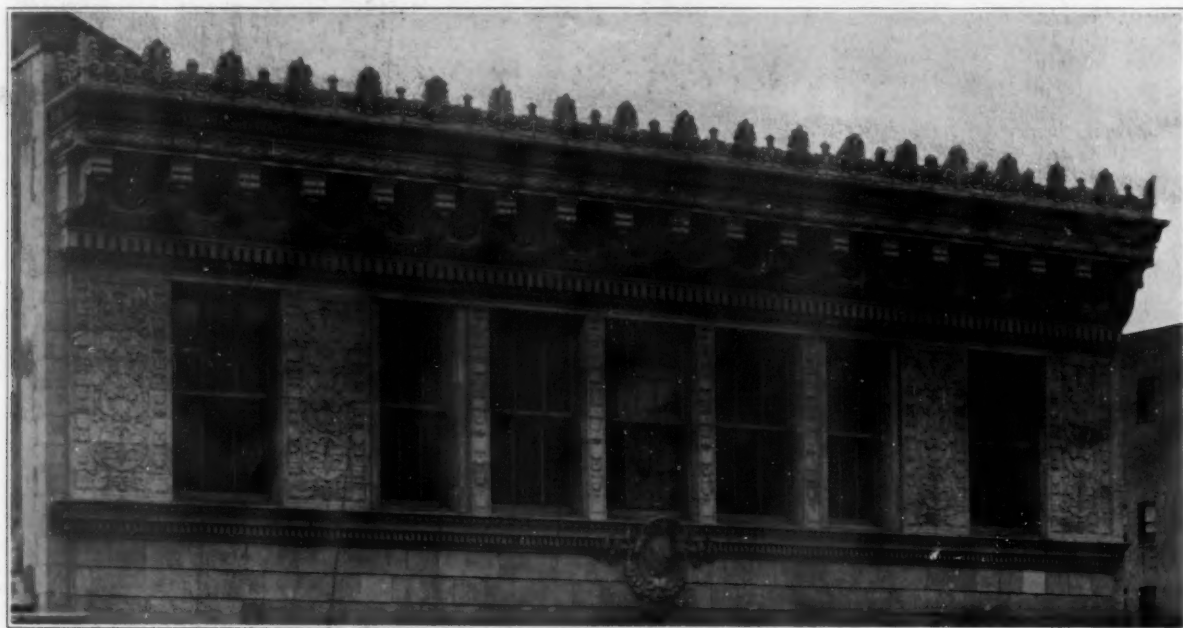
Its plasticity when fresh makes its exterior appearance almost entirely dependent upon the nature of the materials confining it during the process of hardening.

The necessarily universal distribution of the cement through the whole mass gives the exterior natural surface a dull gray color.

Variations in mixture, impurities in the water, variation in the colors of the aggregates, produce gradations in the dull gray color, irregular in amount and in superficial extent.

Is monolithic and adamant when it reaches the age of only a few weeks, if properly made.

Is highly fire, water and acid resistant.



UPPER STORY OF THE EASTMAN KODAK COMPANY'S BUILDING, WEST TWENTY-THIRD STREET, NEW YORK.
McKim, Mead & White, Architects.

The economics of the builders' art is usually placed in the hands of an engineer. He should work with the architect (the artist) during the evolution of the plans, so that the final ones for the structure may combine a maximum of beauty, utility and economy.

No art is stable. Every art finds its basis in human needs. Needs increase, the higher and more complex the civilization. Arts should therefore be constantly evolving to keep up with the development in society. New materials require new methods of treatment. Strict adherence to old forms with new materials does not permit a maximum of economy—is not therefore most useful—and thereby loses in that which is the basis of real beauty.

Concrete has been used for building work from ancient times. Its adaptation to modern needs, however, has been actively exploited only very recently. The development so far made is enormous, but there is every evidence that the growth is still very young. The wide adaptability of concrete is proved by its varied use at the hands of its enthusiastic exploiters. The perfection in the art of its use must depend on an intimate knowledge of its characteristics, so that the utmost advantage may be taken of its good points, and that its poor qualities can be hidden or overcome. These qualities may be summarized as follows:

Good Qualities.

Concrete consists of materials of comparative cheapness and almost universally obtainable.

Poor Qualities.

The whole value of work erected in concrete depends upon untiring supervision, the

Except those having to do with its external appearance, the poor qualities of concrete can be almost entirely counterbalanced by its good points, provided the latter are properly handled by one thoroughly familiar with both the poor and the good qualities. To obviate the objections to the natural superficial appearance of mass concrete work, some artificial surface-treatment or the introduction of colored ingredients is necessary. The monolithic and fire-resistant qualities make concrete especially valuable for residence work, since such buildings will be exceptionally long lived, free from vermin, sanitary and fireproof.

Certain types of construction, devices of erection and methods of design are peculiar to each kind of building material, and to make the best use of any special kind the several peculiarities must be known and advantage taken of them while designing work. Very often details of arrangement and of decorative effect can be so modified as to take advantage of such peculiarities and give most satisfactory results. There follow some of the characteristics of concrete and reinforced concrete and the possible means necessary to take advantage of the good ones and obviate the poor ones—especially with reference to residence construction.

AS TO WALLS.

Under certain circumstances concrete, like brick, will absorb

a considerable amount of water, which will be given off again under natural conditions. This necessitates resorting to various devices in connection with concrete outside-walls of dwelling-houses to make them less absorbent and more impervious to water. The thicker the wall the less pervious it is, but heavy walls have obvious disadvantages. The more cement employed the more impervious the wall; but cement is costly. The larger the size of the aggregate used the more impervious, to some extent, 2½-inch stone giving one-third better results than ½ inch. Large gravel is many times better than large stone. Various foreign substances may be introduced into the concrete to assist in this point. Alum, lime-paste, soft-soap, lye, etc., are variously advocated, but their addition is usually detrimental and their action not well known. Several patent compounds are also on the market. Superficial treatment can also be employed. Either the outside or the inside can be plastered with special cement preparations. Several are advertised as almost perfect in quality. Careful troweling, like cement-sidewalk finishing, is very effective, as it produces a dense layer on the surface. Asphaltic and other so-called water-proofing paints have been devised, and when amply applied to absolutely uncracked surfaces are moderately effective. The construction of walls with an air-space is probably the best device, as the dead air also serves as an insulator against loss and entrance of heat in winter and summer respectively. The usual furring applied to brick walls is an effective method, but somewhat more costly than some others. Hollow concrete, terracotta, or composition blocks are also useful for certain walls, where plaster is to be applied to both sides. There are also several systems which produce hollow monolithic concrete walls at reasonable cost. With these, burlap, paint or other varieties of interior decoration can be applied directly to the inner face of the walls without the expense of plastering. At the same time, the outer face can be finished in any desired manner.

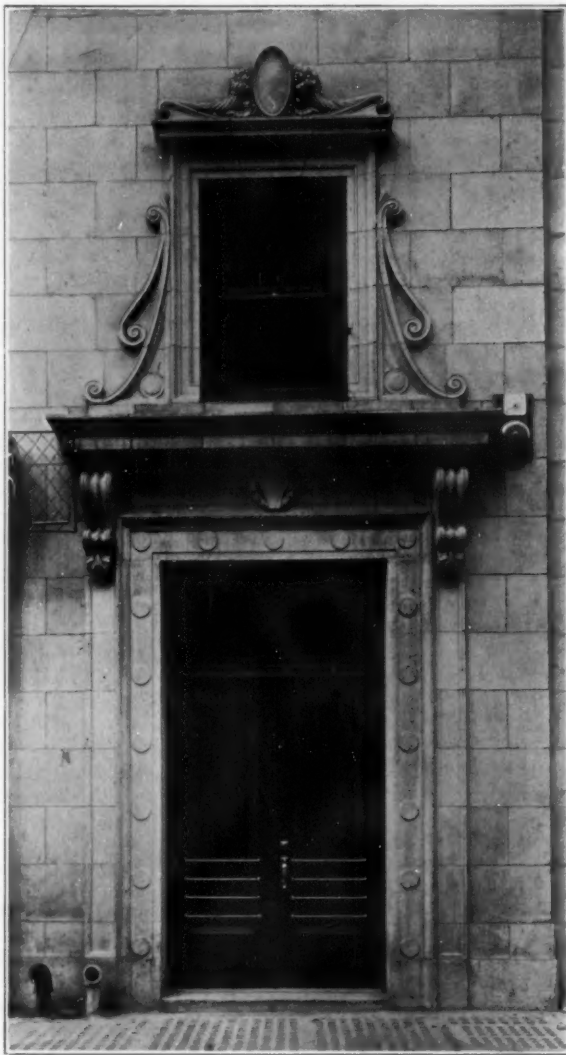
Concrete shrinks while setting. Also, of course, with fall of temperature. This shrinkage cannot be obviated; it can only be distributed or concentrated at special points where unobjectionable. Work constructed in warm weather is almost certain to show temperature-shrinkage cracks in the winter. Work done in cold weather is much less likely to develop cracks, but there are obvious difficulties attendant upon doing winter work satisfactorily and economically. The less cement used, the less the shrinkage. The larger the aggregate, the less the shrinkage. A small percentage of steel, properly located, will distribute the cracking so that it is practically invisible. The use of blocks of concrete or other material, locates the cracks in the joints, unless exceptionally rich mortar is used. This usually effectively conceals the cracks, which really exist, however. Where use is made of curtain-walls between main structural members, the walls can be joined to main members by slots in the latter, the full width of walls. Expansion and contraction will then produce movements only within these slots and cracking will be effectively concealed. Cornices, belt-courses, etc., by the use of reinforcement, can be prevented from showing anything except minute cracks; but it is much better to design such members

with breaks, like pilasters, etc., at frequent intervals. The cornices, mouldings, etc., can be carried around these projections, and cracks can be concentrated at the angles where they are not so objectionable. Smooth surfaces are apt to show minute checks or cracks, when examined closely; and when they become cracked to any extent from shrinkage or contraction from change of temperature, they are very unsightly. Pebble-dash, stucco, or other method of rough decorative treatment, is really the best method of concealing cracking. Close examination will almost invariably show its existence, however. Smooth-plastered mouldings with rough stucco panels have been worked out most satisfactorily in some instances, and show few blemishes even on close examination.

Where walls are to be plastered or stuccoed, they should be left as rough as possible. Dry concrete mixtures, the use of

very coarse sand, a slight dearth of mortar (not of cement), employment of rough lumber for forms, etc., tend to give such a surface. Surface coatings, like plaster and stucco, should be as thin as possible, where continuous good bond is assured. If bond can be secured only at comparatively rare intervals, a thickness of coating must be applied sufficient to have enough body to be self-supporting between bonding points. Conversely, where it becomes necessary to apply materials more than half an inch in thickness, some special means of securing a good bond should be provided. In every case it is wise to clean thoroughly the old surface by washing and scrubbing, and to roughen it by picking or hammering. Acid treatment is also effective, and there are in existence several secret and patented bonding preparations, consisting of tar and cement products. Even an application of pure cement-grout is often not effective unless the surface is first cleaned and thoroughly saturated with water. If greater thicknesses of stucco are required, resort should be made to mechanical bonds. Wire-lath, even when galvanized or painted, is not always of long life, and small-sized wire is of little value in view of the perviousness to air and moisture of the usual plaster and stucco. Quarter-inch should be the smallest size of iron wire ever employed. Use fewer bonds, spaced farther apart, if economy in first cost must be rigidly practised. Copper wire is effective but expensive, while vertical, dove-tailed bonding grooves or slots can be cast in the mass concrete at

small expense. Overhanging cornices, etc., should be most carefully reinforced, because the difference in shrinkage between masses of different thicknesses is likely to crack off the overhanging portion. Although heavy shadows are probably among the best means of securing relief in concrete work, still the use of heavy projections and overhanging masses should be avoided as much as possible, unless they take the form of balconies, etc., amply supported on effective brackets or columns, in which proper reinforcement can be provided.



ENTRANCE TO THE EASTMAN KODAK CO.'S BUILDING, NEW YORK, N. Y.

breaking the edges of the mouldings. Furthermore, even when quite fluid, concrete cannot be worked into such mouldings with any degree of certainty as to result, unless the edges are rounded, beveled, or chamfered, and all surfaces given proper slopes to allow of natural removal of pocketed air and water. Aside from the liability of cracking, there exists another drawback to undertaking long lines or large surfaces in mass concrete, in the extreme difficulty and larger cost involved in maintaining the forms in perfect alignment. Such extended lines and surfaces should be broken occasionally by slight projections, to hide the wavy appearance almost certain to be found. Projections of an inch or two in thickness by two or three times as much in height, in Greek fret or similar simple design, can be constructed without much expense and may be exceedingly effective as decorative features, as well as aid in hiding blemishes of alignment. Such work in intaglio is even less expensive than when in relief, but fails in possessing any curative property.

Simple ornamental work, like the Greek-fret intaglio spoken of above, simple flutings, etc., can be executed in mass concrete with wooden moulds; but their cost soon reaches undue proportions when more intricate detail is attempted and other methods must be followed. By the use of pressed-metal moulds, very complicated work can be accomplished in mass work; but such work is better cast in a shop and set in the work at the proper point, or after the mass work is complete and the forms removed, if proper recesses have been left for its reception. When it is intended that the moulded work shall be set as the work progresses, so that the plastic concrete is poured around the moulded blocks, the latter should be of as large size as possible, especially with regard to the bed. When they are to be set in slots left in the work, manifestly the moulded pieces should be as thin as possible. In either case, some reinforcement is necessary,—considerably more in the latter case than in the former. Depressions, or continuous holes should be moulded into the large blocks so that good bond can be secured to the mass work, and metal bonding-clips must be used in the second case, with proper arrangements provided for their permanent hold in the wall and for their proper attachment to the moulded blocks. As mentioned above, these blocks should be of ample dimensions so that the corrosion which is likely to occur will not soon eat them completely through. In the same manner in which moulded concrete is set in or attached to mass concrete work, terra-cotta or moulded brick may be employed. With these materials a form may or may not be employed. If the design contemplates a continuous brick veneer, the brickwork can be placed first and so constructed and tied together as itself to take the place of wooden forms for wall columns and beams. If the veneer is not continuous, a form must be employed. Even then the brickwork may be erected in sections, scaffold-high, before concrete is placed; but care must then be exercised in pouring the concrete not to disturb the brick. By the use of small wedges to maintain proper thickness of joints, an excellent bond can be secured between brick and concrete, but the joints must almost always be pointed and the brickwork carefully cleaned. Tile-work of almost any degree of decorative effect can be employed in a similar way. The pieces can be tacked to the forms with copper nails, or a patented process may be employed, in which perforated forms are used and the tile glued directly to them with common bill-poster's paste. When it becomes time to remove the forms, the work needs only to be thoroughly saturated with water so to soften the paste that the forms can be removed with ease. Tile will give any color-effects desired. Copper, bronze, painted cast-iron, etc., can be employed for panels where applicable. Massive color-effects can be secured, if care is exercised, by introducing coloring matter among the mass concrete ingredients. Such work, however, is subject to the same variations in uniformity of appearance as is uncolored concrete. Probably the best method of securing uniformity and extent of color is the use of colored stucco, or, perhaps, the application of water-colors directly to the finished surface might serve. In these matters Europeans have had much more experience than we have.

Tooling, etching with acid, and washing the surface with water while the concrete is still fresh are three other methods resorted to when it is desired that the mass concrete itself shall be left without superficial applications which may possibly crack off. These three methods are superior to all others, except possibly the use of tile or brick, or of rough stucco, in con-

cealing the small cracking which is so likely to occur. When surfaces are to be tooled, it is necessary that broken stone be used in the aggregate, as gravel does not take the action of a tool with good results. By employing broken stone of various kinds and colors, together with different colors of sand and a white or gray cement, wide variations in surface effects can be secured. The usual reason for tooling is an endeavor to imitate stone work. The results obtained are apt to be poor imitations, except under conditions which make real cut-stone little more costly. When the surface is to be etched, uniformity of mixture is important, and gravel gives excellent results as well as almost all of the different combinations of aggregate suggested above. The etching process can be carried to any desired depth, but the best results appear when the action removes only the skin-like layer of cement mortar next the forms. Almost identical results can be attained with a scrubbing-brush and plenty of water, if the forms can be removed at an early enough date. With this end in view, special designs have been worked out for the forms. When small-dimension, uniform gravel is used, effects almost identical with pebble-dash stucco can be secured. Obviously, such treatment obliterates sharp edges and is inapplicable to cornices, corners, mouldings, etc., where sharp lines are desired. If such details receive their treatment, the result is somewhat like an old, weathered, time-worn structure. While the last-mentioned methods of treatment are usually less costly per square foot of finished surface than stucco, still, the results are not usually as satisfactory, and in the eyes of many people, the extra cost for that class of work is almost always well repaid in added beauty.

There are certain details of design which can be omitted in concrete, which are imperative with other materials. A window or door opening needs a timber lintel or a brick or stone arch to span it. In concrete, neither device is necessary, as the wall is a monolith with steel imbedded to prevent shrinkage-cracks at the corners of the opening. In this particular instance, besides serving no practical purpose, the cost of moulding lintels or arches is really a considerable item of expense in the construction of a building with many openings. Imitation quoin-stones are also costly details and there is small excuse for imitation stone joints, except to hide variations of workmanship between different day's work. These are obvious examples, but many other smaller ones exist which can be eliminated with good æsthetic and economic effect.

AS TO FLOORS.

In general, almost any arrangement of columns, beams, girders and floors can be constructed in concrete. Intricate, irregular arrangements are, however, considerably more expensive in concrete than in almost any other material.

Three types of floor construction have been evolved thus far. They may be described as, (a) long-span slabs between girders, (b) short-span slabs between beams which, in turn, are carried by the same girders, (c) large, approximately square panels supported on all four sides by beams, and having the slab reinforcement running in two directions, at right angles to each other, while in the first two types the slabs have their principal reinforcement run in but one direction. The second type merges into the first in some systems in which the beams are placed so close together that the space between can profitably be filled, flush with the beam bottom, with hollow terra-cotta or concrete blocks. The third type is usually less expensive than either of the other two, except with short spans or light loads. Under such circumstances, even the beams may be omitted, and the construction consist of nothing but columns and a continuous slab. The third type gives most stiffness in all directions against wind and other lateral forces, while the last-mentioned variety, as also type (a), are lacking in stiffness in at least one direction. This very lack may have been the cause of several concrete-building failures. It would seem, therefore, that where an ideal arrangement can be made, the most economical and most stable structure would result from placing columns at the corners of squares, connecting them by beams forming the sides of the squares and spanning the whole with slabs reinforced in two directions. Almost any house plan can be so altered as to allow of such a structural design, and partitions can be adjusted to fall under beams and intersect at columns. Both beams and columns can then be entirely hidden in the partitions, while considerable total building height can be saved when compared with other materials, because of the thin floor-slabs employed without false ceilings and the attendant loss in air-spaces. Of course, it is

not necessary to maintain exactly identical dimensions in all panels of a row, or between the widths of different rows; but as little variation as possible should be allowed from the square shape, since the economy inherent in that shape is soon lost when differences of span are introduced. On the other hand, combinations can be made, such as of two rows of square panels with a short-span single slab over a hall between the rows, etc. One panel at almost any point can be devoted to a stair-well, or the stairs may be placed in a special panel of different dimensions outside the regular series. When floor plans are laid out with these points in mind, much money can be saved.

Obviously, the same points that were noted regarding the finish of concrete walls are pertinent with regard to the finish of concrete ceilings. The ideal of decoration would seem to be to give a pleasing appearance to each member or portion of a structure and in such a way as, at the same time, to disclose its real use and composition. If this ideal is sound, the employment of such details as imitation beams formed in plaster under large-span concrete slabs is not good architecture. Such designs are reversions to the old wooden period. Similarly, the usual roof projections can best be made in concrete as simple cantilever slabs, while, almost invariably, false roof beams are applied for so-called æsthetic reasons.

Concrete floors finished with a cement wearing-surface are so much less resilient than wooden floors, that many people demand wooden top-floors even with concrete slabs. If a floor is to be finished with a cement dressing, many of the same points apply to the securing of a good bond between the main floor and the top finish as have been noted with regard to the stuccoing of walls. Unless the finish coat is installed at practically the same time as the under floor, a thickness of nothing less than 1½ inches should be allowed. Many advocate 2½ inches. In every instance great care should be exercised in cleaning and saturating the surface of the old work before the new is applied. One of the good points about a cement top on any floor, is that the cement finish can be carried continuously from the floor up the sides of walls and partitions, to form a base which is almost perfect in its sanitary properties. Several patent floor-coverings are on the market, which take the place of the hard, heat-absorbent cement dressing above described. They are usually much more costly, however, but are often an improvement in some point or another.

These are but a few of the many points involved in the use of reinforced-concrete, and others will occur almost daily to any one who is studying the evolution of this old-new building material.—E. P. Goodrich, *M. Am. Soc. C. E.*

REINFORCED-CONCRETE CONSTRUCTION.

ABOUT five years ago the writer was consulting engineer for a building in which a rather unusual stair construction of reinforced concrete was used. The building was otherwise of the typical steel construction, and the foreman who put in the structural steel work was very skeptical as to the strength of the reinforced-concrete construction and insisted that it could not possibly carry its own weight, but would undoubtedly collapse when the centres were struck.

When the concrete had set and the centres were removed, I conducted a series of very severe tests and invited the doubting Thomas to be present. This he was delighted to do, prepared, no doubt, to gloat over my discomfiture when his prediction should come true.

However, nothing happened to justify his evil forebodings. On the contrary, the tests proved the construction to be exceptionally strong and rigid; and as a result the doubter at once developed into a rabid reinforced-concrete-enthusiast. He could see no limit to the strength and usefulness of this wonderful material, and I would not be surprised if, some day, he should attempt to carry his enthusiastic opinions into practice and come to grief.

This, I think, illustrates the conversion of most people from the use of steel to reinforced concrete, and also explains the many failures. We begin with the very justifiable fear of the untried, coupled with lack of ability to analyze the forces at work, and for this very reason become over-confident when the construction, in spite of our misgivings, turns out to be strong and rigid. But there is really nothing to be surprised at. The combination of steel and concrete is only just as strong as the simplest calculation tells us it ought to be, and there is absolutely

nothing mysterious about it. It would, however, appear as if many designers (?) believe that a few steel rods impart a magical strength to the concrete. You will, for instance, find that while a good concrete pier is only loaded up to some 15 tons per square foot, say 208 pounds per square inch, you need only make this pier long and slim and introduce four tiny vertical rods, that of themselves can carry no compression, in order to make this concrete strong enough to sustain anywhere from 600 to 1,000 pounds per square inch. What has really happened is not a great increase in strength but a great reduction of safety, as instanced by recent failures of several buildings so designed.

I think architects are open to severe criticism for the manner in which reinforced concrete is designed. No one can expect every architect to be an expert in a new material or even to study up its antecedents, but an architect has no right to accept without personal examination the word of the man who tries to sell him the new material, i.e. the contractor, or, as he often styles himself, the contracting-engineer, a title that I suppose has been adopted to inspire confidence.

I do not wish to appear as doubting that some contractors are able to design properly a reinforced-concrete or other structure, but with a material of such varying strength and with interests so conflicting as those of owner and contractor, I certainly consider it next to criminal to place the design in the hands of the latter—almost inviting him to dishonesty. What may be expected from this practice is well illustrated by a number of recent failures, some of them resulting in great loss of life and, at least in one case, in an actual indictment against the contractors.

If we had arrived at definite conclusions as to permissible stresses in reinforced concrete, the matter would not be so bad. Anyone who designs steel structures must work within well-established limits, and a step beyond is at once stamped as dishonest. But not so with concrete. Building-laws are silent or vary enormously in their provisions, and so offer chances for the dishonest or the ignorant to dodge responsibility.

I have often been met by the statement: "It is not well to furnish a detailed design in reinforced concrete, as it prevents different firms from using their peculiar form of construction."

This is entirely a fallacy. The design should be at least as detailed as for a steel structure, or rather it ought to be much more fully detailed, as well-established standard details do not exist, as is the case with steel construction, and a good design will fit any special form of construction. Only, one must specify the size of bars, but these bars may be of any of the standard makes, as twisted bars, corrugated, Thatcher or Kahn bars, etc.

But, you will say, some of these bars have a very high elastic limit and will allow of much higher stresses than others. In this I do not agree. The commercial steel of to-day has an elastic limit of somewhere above 32,000 pounds and not above 36,000 pounds, and is a uniform and safe material to use.

It would cost no more to roll our I-beams or other shapes of high carbon steel with an elastic limit of above 40,000 pounds, but such steel is not nearly as uniform and reliable and is therefore not used. Nor is there any more excuse for using it in reinforced concrete.

Specify your steel to have an elastic limit of from 32,000 to 36,000 pounds, in plain bars, and load it in tension up to 16,000 pounds per square inch for important members, or possibly 18,000 pounds for roof construction and for girders which only gradually get their full load. If the steel, through cold working, has gained a higher elastic limit, consider this offset by the greater brittleness and do not increase the stresses on this account.

The concrete should not be stressed over 500 pounds to 600 pounds in compression, depending on the importance of the members.

Columns having only vertical reinforcement should carry not over 500 pounds in compression, and the vertical rods should be well laced together and their area should be at least one and one-half per cent. of the area of the column and this be loaded to only 5,000 pounds per square inch, or as much more than the concrete as the ratio between the modulus of elasticity and of the two materials, here assumed to be 10, or 3,000,000 for concrete and 30,000,000 for steel.

But above all, if you cannot make your own design, either turn it over to an expert designer or, if you must let the contractor do the designing, have an expert engineer pass on the design and you will save yourself much worry and possibly humiliation and grave responsibility, if not actual indictment for gross neglect in case of failure of the building, with consequent loss of life.

Having secured a safe and economical design on which every bidder can make a close estimate, without any guessing on the quantities he will be called on to furnish or as to what may be saved by judicious skinning, the next step is to secure such efficient supervision at the building that the danger of poor work or the omission of essential members in the reinforcing is reduced to a minimum.

It is evident that very careful supervision is necessary, and supervision of a very different character from that required in the building of the steel-cage construction. In such a building the supporting elements, as columns, girders and beams, are brought to the building ready to be erected, and there is generally small danger of placing them in a wrong position, so that the most superficial inspection is sufficient to insure the safety of the building. Not so with the reinforced-concrete building. Here the wooden forms or moulds of the proper outline are first to be built, and inside the so-established outlines the supporting members are constructed. The reinforcement of the girders and beams, and sometimes of the columns, may be shipped as units ready to be erected, but more generally a mass of rods and wires are delivered at the building to be placed in the different members, and it is easily seen what careful attention is required in order that each rod gets in the place where it is wanted.

But even after the reinforcing rods are properly placed in a member only a fraction of the work is done. The concrete is now to be mixed, and just so much sand, cement and stone or gravel must be used, with not too much nor too little water; and all these ingredients must be carefully mixed. It may be getting late and the men are in a hurry; it may mean double pay, if overtime is necessary, before the batch of concrete is all laid, and the contractor or his foreman will try to rush the operation of mixing. And just here the superintendent's presence is absolutely necessary or a poor concrete is apt to result.

But supposing the concrete is properly mixed, the moulds built of the proper dimensions and the reinforcing-bars put in the right places and in the required quantities, even then the work is only half done, for if the concrete is not well tamped in place, or if even a small quantity of rubbish, such as sawdust or chips, accidentally drops into a mould between two layers of concrete, or if the work goes so slowly that some of the concrete takes its initial set before being placed, or if it is winter and the pleasant morning turns into a cold, freezing day, in any of these cases the concrete may have its theoretical strength very much reduced, and the one weak member resulting may cause the collapse of the entire structure.

It must be very apparent that the ordinary superintendent is not equal to look after this work, and still more it is evident how utterly inadequate is the superintendency furnished by a daily visit to the building by the designing architect.

What is needed is to have one or, on a large job, two, or even three inspectors under the general control of an expert, so that every detail of the work can be watched. In no other way is it possible to secure an absolutely safe structure. This extra inspection would, of course, involve some expense, but considering that the safety of the building is at stake, the owner should be willing to pay the cost, which in any case will only be a fraction of the saving, in the use of reinforced concrete, over steel.

GUNVALD AUS.

CONCRETE SURFACES.¹

THE ordinary concrete structure—whether of building blocks or monolithic masonry, and whether as left by the forms or as commonly finished for exposure to view—is anything but pleasing in appearance, and this fact seems to be the principal reason for the disfavor with which some archi-

tecs and engineers regard concrete as a material for construction.

The blocks usually have a bubbly, artificial-appearing surface, subject to a discoloration, that is generally of a sickly or lifeless hue, which offends the eye quite apart from the unpleasant effect of the machine-like regularity of such blocks as are made in imitation of rock-face ashlar. Monolithic concrete is usually finished either by painting with a thin cement wash or by floating, and it is doubtful whether really satisfactory effects have ever been produced by either of these methods on work that was in the forms long enough to get quite hard. The material that ordinarily segregates against the mould forms a skin that seems to have the quality of making very uncertain the attachment to it of any coating, whether of neat cement, paint or of plaster, and if no coating be applied to it and the skin be not removed, the appearance of the work, particularly after a little aging, can be adequately characterized only in language that is too picturesque for a serious paper.

There is, therefore, an active demand for a means of putting a better front upon a concrete

body without overloading it in cost.

It has been suggested that a stucco finish can probably be made to adhere permanently, and it is reported that a plaster coating-mixture of lime, cement and sand has been tried with gratifying results. A very handsome appearance can undoubtedly be thus obtained, but it is generally as unlikely that the coating will endure wholly intact, and as certain that it will not unless the surface be first carefully prepared for it by some such method as treating with acid or by picking it rough, which altogether would make an expensive finish, and if portions should loosen and come off the condition would be shabbier than anything else that can be conceived.

The mere roughening, however, of the concrete surface to insure the adhesion of a coating of any sort will itself, if completely and uniformly done, produce a pleasing and ordinarily satisfactory finish—provided, of course, that the concrete has a complete face fully flushed against the forms.

It follows, then, that tooling the surface to the extent of removing the film is a practicable and always available method of finishing it, and the tooling can be done with a bush-hammer or an axe, by hand or pneumatic power. The tool should be light, and the blows only heavy enough to "scalp" the work, heavy tools and blows being liable to "stun" the concrete, particularly at and near edges. This scalping partially exposes the material of the aggregate, but does not clean it. The complete exposure and cleaning will come with time and exposure to the weather, if the work be outdoors; or the action of the elements can be anticipated by washing the tooled surface with a half-and-half dilution of hydrochloric acid, which of course must be thoroughly rinsed off.

The cost of such tooling, without subsequent cleaning with acid, has been variously found to be from three to twelve cents per square foot, according to the character and extent of the work and the equipment.

Experiments upon small blocks have shown that a very expeditious method of removing the skin is grinding with a coarse grained emery or carborundum wheel. The skin is cut about as quickly as the block can be well passed over the wheel, and although no actual comparison has been made and there is no knowledge of a trial of it on large work with a portable wheel, it would seem that with compressed air or an electric motor and a flexible shaft, the emery wheel might be used on any work with about the same facility as a power bush-hammer, and the rapidity with which the wheel cuts away the face indicates that such a method of tooling will prove to be no more expensive than bush-hammering. The wheel might be small in size and therefore of light weight for convenience in handling, and could be fitted with small guide rollers to limit the depth of cutting and secure reasonable evenness in the dressed surface.



PHOENIX SENIOR SOCIETY BUILDING, DARTMOUTH COLLEGE, N. H.
W. M. Butterfield, Architect.

¹A paper by Henry H. Quimby, M. Am. Soc. C. E., read at the annual meeting of the National Association of Cement Users, Chicago, January 8-11.

Building blocks have been treated, without the preliminary tooling, by immersion for a sufficient length of time in an acid bath strong enough to dissolve the skin and some of the cement mortar between the particles of the aggregate, exposing and cleaning the particles and even leaving them in relief. This process, which is said to have been patented, includes washing after the acid bath, then immersion in an alkali bath to neutralize any absorbed acid remaining, then final washing with water. It is presumably expensive, is of necessity limited in its application to portable work, and care must be taken to avoid using in the concrete any sand or stone that is liable to injury by the acid.

It thus appears that the removal of the film and exposure to view of the clean aggregate by whatever method obtained is the essential feature of the most certainly durable and generally satisfactory surface finish of concrete. Of course it should be understood that the surface must be fully flushed—must be without cavities or any visible voids between the stones. This condition can only be secured, when pressure cannot be applied, by using wet concrete thoroughly spaded or forked against practically water-tight forms, or by using with stiffer concrete a separate mortar or fine concrete applied against the face form with a trowel just in advance of the body concrete. Stiff concrete will not completely flush against the forms by mere ramming, even if the ramming does work it to a liquid on the top of the layer. Care must be exercised with every portion of the face or voids will occur and appear when the forms are removed, and will necessitate patching. Such repairs cannot be made sightly unless at the time they are made the body is still green—before hard set has taken place. If the surface is accessible

and inexpensive, yet produces the most pleasing and in all respects most satisfactory finish which has yet become known.

This process consists wholly in scrubbing the fresh surface with a brush and water, thereby removing the film, and with it all impression of the forms, and exposing the clean stone and sand of the concrete. If it be done at the right time—that is, when the material is at the proper degree of set—merely a few rubs of an ordinary house scrubbing-brush with a free

flow of water to cut and to rinse clean, constitutes all the work and apparatus required. A little additional rubbing will bring the larger particles into appreciable relief, which heightens the effect and, in the judgment of most observers, enhances the beauty of the face.

The practicability of removing the forms at the proper time for such treatment depends upon the character of the structure and the conditions under which the work must be done. The system cannot be applied to the soffit of an arch nor to the underside of a reinforced-concrete floor, because the centering must be left as support so long that the surface against it is almost stone hard. If, however, the surface material there is the same as at the sides which have been scrubbed, the soffit can be brought to match the sides by tooling and then cleaning with acid and water as before described.

The texture and color of the surface obtained by this process will vary with the character of the aggregate of the concrete, because in a mixture of cement, sand and stone the cement is in small proportionate volume and has but little influence on the color of the ensemble. Some opportunity is thus afforded for the exercise of individual taste in texture and color, and it is very easy to arrange a quiet color scheme in any work that may



WAGONER UNDERTAKING CO.'S BUILDING, ST. LOUIS, MO.
F. C. Bonsack, Architect.



INTERIORS: WAGONER UNDERTAKING CO.'S BUILDING, ST. LOUIS, MO.
F. C. Bonsack, Architect.

while still friable, blemishes can easily be removed without leaving a scar.

This fact suggests the desirability of early removal of the forms, and their removal after the concrete has set sufficiently to maintain itself, but before hard set has taken place, furnishes the opportunity for applying a treatment that is very convenient

be suited to it. Warm tones can be obtained by the use of crushed brick or red gravel. A dark colored stone with light sand will produce a surface that resembles gray granite. Fine gravel gives an appearance so like sandstone that even close examination will not enable one to distinguish between them. In the construction of monolithic concrete masonry for bridges for

the city of Philadelphia it is the practice to use a fine concrete or granolithic face composed of 1 cement, 2 bank sand, and 3 crushed and cleaned black, slaty, shale, of the size commonly used for tar roofing—say $\frac{1}{4}$ -inch to $\frac{3}{8}$ -inch. This mixture is placed against the face forms and the body concrete is placed against it and rammed into it immediately. In the three years since this process was adopted and during which it has been applied to twelve bridges, no case of separation of granolithic face has been observed, and not a single hair-crack has been found, nor any kind of deterioration or tendency to discoloration noticed—indeed the weathering seems to make the surface cleaner and more stonelike.

In general the washing is done on the day following that on which the concrete was deposited. Portland cement is used. When a quicker setting cement than usual is met, or through some other influence the surface is found, upon removing the forms, to be too hard for the scrubbing-brush, a wire brush is employed first, then a small block of wood or a brick-bat with water and sand, which is found necessary to cut the film.

If the surface has hardened so as to require the grinding action of the sand and block the aggregate will not be brought out into very decided relief and the face will therefore be comparatively smooth. In cold weather, when crystallization proceeds slowly, the forms may require to remain two days before the washing can be done safely, and in very cold weather they have been left a whole week and yet the scrubbing was successful.

Consideration of the cost of the process may involve the question of the design of the forms. When the work is such that not the whole height of it can be placed in one day it may be advisable to construct the form so that the planks can be removed without disturbing the uprights. This will add to the cost, but may be compensated for by the saving in planks. In the case of a long or heavy wall where only one course can be laid in a day only one course of planks is required.

If indentations are made at the joints between courses, the joints can easily be concealed. If the indentations are not desired great care must be taken to scrape thoroughly clean the top of each course quite to the face and to use the same consistency of the new granolithic facing as that of the lower course. It is possible thus to make a joint that will not be very noticeable, but the vigilance of the inspector must not be relaxed at any point, and even then the joint will be at least distinguishable. The bead indentations are very convenient and useful in working, and in appearance they relieve what otherwise would be a large blank area.

When the planks are desired to be removable the studs are set some distance from the face—8 inches to 12 inches—and the planks are braced against them by cleats nailed so as to be easily loosened. The planks are in one width the full depth of a course, either solid or made up of narrow planks battened together. A triangular bead strip is nailed to the face at each edge and the layer of concrete is finished at the middle of the top bead.

When a plank is taken off it is scraped clean of adhering cement, then oiled, and reset with its bottom bead fitted into the half indentation just left by the top bead.

A couple of carpenters with perhaps a helper will take off and reset a course of plank say 100 feet long in four to eight hours.

The course may be whatever is desired for either convenience or architectural effect. The yardage of concrete accommodated will vary also with the thickness of the wall and the proportions of face to back. Thus the cost of changing forms will vary from 25 cents to 75 cents per cubic yard. In building work generally the ordinary forms can be used. Of course, care must be taken not to load members too heavily while they are green and naked, but the same care should be exercised with members still in forms because the forms while preventing collapse will not prevent injury to the concrete by undue pressure upon it.

The cost of the scrubbing is trifling, if done at the right time. A laborer may wash, say, 100 square feet in an hour, or the same area if it has been permitted to get hard may take two men a whole day to rub into shape.

The early removal of the forms makes possible the neat repair of any blemishes that may be revealed.

The question of efflorescence is an important one in the consideration of the appearance of concrete structures. The scrubbed surface is not subject to the hair-cracks that in some faces seem to absorb moisture during storms and then exude the white spreading disfigurement. But if there are joints in the work

there is danger of efflorescence, and observation leads to the belief that if within twenty-four hours of the completion of a course the top surface be carefully scraped to remove every particle of the *laitance*, and then before depositing the next layer of concrete the scraped surface be coated with thin cement mortar, the joint ought to be impervious to moisture from either front or back, and no trouble with efflorescence ensue.

THE ARTISTIC TREATMENT OF CONCRETE.¹

THE consideration of concrete from an aesthetic point of view may strike the average cement-user as inappropriate and impossible, for hitherto the term "concrete" at once suggested foundations, piers, dams, abutments, and, nowadays, it more than likely calls to mind columns, beams, floors, walls and, in fact, the entire structural parts of buildings. But it must be evident that our experience with this new material, new only, however, in the sense of adaptation, will show that like all legitimate and substantial structural materials

it, too, will prove to be susceptible of artistic treatment in design. Wood and stone architecture are as old as the hills, and the art of the mediævalist in developing true styles with these humble materials rightfully belongs to the world wonders. Brick and terra-cotta can scarcely claim quite so much distinction, although in point of artistic treatment they were brought to high development in the Gothic art of Italy. Iron and steel, however, do not fare quite so well, except in a small way along the lines of purely ornamental work; for when the modern rolling-mill began to turn out its product of structural-shapes, and engineers discovered the wonderful possibilities of riveted sections and connections, there was a great rush for structural iron and later for steel. Everything imaginable was made of it, more so in Europe than here. Bridges and viaducts, certain classes of business blocks and public buildings, even churches and cathedrals, all vied with one another in their

¹A paper read at the annual convention of the National Association of Cement Users, at Chicago, January 9, by Mr. A. O. Elzner, architect, of Cincinnati, O.



INTERIOR OF THE HERDIVORA BUILDING, CINCINNATI ZOOLOGICAL GARDENS.
Elzner & Anderson, Architects.

architecture of iron and steel, and while some notable attempts achieved a measure of success, it required many years to develop an artistic style of design. Yet even at this late day structural engineers as a class seem determined to ignore the application of aesthetic principles to their designs of exposed work.

But we feel quite hopeful. There has been, and is, much teaching and preaching of aesthetics. Schools, periodicals and municipal art societies are doing much to educate the popular taste and to create a demand for beauty in public works and this campaign, whose influence is spreading rapidly, will undoubtedly bring designers to recognize and appreciate the necessity and propriety of combining beauty with utility in all visible constructions.

This problem will be greatly simplified in concrete work; for here for the first time we come to deal with a plastic material which can be moulded and modeled at will. Beauty, however, in structural design is worthy of the name only when, like beauty in nature, it has character. It must not be a servile copy of the style peculiar to some other material, but in fact must express the individuality of its own nature: it must not disemble.

It is just this peculiar condition that we must be careful of in our concrete-block architecture. At present the tendency in the manufacture of these blocks is to imitate the split face of stone ashlar. This is radically wrong in principle and should not be tolerated. A flat, smooth face will always look well. However, if a pitched or split face is desired, let it be produced by casting the block flat and then pitching off the face with chisel and hammer just as is done with stone. The clean fracture of the concrete thus exposed will be eminently effective and artistic and will have all the merit that belongs to truthfulness. Plain concrete ashlar walls might in some cases be effectively relieved by the introduction of bands of blocks decorated with some simple ornament moulded in the face, very much as is done with terracotta. But by all means avoid moulded rock-faced work. It is artistically bad. The frequent and constant repetition of a few regular sizes and patterns ruins an effect which should be counted largely as accidental, but always expressive of a fine artistic sense in the selection and grouping of the individual blocks. Artificiality, imitation and misrepresentation are stamped all over such work and can be recognized at first glance.

Solid concrete walls have a great advantage over block walls in that they lend themselves much more readily to artistic treatment. This is especially true where they are used in suburban and country buildings, perhaps because of the touch of nature in the surroundings which more nearly accords and harmonizes with the broad treatment that can be so effectively employed in wall-surfaces. Perhaps the best sources of inspiration that can be had for such treatment are to be found in the old Spanish missions of California, which, although not of concrete, nevertheless at once suggest its use and above all are fine examples of the artistic value of broad wall-surfaces relieved by exquisitely proportioned openings judiciously spaced and not infrequently embellished by a moderate use of ornamentation.

Let us say, then, speaking of domestic architecture, that where walls are made of solid concrete the surfaces should be as unbroken as possible, avoiding especially artificial jointing, of which so frequent use is made, obtained either by scratching a joint into the fresh mortar with which the surface is plastered after the removal of the forms, or by planting beveled wood strips on the inner surface of the forms, thereby moulding the joint directly into the concrete.

Both methods are highly objectionable, utterly senseless and aesthetically very bad and should be shunned. In work of moderate cost, where effects are to be sought in an inexpensive, straightforward and natural way, there can be no offense taken if the concrete is left untouched after removing the forms. In fact, this method has so much merit that it might with perfect propriety be classed as the most thoroughly artistic. That is probably just what the builders of the old Spanish missions would have done, if they had had concrete to use for their buildings.

To be sure, if such treatment is to be used, some care should be exercised in the preparation of the form work, so that the result may not have the effect of a lot of patchwork.

In more pretentious work several methods of treating the exposed concrete are available. A thin skin or crust of neat cement usually is found to cover the surface where concrete was deposited wet and was well tamped. This crust may be removed while still soft by means of a stream of water having some force, or by stiff wire brushes, in which cases the forms must

be removed promptly and just as soon as the work will stand it. This, however, involves considerable danger and should be done only by thoroughly experienced persons. If successfully accomplished, the effect of the rough surface thus produced is good and consistent, for it exhibits the material in its true nature and avoids all semblance of artificiality.

This treatment, however, entails so many difficulties that it will not be very popular, and it will be advisable to adopt some other simpler and safer method that will give similar results. The surfaces can be tooled all over with a chisel as in some classes of stonework; but while the result may be effective, it is rather expensive and slow work and will therefore be but sparingly used. It is difficult, too, to avoid loosening an occasional pebble or stone and thus spotting the surface with objectionable blemishes, and possibly opening up some internal cavities which are quite apt to occur, thus starting a leak in the wall.

A simple and inexpensive, yet thoroughly practical, method of securing an artistic effect consists of covering the wall-surface with a splatter-dash coat of cement-mortar applied by splashing it on with a paddle or a broom—or, better still, it may be first spread on with a trowel and then roughened by stippling with a stiff broom or brush, or even a flat board, in which case the roughening is obtained by suction against the board. When such treatment as this is to be used it may be highly appropriate in some cases and indeed quite interesting to decorate parts of the surface with some simple panel-work or free-hand modeling. In case of panels it is best and simplest to adopt sunken work, as this can be readily produced by merely planting a board or block of desired shape against the inside face of the form, so that it leaves its impress upon being removed from the concrete. Or else a reverse mould made of some artistic bit of carving for a panel, or over a door or window, or a frieze, etc., may be nailed against the forms, and the resulting impress will be thoroughly effective, although a much higher artistic value would be due such work if it were modeled by hand directly in the cement mortar as it is applied and before it has had a chance to harden.

This sort of work is being done extensively and successfully in Germany, where the modern style of "Art Nouveau" presents abundant opportunity for endless designs. It is already finding much favor in our own country and ought to reach a high degree of development.

Mouldings, especially in continuous courses, if attempted at all, should be of the simplest possible design; bold, yet of moderate projection and free from small delicate members. Square offsets and beveled projections serve very well in the place of conventional mouldings and rather accentuate the character of the work and heighten its effect. Dentils of fair size can be worked in to good advantage and with comparatively little difficulty. Such work should, however, be used sparingly on account of the impracticability of treating the surface of the resulting small members, unless great freedom and latitude are allowable without detriment to the artistic character of the design. It is particularly difficult to do this in case the walls are to be plastered over with cement mortar. Where this is done the work should be finished under the float rather than the trowel, so as to minimize the tendency to crack or craze, a great source of annoyance and disfigurement. Trowel finish, furthermore, almost invariably produces a series of blotches of different shades and textures which, if introduced into rough work, have much artistic value, but must be classed as nothing better than blemishes in smooth troweled surfaces. Moreover, it is extremely difficult and well nigh impossible in plastering over mouldings or projecting band-courses to keep the edges straight and true, as they should be in smooth finish, with the result that the poor, slovenly workmanship imparts an air of cheapness and flimsiness to the building instead of the reverse, value and substance. Such then are some of the readier methods that can be employed in producing artistic effects with concrete. This humble material, so replete with possibilities, but as yet so little understood, is manifestly destined to take an important place in the construction of our buildings and must therefore strongly influence their design. But it means long, continuous and close observance and study of its nature, its possibilities and its limitations, and if our designers will devote themselves sufficiently to this subject, as it so well deserves, they will discover in concrete a new and useful friend, and with its help will evolve a new architecture that will be full of life and character, strength and dignity and all else that goes to make a living style.

ENGINEERING ADVICE AS TO REINFORCED CONCRETE.¹

YOUR Committee on Architecture considers it advisable to devote its annual report chiefly to reinforced concrete, on account of its increasing use for structural purposes in engineering and architecture.

This material is now regarded by the public generally as a panacea for all the difficulties and errors frequently made in construction, and also as cheaper and more economical than any system of equally substantial and durable construction. But certain precautions must be observed, or very serious accidents are certain to result from its use by inexperienced or careless men, especially by the "skin" contractor, and it may be well to mention some of the probable sources of trouble.

I. QUALITY OF MATERIALS.

When subject to inspection by competent superintendents, the cement will usually be fresh and of a reliable brand, the sand and aggregate will be free from clay and dirt, due proportions be used, and the method of mixing and tamping be reasonably efficient and uniform. Then the resulting structure can reasonably be expected to have the computed strength, which will increase for an unknown time, perhaps continually.

But many contractors prefer to believe that an addition of lime paste strengthens Portland cement, and, if this were true, more paste would make it still stronger, attaining a maximum strength without any cement at all. Of course the setting is delayed, but this is of less consequence in walls, where most of the contractor's experience has been gained. Owners of proposed structures know very little concerning the relative strengths of various brands of cement, and they are likely to consent to the substitution of an inferior grade, if the contractor offers a small discount on the cost of the work.

The aggregate also varies considerably, as crushed soft sandstone is sometimes supplied instead of hard limestone or granite. The contractor is also inclined to suggest coal cinders as much cheaper and just as good, while cinder concrete is entirely unfit for structural members, being only suitable for use as a mere filling.

2. WORKMANSHIP.

The wooden forms require to be true and to retain their shapes without deflection or bulging when the concrete is tamped in place. Concrete should always be mixed in a suitable machine, for the hand process is very uncertain, even when done under careful supervision. It must be tamped carefully and uniformly without displacing any part of the steel reinforcement, and this work must be done by experienced men, not by common laborers employed by chance.

3. SETTING.

Since the wooden moulds are expensive and the owner desires the completion of the building at the earliest moment possible, there is always a temptation to remove the moulds too quickly in order to use them for a higher part of the structure. This should never be done, for it probably causes most of the serious accidents and sometimes the destruction of buildings, as frequently reported in the newspapers. Cracks are also likely to occur in the exposed surfaces of beams and floor-slabs, thus seriously weakening those members.

4. PROTECTION FROM CONCENTRATED LOADS.

During the construction of a building the materials for the upper stories or the roof are frequently piled up in masses on the floors already built. This is perhaps safe while the forms are in place, since these are usually strongly shored and supported. But after these are removed, such concentrated loads generally cause a permanent deflection and may rupture the floor. The average laborer or mechanic regards a floor as similar to a solid ledge of natural rock, perfectly able to support any load that may be piled on it. Here, then, is a great risk to concrete structures, unless very carefully superintended.

5. USE OF STEEL COLUMNS ENCLOSED IN CONCRETE.

Although buildings consisting of several stories have been successfully built, in which the supporting piers or columns are of concrete reinforced by steel rods and bonds, only sufficient to prevent bending out of verticality, it is evident that for higher structures, or those exposed to heavy floor loads, the column loads should be borne by a steel column to which the

floor beams are properly connected, and not be supported merely by a stiffened concrete pier. This is especially true in case the piers are exposed to side pressures or jolts or moving loads are carried on the floors.

6. FIREPROOF INTERIORS.

Interiors should be made fireproof. Reinforced concrete is merely incombustible, not fireproof, like terra-cotta or bricks. It is calcined to a considerable depth by exposure to great heat and is liable to be washed off by a stream of water, possibly exposing the steel to heat and certainly requiring extensive repairs. Therefore, as careful precautions should be taken as in case of a steel-frame fireproofed building to avoid wood finish, wooden partitions, wooden furniture, and accumulations of books and papers, which would supply materials for a destructive fire. Wired-glass, metal sash and metal-covered doors would also be excellent.

It is probable that these precautions are often impossible, and that a chief reliance must be placed on prompt extinguishment of any local fire before it has time to spread through the building.

7. PRECAUTIONS AGAINST FROST.

Construction should not continue during freezing weather, and all completed work not fully set should be thoroughly protected from frost. The average contractor usually argues that a "frozen set" for plastering or mortar is even better than one without freezing. But this is certainly doubtful, unproven and to be avoided always. His argument merely tends to extend the season for his building operations and is therefore open to suspicion, especially since the experience of every architect reminds him of serious damages to his buildings by frost. Freezing certainly is likely to make the concrete less compact, cause cracks, and retard setting. The use of salt, hot water, heated sand and aggregate are merely palliatives to soothe the conscience of the superintendent. This danger will be most likely to occur in northern cities where the building season is too short for the amount of work to be done, and owners and contractors are willing to take almost any risk in order to complete the building and make it produce revenue at the earliest date.

These suggested dangers in the use of reinforced concrete show, in my opinion, that the use of this material should only be permitted under the direct supervision of a competent engineer or architect, and never be left to the mercies of an inexperienced contractor, who sometimes regards a structure as safe if it does not fall before his pay is received. Yet the chief danger would come from a failure to observe all of the preceding precautions, rather than through dishonesty in materials or workmanship.

With proper care in execution this material is certain to be widely employed for many kinds of structures, will be reasonably resistant to fire, and its strength will increase for a long time. It will doubtless take the place of wood construction for all the more important or expensive buildings, except tall fireproof office-buildings and department-stores. For these the loss of time in erection and the loss of rental would more than exhaust any saving in the cost of construction, not to mention the probable higher rate of insurance on the building and its contents.

In computing the safe strength of any proposed reinforced-concrete structure, the designer should be very conservative in applying formulas and data based on experiments made at testing-stations, where all precautions are observed and the work is done by experts in a manner far superior to that possible in actual structures.

Reinforced concrete was invented in 1868, in France, by Joseph Monier, a gardener, being first utilized by him in building a greenhouse. Its use extended very slowly, so that the material has been largely employed in France and Germany only during the past fifteen years for all classes of buildings, even for those of monumental character, covered by large domes and vaults. Few accidents have occurred, as the properties of the material have been carefully determined by experiments made by the most famous investigators in Germany and France, and the governments have made and strictly enforced stringent rules for the execution of the work. *Béton und Eisen*, a monthly journal of the most scientific character, contains numerous examples of recent structures, calculations of their safe strength, and discussions of all matters of interest.

To indicate the very careful regulations for reinforced-concrete construction, it may be of interest to quote a few points from the general order issued by the Prussian Minister of Public Works in 1904:

¹Report of the Committee on Architecture: Illinois Society of Engineers and Surveyors.

"Complete drawings, calculations and specifications must be submitted in order to obtain a permit to build.

"Only Portland cement of the Prussian standard is allowed.

"Sample blocks must be tested.

"No concrete to be made in freezing weather, and concrete must be protected from frost.

"Side planks may be removed after three days, other forms and supports only after fourteen days.

"Structures must be approved by State building-officials.

"Rules, formulas and data are given, which must be employed in computing the safe strength of floor-slabs, beams and columns of reinforced concrete."

A Prussian building-ordinance is made to be obeyed strictly, not suspended at the request of an alderman or the order of a city council. It is evident that it would be almost impossible for a dangerous accident to occur in Prussia, and that this new material may safely be used there. There should be a State building law in Illinois requiring the minimum precautions necessary for safe building. Until such a law exists and is enforced reinforced-concrete construction should be executed only by competent engineers or architects. If left to the ordinary contractor serious accidents will certainly occur, casting undeserved odium on a very useful and promising method of construction.

Mr. F. Oswald, of this committee, reports that he has completed the Madison County Almshouse, consisting of concrete basement and two stories of brick; floors steel I-beams and reinforced concrete, iron stairs, the latter item increasing the cost of wooden stairs about forty per cent. The floors are finished with a $\frac{3}{4}$ -inch coat of Portland cement and crushed granite screenings, half-and-half, excluding the use of wooden floor for sanitary reason and fire protection. In dormitories, floors will be covered with heavy linoleum or matting.

The average cost of walls per cubic yard of different materials he found to be as follows:

For solid walls of concrete of one Portland cement, two sand and five crushed stone, the cost, including boxing for the forms, is \$5.40 to \$6.00 per cubic yard, with safe crushing load of 150 pounds per square inch.

The cost of coursed rubble stonework per cubic yard is as follows:

Good quality of stone delivered at building site.....	\$2.75
Mortar, one part Portland cement, 2-3 barrel at \$2.00.....	1.33
Two parts sand, 7 cubic feet at \$1.00.....	.25
Coursed stone, mason's work.....	2.75
	\$7.08

Safe resistance 300 pounds per square inch.

Common rubble masonry with lime mortar costs \$5.00 per cubic yard.

Safe resistance 180 pounds per square inch.

Good hard red bricks, delivered, cost \$8.00 per thousand.	
Per cubic yard, 500 bricks.....	\$4.00
Mortar, one part Portland cement, $\frac{3}{4}$ barrel at \$2.00.....	1.50
Two parts sand, 1-5 cubic yard at \$1.00.....	.25
Brick-mason's work at \$5.00 per thousand, measurement 600.	3.00
	\$8.75

Safe resistance 200 pounds per square inch.

Common brickwork for internal walls in lime mortar costs \$6.00 per cubic yard.

Safe resistance 150 pounds per square inch.

COMPARISON OF COST AND SAFE STRENGTH.

Concrete per cu. ft. 22 cts., safe strength per sq. ft. 10.8 tons, cost	20.3 cts.
Coursed stone Portland cement 26 cts., safe strength per sq. ft. 21.6 tons, cost.....	12.0 cts.
Common stonework in lime mortar 18½ cts., safe strength per sq. ft. 12.9 tons, cost.....	15.5 cts.
Hard bricks in Portland cement mortar 32.4 cts., safe strength per sq. ft. 14.4 tons, cost.....	22.5 cts.
Common bricks in lime mortar 26 cts., safe strength per sq. ft. 10.8 tons, cost.....	24.0 cts.

This table shows that stonework is cheapest, considering the comparative safe strength.

THE TREATMENT OF CONCRETE SURFACES.¹

A PLEASING and consistent surface finish generally has but little to do with the strength of a concrete structure, but it is not inconsistent with maximum strength in any structure.

Next to form or design, the character of the surface has most effect on the appearance of concrete, whether in a building arch, wall or abutment, in fact, when the view is had at a very close range, or in such structures as retaining-walls or pavements the surface finish may take precedence over proportion.

It is not intended to attempt a full discussion of the subject, but only to describe some methods used in trying to obtain satisfactory surfaces in the various classes of concrete work done in the South Park system of Chicago.

The imperfections in the exposed surfaces of concrete are due mainly to a few well-known causes which may be summed up as follows:

1. Imperfectly made forms.
2. Badly mixed concrete.
3. Carelessly placed concrete.
4. Efflorescence and discoloration of the surface after the forms are removed.

Forms with a perfectly smooth and even surface are difficult and expensive to secure. Made of wood, as they usually are, it is not practical to secure boards of exact thickness, joints cannot be made perfectly close, the omission of a nail here and there allows warping and the result is an unsightly blemish where least wanted.

Badly mixed concrete gives us irregularly colored, pitted and honeycombed surfaces, with here a patch of smooth mortar and there a patch of broken stone exposed without sufficient mortar. Careless handling and placing will produce the same defects.

But granting we have the best of labor, that all reasonable expense and care is had in making up forms, in mixing, handling and placing the concrete, that it is well spaded, grouted, or the forms plastered on the surface, the results are not satisfactory. All these efforts tend to produce a smoothly mortared surface, and the smoother the surface the more glaring become minor defects. The finer lines of closely made joints in the forms become prominent, the grain of wood itself is reproduced in the mortar surface, hair-cracks are liable to form, and worst of all, efflorescence and discoloration are pretty sure to appear. We surely have been working on a wrong theory.

It is of doubtful efficiency to line the forms with sheet metal or oilcloth. Imperfections still appear.

Two methods suggest themselves as likely to overcome the defects alluded to above. (1) Treating the surface in some manner after the forms are removed to correct the defects, and (2) using for surface finish a mixture which will not take the imprint of and which will minimize rather than exaggerate every imperfection in the forms and which will not effloresce.

Methods of treating the surface by bush-hammering, tooling and scrubbing with wire brushes and water have been described in various published articles, all of which have for their object the removal of the outer skin of mortar in which the various imperfections exist. But the method most used in the South Park work is the acid treatment. It consists of washing the surface with an acid preparation to remove the cement and expose the particles of stone and sand, then with an alkaline solution to remove all free acid, and finally giving it a thorough cleansing with water. The operation is simple and always effective. It can be done at any time after the forms are removed, immediately or within a month or more. It requires no skilled labor—only judgment as to how far the acid or etching process should be carried. It has been applied with equal success to troweled surfaces, like pavements, to moulded forms, such as steps, balusters, coping, flower-vases, etc., and to concrete placed in forms in the usual way. It, of course, means that in the concrete facing only such material shall be used as will not be affected by acid, such as sand or crushed granite. It excludes limestone.

The treated surface can be made any desirable color by selection of colored aggregates or by the addition of mineral pigments. The colors obtained by selection of colored stone are perhaps the most agreeable and doubtless more durable.

There have been moulded in the South Park shops blocks for buildings, columns, architectural mouldings and ornaments with both red and black crushed granite, all treated with the acid to

¹A paper by Linn White, Engineer South Park Commissioners, Chicago, Ill.

bring out the natural colors of the stone. There has been a large quantity of concrete pavement laid with torpedo sand surface colored a buff sandstone color with a small quantity of yellow ochre and mineral red and treated with acid. The buff color imparted to the surface is a welcome relief from the glare of the ordinary whitish gray concrete pavement in the sunshine, and the etching of the surface adds to the softness of the color, at the same time preventing any slippiness. This same buff color has been used to a large extent in steps, bases of lamp posts, and other moulded articles to be placed on or near the ground. With sand as the aggregate thousands of pieces have been moulded for coping, balustrades, concrete seats, drinking fountains, pedestals, etc., which, when treated with the acid, appear like fine grained, almost white sandstone.

Where there are projections or marks left by the moulds or forms they are tooled or rubbed down before treatment, and where it is necessary to plaster up rough places or cavities in the surface it may be done after treatment and cannot be detected.

These various classes of work have been done on a large scale during the last three years in connection with the improvement of new parks and has in all cases proved satisfactory.

The second method of preventing or minimizing surface defect has also been tried in the South Park work with quite a measure of success.

During the years 1904, 1905 and 1906 groups of concrete buildings have been erected in nine different parks, costing, with their accessories, from \$65,000 to \$150,000 for each group. These buildings are all monolithic structures with occasional expansion-joints, the exposed surfaces of walls being of concrete composed of one part of cement, three parts of fine limestone screenings and three parts of crushed limestone known as the one-fourth-inch size. This was thoroughly mixed quite dry so no mortar would flush to the surface and well rammed in wooden forms made in the usual manner. The result was an evenly grained, finely honey-combed surface, of a pleasing soft gray color, which grows darker with time and blends admirably with the park landscape. In placing it was not spaded next the form; it was too dry to cause any flushing of mortar, so there is no smooth mortar surface, the imprint of joints between the boards is hardly noticed and the grain of the wood is not seen at all. There is no efflorescence apparent on the surface anywhere and cannot be on account of the dryness of the mixture and the porosity of the surface. The buildings are used as gymnasiums, assembly-halls, reading and refreshment rooms, and as a rule the same gray concrete finish is given the interior walls as the exterior. In some cases a little color has been applied on the interior walls and the walls of shower and bath-rooms have been waterproofed with plaster. The porosity of the surface makes it well adapted to receive and hold plaster.

This sort of surface is not capable of treatment with acid as a smoothly mortared surface, nor is it desirable. Consequently the only color obtainable is the natural color of the cement-covered stone, but which is softer and far more agreeable than the gray of the usual mortar-finished surface. It is not suited for the surface of a pavement and is not impervious to water. Although it is evident the water enters the pores to a considerable extent there is no evidence of injury from the frost during the two winters some of the walls have stood.

The same finish has been used for retaining-walls, arch bridges, fence-posts, walls enclosing surface yards, etc. In the buildings the thin walls were made entirely of this mixture, while in the heavier structures it has been used only as a facing. Two reinforced arches of 60 feet span were faced with this mixture, but the steel was imbedded in a wetter, more impervious concrete. This same dry mixture can be used for moulded stones when the mould is open enough to permit tamping, and of course it is eminently suited to block machines.

The dry, rich mixture, with finely crushed stone, has been found specially suited to another condition where a sound, smooth surface was particularly difficult to secure, *viz.*, for the underwater portion of a sea-wall on Lake Michigan. It was mixed very dry and dumped in mass in sunken boxes joined end to end, made fairly watertight, but from which the water was not excluded.

With the finely crushed stone a sound, smooth surface was obtained (when the sides of the boxes were removed) where it was manifestly impossible to plaster or grout the surface and where spading a mixture of coarser stone simply washed the cement away from the surface stones. On account of the variable water-level it was particularly desired to have a sound, smooth surface.

Of the work described, most of the monolithic buildings, the arch bridges and some of the walls and paving have been done by contract. All of the moulded work, the buildings made of blocks, service yard walls, etc., and all the acid treatment has been done by the park forces. Nearly all the various brands of Portland cement sold in the Chicago market have been used in varying quantities with equally good results.

In both methods described honest work and careful inspection are as necessary for good results as in any other first-class construction. Neither method cheapens concrete work. The acid treatment slightly increases the cost. The surfacing with fine crushed stone adds nothing to the cost.

By the acid treatment, together with rubbing and chipping, all irregularities can be corrected. With the fine crushed stone surface all irregularities and form marks are not prevented, but they are greatly minimized.

In not all the work done by the second method were the results entirely satisfactory. The original specifications called for $\frac{1}{2}$ -inch stone, which was afterward changed to $\frac{3}{4}$ -inch. Experience taught the correct quantity of water to use for best results. But altogether both methods are so satisfactory that their use will doubtless be continued in the South Park work until something better is developed.

THE DEFECTS AND VIRTUES OF REINFORCED CONCRETE.

DURING the discussion of a paper on Reinforced-Concrete Construction, read before the Engineers' Club of Philadelphia, October 6 last, Mr. Wm. Copeland Furber spoke as follows:

THE history of reinforced-concrete construction deserves the most careful study on the part of structural designers. Reinforced concrete has successfully met the charges of its critics and confounded many of the prophets who predicted nothing but failure for its portion. It is to-day recognized as one of the four methods of structural design, and these methods can be named in the probable order of their historic employment, *viz.*, wood, masonry, iron and, lastly, reinforced construction of iron and concrete. The evolution of the theoretical design of reinforced construction has been slow, largely because the engineering students were not quick to realize that the adhesion of concrete to metal could be used as a factor in determining the transfer of stresses from one material to another. The value of rivets and bolts to transmit stresses could readily be calculated, because the facts were easily ascertained and easily proved, but the ability of the concrete in a beam to transmit the web stresses to a horizontal metal reinforcement or flange was not so readily comprehended. The definite certainty of riveted connections made it difficult to even think, let alone admit, that such a material as concrete could be trusted to transfer stresses to iron bars or rods, although it was quite easy to prove by trial that such a capacity existed. Theoretical objections to this proposition gave way, upon trial, to new conceptions based upon the newly discovered facts, and then the new theories appeared which embraced these facts.

With the advent of reinforced concrete, came the inevitable accompaniment of all things of a more or less mysterious nature: the quacks, who made many claims for the new material and whose real knowledge of the subject was purely empirical. The quack designers and the quack builders have done much to delay the final acceptance of the new combination, as a proper and legitimate form of structural design, and even now the unreasoning and unreasonable advocates of this new form of construction will not admit that this form of construction has any defects worthy of mention.

Reinforced concrete has, like all other good things, the defects of its virtues, and no intelligent designer can allow these defects to pass unnoticed, if he aims to keep his mind free from prejudice. Reinforced concrete deserves a high place as a method of construction, and with the growing scarcity of lumber its employment has become a practical necessity. It is also a step in the direction of the erection of permanent buildings with a resultant decrease in the fire-hazard and a lessening of the spendthrift fire-waste of which this country is the chief exponent. For this reason, if no other existed, the new construction can be hailed as a Godsend.

There is, perhaps, no material used in construction in which the workmanship factor so largely enters. We may inspect iron, wood, brick, stone, etc., and accept them or reject them as they meet or fail to meet our requirements, for they are

finished units of construction, but while the separate component parts of the concrete are definite things, yet in their combined form they become a new chemical and mechanical substance which may be good or bad according to the intelligence and care used in mixing, placing and protecting them until a proper setting has taken place.

There are several prevalent superstitions among the ordinary workers in concrete that seriously operate against the probability of good results being obtained unless the work is most carefully supervised. One of the superstitions is that cement possesses some magical property that enables a very small quantity to go a long way, or in other words, that it takes but a "little to leaven the lump" of sand and stone, and these same workmen think that they are doing their "boss" a good turn when they "skin" on the quantity of cement.

Another delusion is that "drying" and "setting" are coincident, and that the first must occur before the second has happened. I suppose that reasoning from the setting of other materials, like paste, mucilage, glue, varnish and other materials of like nature in which water or alcohol is the solvent, it is natural for them to suppose that cement must dry before it sets, and this belief causes no end of trouble, unless it is most carefully guarded against. I was called upon to investigate, last fall, two concrete structures which failed largely through the belief on the part of the foreman of each job that the concrete should be allowed to dry out as fast as possible. Their efforts in this direction were aided by high winds and the cold weather, which retarded the setting. In one instance, several buildings of a group and in another the floor system of a city-hall collapsed. The contractor placed the failure on the cement and threatened to sue the cement manufacturer for damages, but a little investigation showed that the failure in both instances was due to the belief on the part of the foreman on each job that rapid drying was not only desirable but essential to the setting of the concrete. Had the foreman in each case known the fundamental chemical necessity for water during the setting, this failure would not have occurred.

Another great drawback to the use of concrete work is the uncertainty as to whether some careless, ignorant, or designing workman may not have spoiled the work at a critical point by improper methods or materials, and no subsequent inspection is going to detect this weakness until it is possibly too late to remedy it.

Carelessness, indifference and irresponsibility seem to be the order of the day, and this is particularly so in the building trades. Where materials can be inspected after erection, as in brickwork, stonework, ironwork, etc., it is very hard to get even passably good results, but with a material that has to be taken on faith, like reinforced concrete, it requires a perpetually optimistic temperament to prevent undue anxiety from spoiling one's peace of mind.

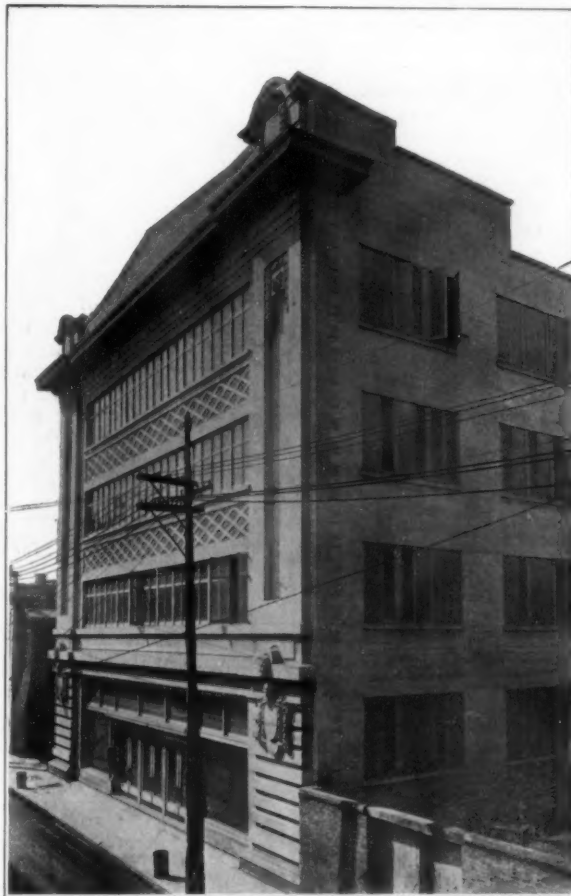
Regarding the ignorance of the ordinary workers in concrete concerning the chemical value of water in the setting of cement, it should be remembered that cement is a chemical product and requires some brains to make proper use of it. When it was deposited in large masses, the chances of drying out, too rapid setting, and the disturbing of the mass due to vibration,

were not great, but in reinforced-concrete construction these dangers are ever threatening.

As a step in the education of the uninformed workers in cement, I would earnestly suggest to the manufacturers that they attach a tag to each bag or barrel of cement giving in a concise manner the essential facts regarding the use of water in the mixing and setting of cement. Thus, without any great effort, each man who handled the bag of cement would unconsciously perhaps become a missionary in spreading the knowledge of how cement should be used, and better work would follow and more cement would be used, and thus the manufacturer would reap an advantage for his altruistic labors in a material and pecuniary way.

The fireproofing of concrete structures is one that deserves as much study as the fireproofing of iron structures. The advocates of reinforced-concrete construction do themselves no credit and do their material a great deal of harm by claiming that concrete is a fireproof material. The simplest tests which can be made by a school-boy will prove that cement, after setting, cannot

resist fire without detriment, and the point of absolute structural disintegration is determined solely by the length of time it is kept in contact with the fire. A few briquets, the kitchen-range and a bucket of water will prove this in a most practical and satisfying way, and remove any lingering doubt one may have on the subject. Chemically, this conclusion can be justified by recalling that in the setting of cement from ten to twenty-five per cent. [of water] is crystallized into the new mixture and remains there, not in the form of dampness—for the material can be perfectly dry—but as a chemical compound of the mass, and knowing this it can also be shown that this combination can be broken up and separated again by heat, which brings the cement back to somewhat the original form it had before being mixed with water. All this being proved or admitted, it is next in order to find a method to protect the concrete from reaching high temperatures, and our experience in fireproofing ironwork will help us in this direction. Porous fire-clay blocks are useful as a slow conductor of heat and they will also withstand high temperatures without changing their chemical composition, and in addition their porous nature gives them the ability to resist sudden changes of temperature without fracture. By protecting the structural parts of the construction with this material it is possible to construct a building of great fire-resisting capacity at a cost considerably less than if structural steel fireproofed



PEERLESS LAUNDRY BUILDING, MOBILE, ALA.
George B. Rogers, Architect.

Every portion of this building, from foundation to roof, smoke-stack as well as stairs, is of reinforced concrete. There are 27,000 square feet of flooring, and the front girders have a clear span of 50 feet. The stucco finish of the main front is applied directly to the rough concrete. The side walls are 4 inches, and left as they come from the forms.

with the same material were to be used.

The porous-terra-cotta manufacturers have provided a material which can be easily laid with the centering and which unites with the concrete, forming a monolithic structure with a protecting surface of porous fire-clay terra-cotta.

The application of reinforced concrete to mill structures, which have heretofore been built of large sticks of lumber, helps wonderfully in the direction of better buildings. Large sticks of lumber are becoming very hard to obtain, and even when they can be obtained in good condition the subsequent checking of the wood seriously impairs their strength and capacity. Before the advent of reinforced concrete there was but one other way to obviate this and that was by the employment of structural

ironwork. In reinforced concrete we have a material which is particularly suited to commercial structures of all kinds, but in the employment of any composite material like reinforced concrete eternal vigilance is the price of safety.

THE LITERATURE OF REINFORCED CONCRETE.

THE increasing use of reinforced concrete as a structural material has led to the production of many books treating of its properties and applications.

The first to be published written in English (omitting the brief analysis of reinforced-concrete beams in the late Prof. J. B. Johnson's "Materials of Construction") was "Reinforced Concrete Construction," by L. J. Mensch. The author is a practical designer of and a contractor for this method of construction, and he writes as an advocate, first, of reinforced concrete as a superior substitute for other structural materials, and, second, of certain forms or systems of reinforcement. But, while largely an argument for the practices and opinions of the author, the book contains many suggestions for the constructor.

The next book in order of publication was "Reinforced Concrete," by A. W. Buel and C. S. Hill. This work, of which a revised edition will soon appear, is a general treatise on its subject. It aims to give equal prominence to computation, design and methods of construction. Part I. states and discusses formulas and methods of calculation for beams, columns, walls, arches, conduits and tanks, and sets down those facts relating to the properties of concrete and steel which are of most use to the designer. Part II. describes and illustrates forms and types of structures that have been built of reinforced concrete. Part III. describes various forms of reinforcement and the methods of construction employed in foundation-work, bridges, buildings, conduits and tanks.

To the general reader Part II. will probably prove the most interesting part of the book. It describes perhaps two hundred reinforced-concrete structures: foundations, piles, floors, columns, walls, roofs, sewers, aqueducts, tanks, bins, arches, dams, chimneys. About two hundred drawings illustrate this portion of the text, and these are fully dimensioned. The structures shown are not critically discussed, the idea being to place actual structural details before the reader in such variety and number that he may be practically sure of finding something about any particular detail in which he is interested and may see how it has been worked out by other designers.

The hundred pages of Part III. are intended principally for the contractor. They tell briefly of the quantities and composition of concrete, describe various kinds of reinforcement and illustrate forms and methods of concreting for foundations, buildings, bridges, tanks, reservoirs and conduits. This part has a final chapter on methods of facing and finishing exposed concrete surfaces.

"Reinforced Concrete," by Charles F. Marsh, was first published in England. Like the American work just reviewed, it is an attempt to cover the whole field of reinforced concrete—computation, design and construction. The author has, however, derived his information chiefly from the practice of Continental Europe; in fact, comparatively little of the book, aside from the author's deductions, is of English origin. This is doubtless due to the fact that the British building laws and ordinances are or were such as almost to prohibit this form of construction. The book is divided into seven parts. Part I. reviews the subject in general and discusses the advantages and disadvantages of reinforced concrete. The ninety pages of Part II. are devoted entirely to descriptions and illustrations of systems of reinforcement. Some fifty systems are considered, and the reader who desires to see the versatility of invention in this particular will find this part an interesting study. Part III. treats of materials and their combination and deals entirely with European practice. The sixty pages of Part IV. are devoted to forms, falseworks, methods of concreting, forms of reinforcement, and the facing and finishing of surfaces. One of the most suggestive sections of this part deals with the molding of members before putting them in place. Part V. presents the data resulting from the experimental researches of the European experts and the constants of strength, elasticity, adhesion, etc., recommended by the

author for use in computation. Part VI. discusses methods of calculation. The author presents first his own analyses and formulas and follows with those of Hennebique, Ritter, Considère, Cristophe and others. It is for this part and for Part V. on tests and Part II. on systems of reinforcement that the book is to be chiefly commended. In Part VII. there are assembled a large and rather miscellaneous list of descriptions and illustrations of reinforced-concrete structures.

Next in order of publication come two American books, whose similarity of scope makes it most convenient to consider them together. These are "Concrete, Plain and Reinforced," by F. W. Taylor and Sanford E. Thompson, and "Cements and Concrete," by C. L. Sabin. In each of these the consideration of reinforced concrete is an incidental feature of a general treatise on cement, mortar and concrete. Briefly characterized, the latter is particularly strong in its discussion of cement-testing and its presentation of original results of tests of cements, mortar and concrete, while the former is a thorough and generally excellent work on the making and practical handling of concrete. Most of the rules laid down in these books for the mixing, handling and placing of concrete are quite pertinent to work in reinforced concrete and are presented with far more thoroughness than in any of the books dealing especially with that material. The need for a strong and reliable concrete is so imperative in reinforced-concrete construction that this feature makes the books in question of particularly great value to the constructor. Both books begin by describing and classifying the various hydraulic cements, and contain instructions for testing, results of tests, directions for choosing sand, and aggregates and for proportioning mixtures, and directions for mixing and placing concrete in building-work, piers, dams, retaining-walls, arches and other structures.

In the next book, "Concrete-Steel," by W. Noble Twelvetrees, a well-known English structural engineer, no attempt is made to cover the subject of reinforced concrete and its application to construction. The work is rather a discussion of fundamental principles. Beginning with a statement of the physical properties of concrete and of steel and of concrete and steel in combination, the author then takes up the theory of reinforced concrete and gives rules for correct design and calculation of strength and practical examples of the chief types of members employed in construction. His presentation of the subject is excellent in all cases; but it is unfortunate that many of the data accepted by him are matters in dispute or have been discredited by more recent investigations.

"A Handbook on Reinforced Concrete," by F. D. Warren, is the only book on this subject which has so far appeared in 1906. Part I. is introductory and contains references to provisions for securing good construction. Part II. has sixty-seven pages devoted to tests of beams, floors and roofs; which tests, according to the author, justify the use of certain constants and coefficients used in his tables. Part III. contains tables giving safe loads, bending moments, deflection under load, etc., for beams, floors and columns, and also the comparative cost of reinforced concrete, cast iron, steel and timber construction. Part IV. gives similar information for roof-trusses up to 125 feet span. The idea of making up the publication in handbook form is a good one; it is all the more to be regretted that the author is, in the reviewer's opinion, frequently in error in his assumptions and his reasoning. The book is therefore one which it would be unsafe to put in the hands of the inexperienced.

In addition to these seven more or less complete and general works, there are others which take up special phases of reinforced-concrete construction. First is Prof. William Cain's little book on "Concrete-Steel Arches," which is a discussion of the analytical and graphical calculation of arches. Next comes Mr. Leon S. Mossieff's translation of Considère's papers and their compilation in a book entitled "Experimental Researches on Reinforced Concrete." The subjects treated in these papers are: Reinforced concrete in bending; the deformation and testing of reinforced-concrete beams; effects of changes of volume of con-

"Reinforced Concrete Construction," by L. J. Mensch. Chicago: William Seafert. Price, \$2.

"Reinforced Concrete," by A. W. Buel and C. S. Hill. Part I.—Methods of Construction, by A. W. Buel. Part II.—Representative Structures; Part III.—Methods of Construction, by C. S. Hill. New York: The Engineering News Publishing Company. Price, \$5.

"Reinforced Concrete," by Charles F. Marsh. New York: D. Van Nostrand Company. Price, \$7.

"A Treatise on Concrete, Plain and Reinforced," by F. W. Taylor and Sanford E. Thompson. New York: John Wiley & Sons. London: Chapman & Hall, Limited. Price, \$5.

"Cement and Concrete," by C. L. Sabin. New York: McGraw Publishing Company. Price, \$5.

"Concrete-Steel," by W. Noble Twelvetrees. London: Whitaker & Company. New York: The Macmillan Company. Price, \$1.90.

"A Handbook on Reinforced Concrete for Architects, Engineers and Contractors," by F. D. Warren. New York: D. Van Nostrand Company. Price, \$2.50.

"Concrete Steel Arches," by Prof. Wm. Cain. New York: D. Van Nostrand Company.

"Experimental Researches on Reinforced Concrete," by Armand Considère. Translated and arranged by Leon S. Mossieff. New York: The McGraw Publishing Company. Price, \$2.

crete; tensile and compressive resistance of reinforced concrete; resistance of concrete to shearing and sliding; effects of cracks, and compressive resistance of hooped and reinforced concrete. These books of Cain's and Considère's are essentially books for the computer and designer.

The constructor will find his needs specially considered in Mr. H. P. Gillette's "Handbook of Cost Data,"¹⁰ some 140 pages of which useful work are devoted to records of costs of materials, forms, mixing, handling, depositing and finishing.

The highest and earliest development of reinforced-concrete work occurred in France and Germany, so that the foreign literature of the subject should not be overlooked. Probably the best general treatise is "Le Béton Armé,"¹¹ by Paul Christophe. This book covers computation, design and construction. Part I. discusses general principles and systems of construction. Part II. describes and illustrates the application of reinforced concrete to buildings, bridges, reservoirs, etc. Part III. has to do with the execution of work in this material. Part IV. discusses the theory and methods of calculation. Part V. treats of the advantages and disadvantages of reinforced concrete as a structural material.

The great advantage—particularly to the author of a technical book—of having the last word has been utilized by Mr. Homer A. Reid, in his "Concrete and Reinforced-Concrete Construction."¹² The first six chapters of this nine hundred page book contain some historical matter and a discussion of materials, and methods of proportioning ingredients and mixing and placing concrete. Chapter VII. analyzes the factors that affect cost, and chapter VIII. treats of the finishing of concrete surfaces. Nearly a hundred and fifty pages are devoted to the application of reinforced concrete to building construction. This feature of the book and the fact that Mr. Reid presents the general theory of reinforcement as applied to beams, slabs and columns with unusual clearness and conciseness are what cause the work to be of exceptional interest to architects.

A BOOK ON THE SAN FRANCISCO DISASTER.

This work,¹³ covering two hundred and seventy large pages, is really a report made to the board of directors of the Roebing Construction Company by its expert engineer. But although Mr. Himmelwright's investigation was doubtless undertaken primarily for business reasons, the whole report gives evidence of impartiality and of careful observation leading to just conclusions.

The first thirty pages contain a historical account of the earthquake and a general discussion of the effects of shock and conflagration on buildings of various classes. Following this is a detailed report on the "Class A" or fireproof buildings. Some seventy-six such structures were studied and the damage done to each is separately chronicled. A hundred and fifty full-page photographic views make clear the points brought out in the text.

The conclusions which Mr. Himmelwright draws from his observations are set down under the following seventeen heads:

THE LESSONS OF THE FIRE.

- I. Protect the openings of the outside walls against the exterior fire hazard.
- II. Protect the columns and other important structural members in proportion to the requirements.
- III. Use refractory materials for the façades.
- IV. Select a concrete floor-construction of recognized strength and fire resistance.
- V. Adopt reinforced-concrete for partitions.
- VI. Never permit pipes inside the column protection.
- VII. Provide metal treads for stairways.
- VIII. Provide for the expansion of steel lintels and mullions.
- IX. The filling between the floor arches and the under side of the finished floor should never be omitted.
- X. Avoid light supports and copper wire in metal lath-and-plaster ceiling construction.
- XI. Small steel vaults and fireproof safes proved ineffective in preserving their contents.

¹⁰"Handbook of Cost Data for Contractors and Engineers," by Halbert P. Gillette. New York: Myron C. Clark Publishing Company. Price, \$4.

¹¹"Le Béton Armé et ses Applications," by Paul Christophe. Paris: Ch. Beranger. Price, \$7.

¹²"Concrete and Reinforced-Concrete Construction," by Homer A. Reid, Assoc. M. Am. Soc. C. E., Assistant Engineer, Bureau of Buildings, New York City. New York: Myron C. Clark Publishing Company. Price, \$5.

¹³"The San Francisco Earthquake and Fire. A Brief History of the Disaster. A Presentation of Facts and Resulting Phenomena, with Special Reference to the Efficiency of Building Materials. Lessons of the Disaster." By A. L. A. Himmelwright, C.E., M. Am. Soc. C. E. New York: The Roebing Construction Company.

THE LESSONS OF THE EARTHQUAKE.

- XII. Avoid locations in close proximity to geological fault lines.
- XIII. The foundation must be capable of moving as a unit.
- XIV. Adopt the steel skeleton frame method for the superstructure.
- XV. The best materials and workmanship only are admissible for wall construction.
- XVI. Avoid high chimneys and towers of plain masonry.
- XVII. Roofing tiles should be thoroughly anchored in position.

Other and different lessons might be learned from the data which are supplied by the author, but the book as a whole is the most complete record available of the condition of the San Francisco buildings after the great earthquake and fire.

ILLUSTRATIONS

THE AUTOMOBILE CLUB OF AMERICA, WEST 54TH STREET, NEW YORK, N. Y. MR. ERNEST FLAGG, ARCHITECT, NEW YORK, N. Y.:

EIGHT PLATES.

This building, a reinforced-concrete skeleton, is faced with terra-cotta. A fairly successful attempt at polychromatic effect has been arrived at by introducing low-toned slip-covered terra-cotta in the modelled work about the entrance and the great windows of the first story.

THE ADMINISTRATION BUILDING OF THE GEORGE N. PIERCE COMPANY, BUFFALO, N. Y. MR. GEORGE CARY, ARCHITECT, BUFFALO, N. Y.: SIX PLATES.

BUILDING OF THE EASTMAN KODAK COMPANY, WEST 23RD STREET, NEW YORK, N. Y. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.: THREE PLATES.

In this case the reinforced-concrete skeleton construction is veneered on the street front with terra-cotta.

HOUSE OF ALFRED MITCHELL, ESQ., PORT ANTONIO, JAMAICA, W. I. MESSRS. CHAPMAN & FRAZER, ARCHITECTS, BOSTON, MASS.

This reinforced-concrete building endured without injury the earthquake spasms that wrecked Kingston and other places, a few months ago.

HOLY TRINITY CHURCH, HAVANA, CUBA, W. I. MESSRS. CRAM, GOODHUE & FERGUSON, ARCHITECTS, BOSTON, MASS.: SIX PLATES.

While the structural parts of this building are of reinforced-concrete, the columns, doors and window finish and all other moulded decorative portions were cast in cement separately and built into slots, recesses, etc., provided for them in the mass work.

EPISCOPAL CATHEDRAL, MANILA, P. I. MESSRS. STURGIS & BARTON, ARCHITECTS, BOSTON, MASS.: FOUR PLATES.

With the exception of the roof, this building is of reinforced-concrete construction.

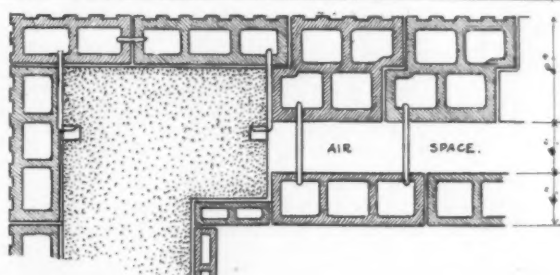
PARISH-HOUSE OF THE EPISCOPAL SOCIETY, MANILA, P. I. MESSRS. STURGIS & BARTON, ARCHITECTS, BOSTON, MASS.

MERCHANTS' NATIONAL BANK BUILDING, NEWARK, N. J. MR. CHARLES P. BALDWIN, ARCHITECT, NEWARK, N. J.: TWO PLATES.

In this case the reinforced-concrete structural parts are veneered with stone work.

HOUSE OF P. A. ROCKEFELLER, ESQ., GREENWICH, CONN. MESSRS. HISS & WEEKES, ARCHITECTS, NEW YORK, N. Y.: THREE PLATES.

We regret extremely that our reproductive process has done such scant justice to the very admirable and thoroughly prepared



drawings which were prepared for this building. The architects have taken unusual care and efficient precautions to make the walls of the building not only fireproof, dampproof, and soundproof, but airproof as well. The accompanying diagram de-

clares clearly that the comfort of the inhabitants is, in an unusual degree, not likely to be much affected by changes in the external temperature.

THE CHÂTEAU DES BEAUX-ARTS, HUNTINGTON, LONG ISLAND, N. Y.
MESSRS. DELANO & ALDRICH AND MAURICE PRÉVOT, ARCHITECTS, NEW YORK, N. Y.: EIGHT PLATES.

This establishment, which is to combine a hotel with restaurant, casino, bathing-pavilions, garage, villas, etc., is located on Huntington Bay. The site begins at the water's edge with a bluff and continues to rise back the full depth of the property, which is about one-half mile. On the edge of the bluff at the water's edge to the Casino. About two hundred feet back from this are the main buildings of the hotel. Back of the hotel buildings, on a level stretch, will be the polo-grounds, tennis-courts, and a field for all sports. Farther back the ground rises rapidly and lends itself very aptly to the scheme which incorporates a number of villas, so placed that each one will have a clear view overlooking the harbor and the Sound. The garage, which will accommodate fifty automobiles, is located on the east side of the property alongside of the road. This road is sixty-six feet wide and will connect directly with the new "automobile speedway," which is now in the course of construction.

The establishment being thus located should prove a rendezvous for automobile-tourists and yachtsmen. It is to be treated in somewhat the same manner as certain French establishments, such as the Pré-Catalan in the Bois de Boulogne, and is being erected for the owners, Messrs. Bustanoby Bros., of the Café des Beaux-Arts, New York City.

The central feature is the main hotel building, with two wings devoted to sleeping apartments, each containing sixty rooms. Each room is complete with bath and toilet and is so constructed that it will be absolutely sound-proof. This group of buildings is located about two hundred and fifty feet from the water's edge and overlooks the Casino and the bay.

In front of these buildings, on the water's edge, is located the Casino with its café, dining-room, private dining-rooms and billiard-rooms, all opening on broad terraces built over the seawall. On the roof is an open garden. The Casino is connected with the main building by underground tunnels.

Between the Casino and the Main Buildings, there is a terrace in the guise of a formal garden, located in which will be small pavilions in which meals will be served. These pavilions will be reached through underground passages from the kitchen, the Casino and the Hotel.

The parts of this establishment that will be open to the public this spring are the Casino, the east wing of the Hotel group and the garage. On the site of the main hotel building, there now stands what was formerly known as "Locust Lodge." This has been remodelled entirely and handsomely refurnished and will be used in connection with the other buildings this season.

All of the buildings in connection with this establishment will be fireproof, being constructed throughout of reinforced-concrete, using both the column and girder and solid slab construction.

The exterior of the buildings will be finished in stucco, all of the cornice and ornamental work being in cement. The architects, as will be seen on the accompanying drawings, have been especially careful in designing the structural concrete work so as to permit of the mouldings and cornices being run directly thereon. All of the ornamental work will be cast in cement from models executed from the architects' drawings. Considerable of this casting will be done directly on the works. Special care has been exercised in the modeling, so that when the castings are drawn the discouraging results usually obtained have been overcome and the effect obtained is that of handcut stonework. There will be no natural stone used on any part of the construction work, everything being of concrete and cement mortar.

VACCINE LABORATORY AND STABLE FOR NEW YORK CITY BOARD OF HEALTH, WESTCHESTER, N. Y. MESSRS. SNELLING & POTTER, ARCHITECTS, NEW YORK, N. Y.: FOUR PLATES.

THE UNION BUILDING AND THE SANTA FÉ FREIGHT DEPOT, LOS ANGELES, CAL. MR. HARRISON ALBRIGHT, ARCHITECT, LOS ANGELES, CAL.

CITIZENS' NATIONAL BANK BUILDING, LOS ANGELES, CAL. MR. HARRISON ALBRIGHT, ARCHITECT, LOS ANGELES, CAL.: TWO PLATES.

The footings, columns, girders, floors, walls, etc., are of reinforced-concrete. The floors of the lobby, banking-room and toilet rooms are mosaic tile. The floors of all corridors and offices

are cement. The interior doors, trim, etc., is mahogany-finished birch. The walls and ceilings throughout the building are tinted. Throughout the several stories the floor panels in this building have been subjected to excessive test loading under the supervision of the architect and the city building inspectors, and pronounced by them to be the strongest floors in the city.

HERBIVORA BUILDING IN THE ZOOLOGICAL GARDEN, CINCINNATI. MESSRS. ELZNER & ANDERSON, ARCHITECTS, CINCINNATI, O.

HOUSE OF MR. ALBERT KAHN, ARCHITECT, DETROIT, MICH.

HOUSE OF ROBERT ANDERSON, ESQ., CINCINNATI, O. MESSRS. ELZNER & ANDERSON, ARCHITECTS, CINCINNATI, O.: TWO PLATES.

THE U. S. GRANT HOTEL, SAN DIEGO, CAL. MR. HARRISON ALBRIGHT, ARCHITECT, LOS ANGELES, CAL.: TWO PLATES.

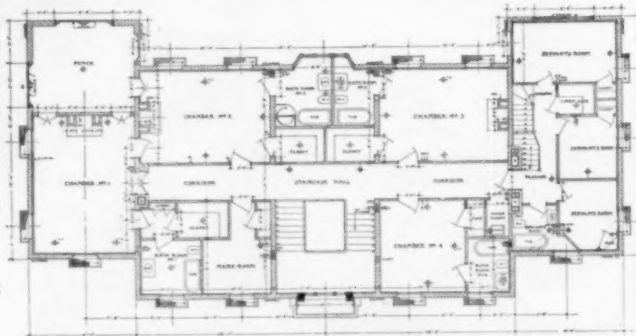
The footings, columns, girders, floors, walls, etc., are all constructed of reinforced-concrete. The exterior of the building will be faced with cream-colored glazed terra-cotta. The floors of the lobby, café, bar-room, toilet-rooms and bath-rooms will be of mosaic tile. The floors of billiard-rooms, ball-room and parlor will be of wood mosaic. Floors of all other rooms and corridors will be of cement with fastenings for carpets imbedded therein. The interior trim will be birch, finished a rich mahogany color. The walls of all rooms throughout entire building will be decorated.

HOUSE OF DANIEL BACON, ESQ., ARDSLEY-ON-THE-HUDSON, N. Y. MR. OSWALD C. HERING, ARCHITECT, NEW YORK, N. Y.

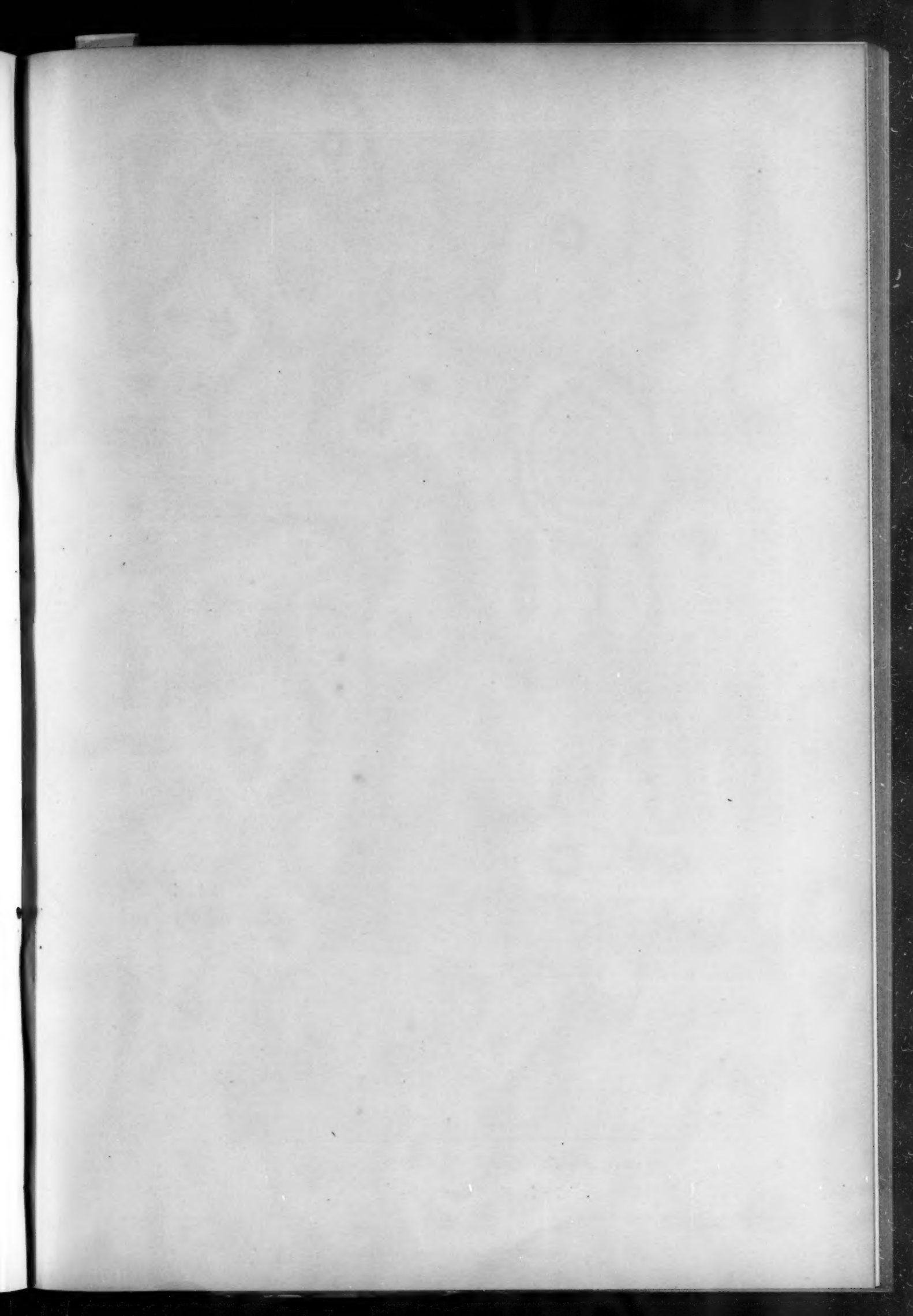
This house, 35 feet wide and 90 feet long, is built of reinforced-concrete from the footings to the gables, including the floors and



bearing walls, with partitions and furring of hollow terra-cotta blocks. The low attic, however, left unfinished for general storage, is roofed in the usual manner with wood rafters. The exterior walls will be finished with a selected pebble-dash. The roof tiles are of a yellow-brown, especially made to conform to the color scheme, and above the second-floor windows panels in relief, by a well-known sculptor, will be executed from the architect's drawings. These panels are to be made of cement colored in three tones. The rafter ends, window-casings, and all the exterior woodwork will be stained a gray-black, and the contrast of color against the background of warm gray concrete will be effective and pleasing.



The contract was awarded without competition to a builder experienced in concrete work and with a reputation for honesty and thoroughness. Such an unusual procedure is not surprising, however, as it has come to be recognized that unless this form of construction is carefully and honestly carried out, disappointment and possible disaster will ensue.





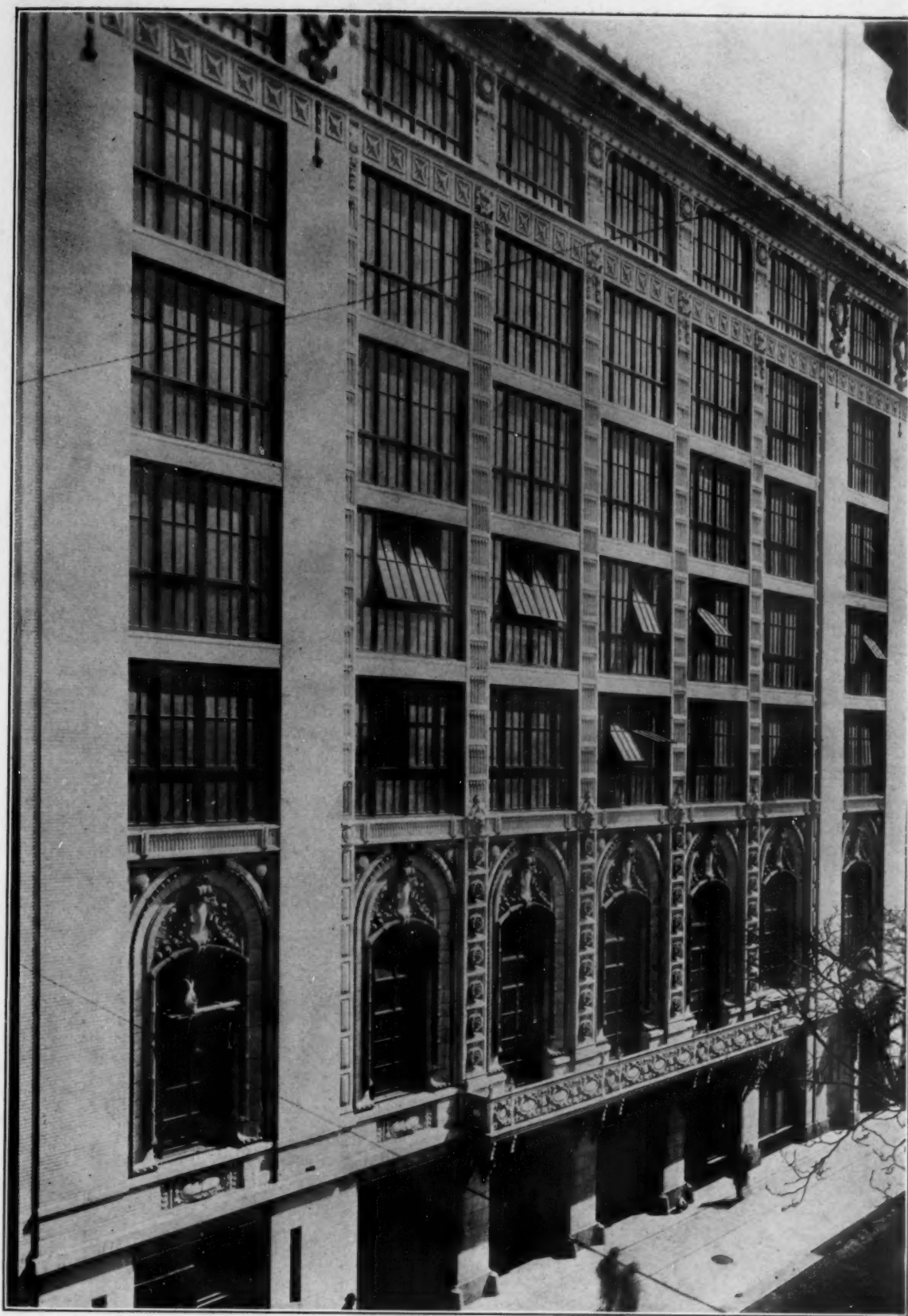
CLUB ENTRANCE: AUTOMOBILE CLUB OF AMERICA, W. 54TH ST., NEW YORK, N. Y.

Ernest Flagg, Architect.

The American Architect and Building News.
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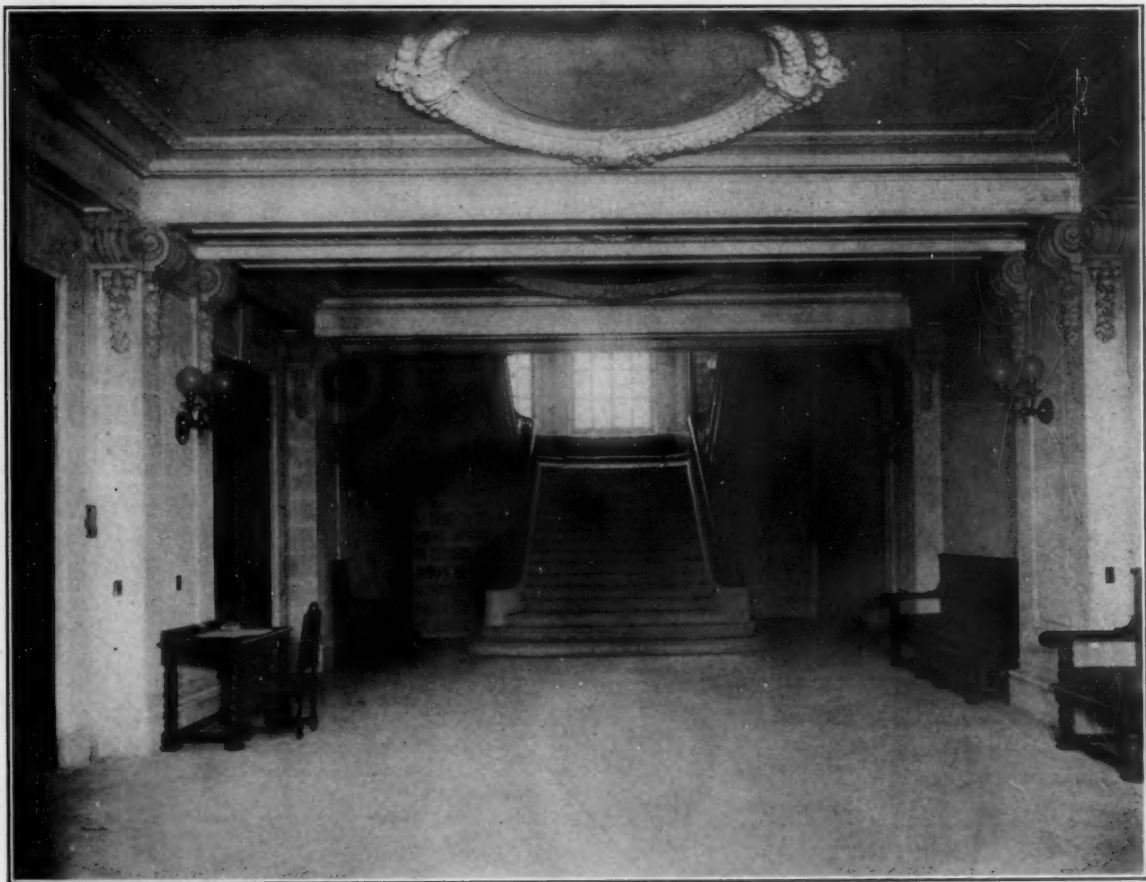
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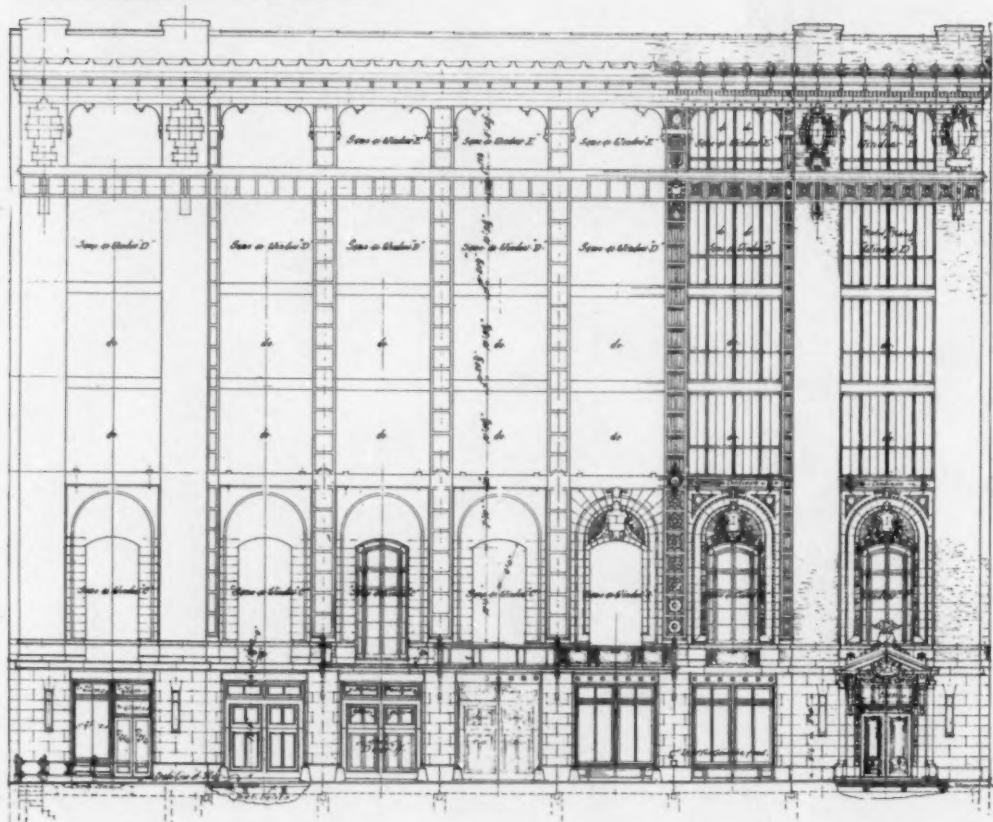
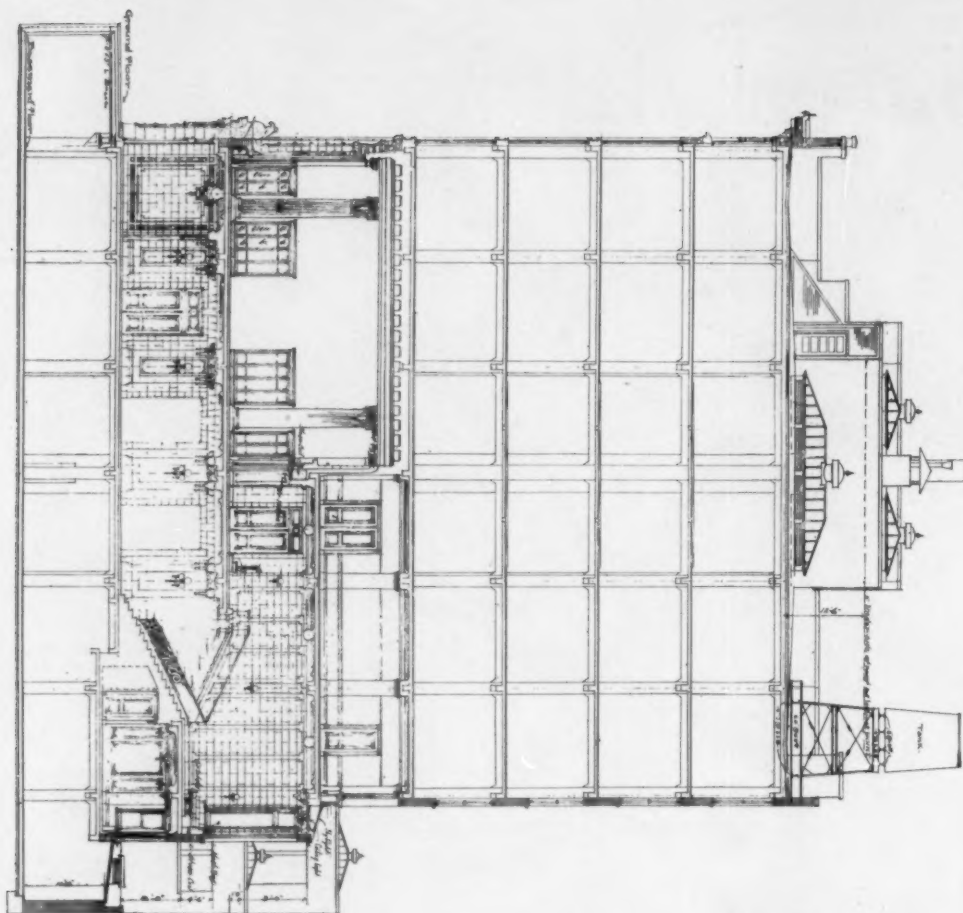
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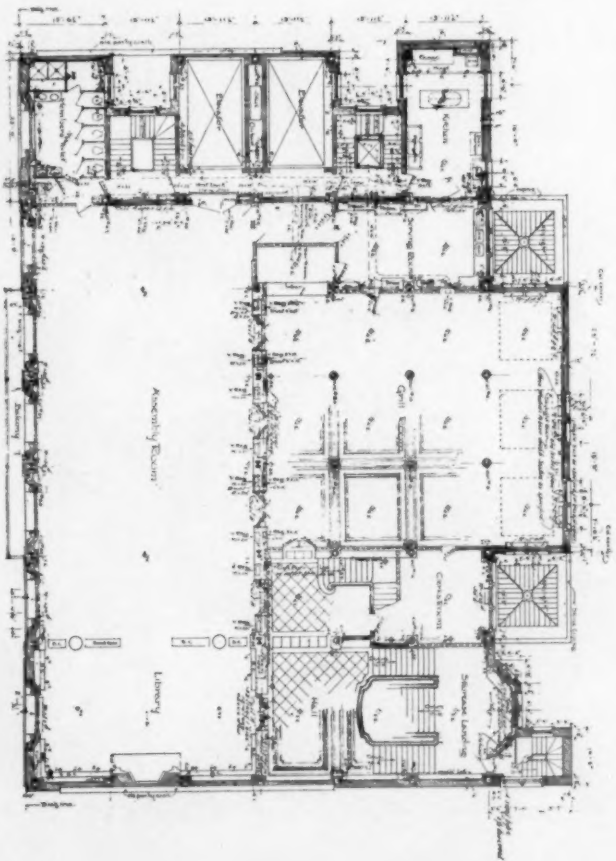
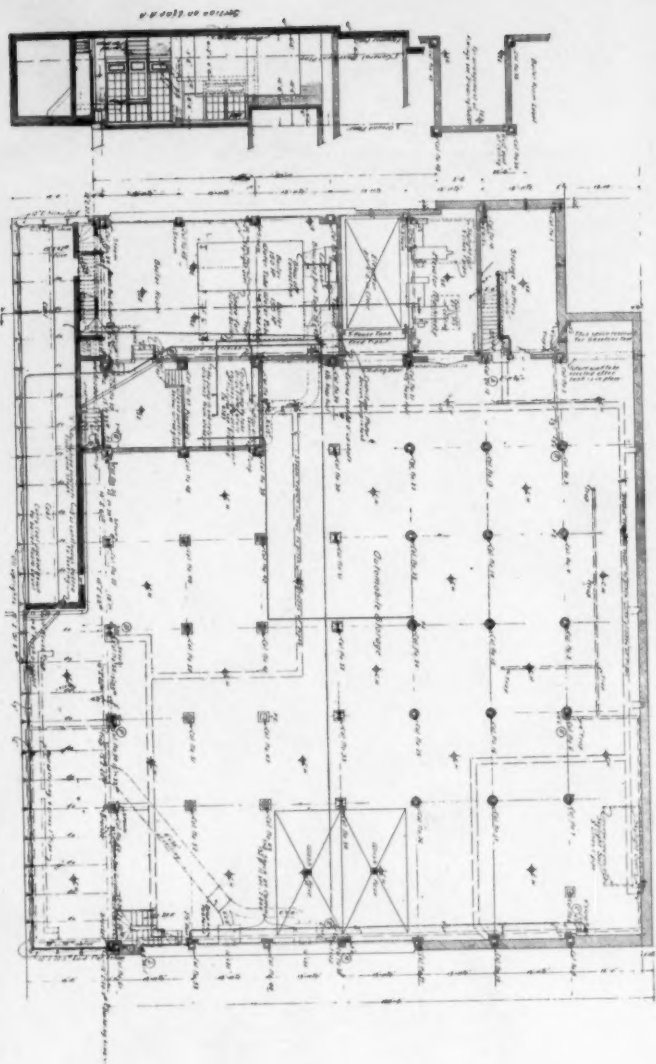
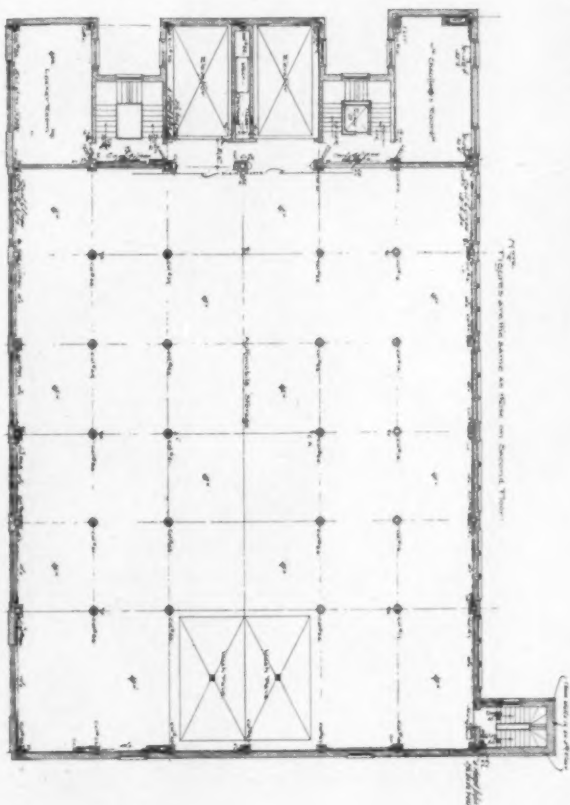
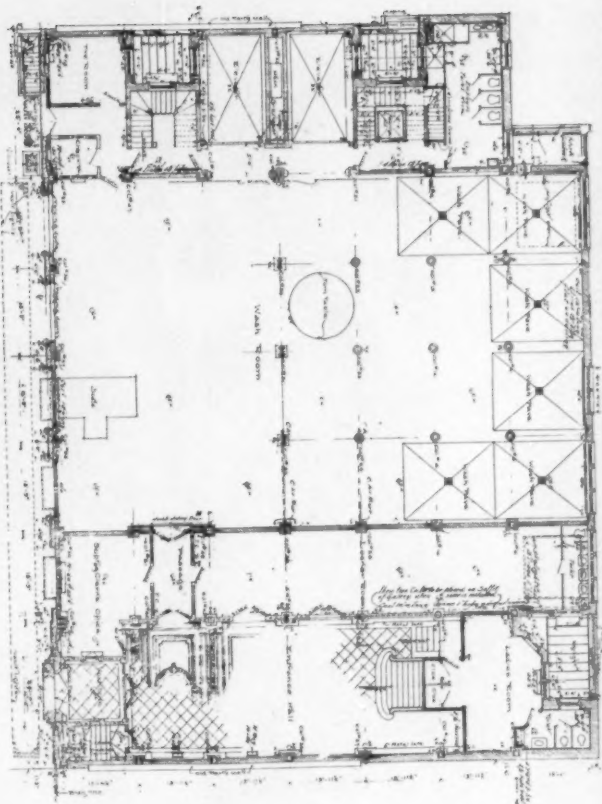
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ELEVATION AND SECTION: AUTOMOBILE CLUB OF AMERICA, NEW YORK, N. Y.

Ernest Flagg, Architect.



PLANS: AUTOMOBILE CLUB OF AMERICA, W. 54TH ST., NEW YORK, N. Y.

Ernest Flagg, Architect.

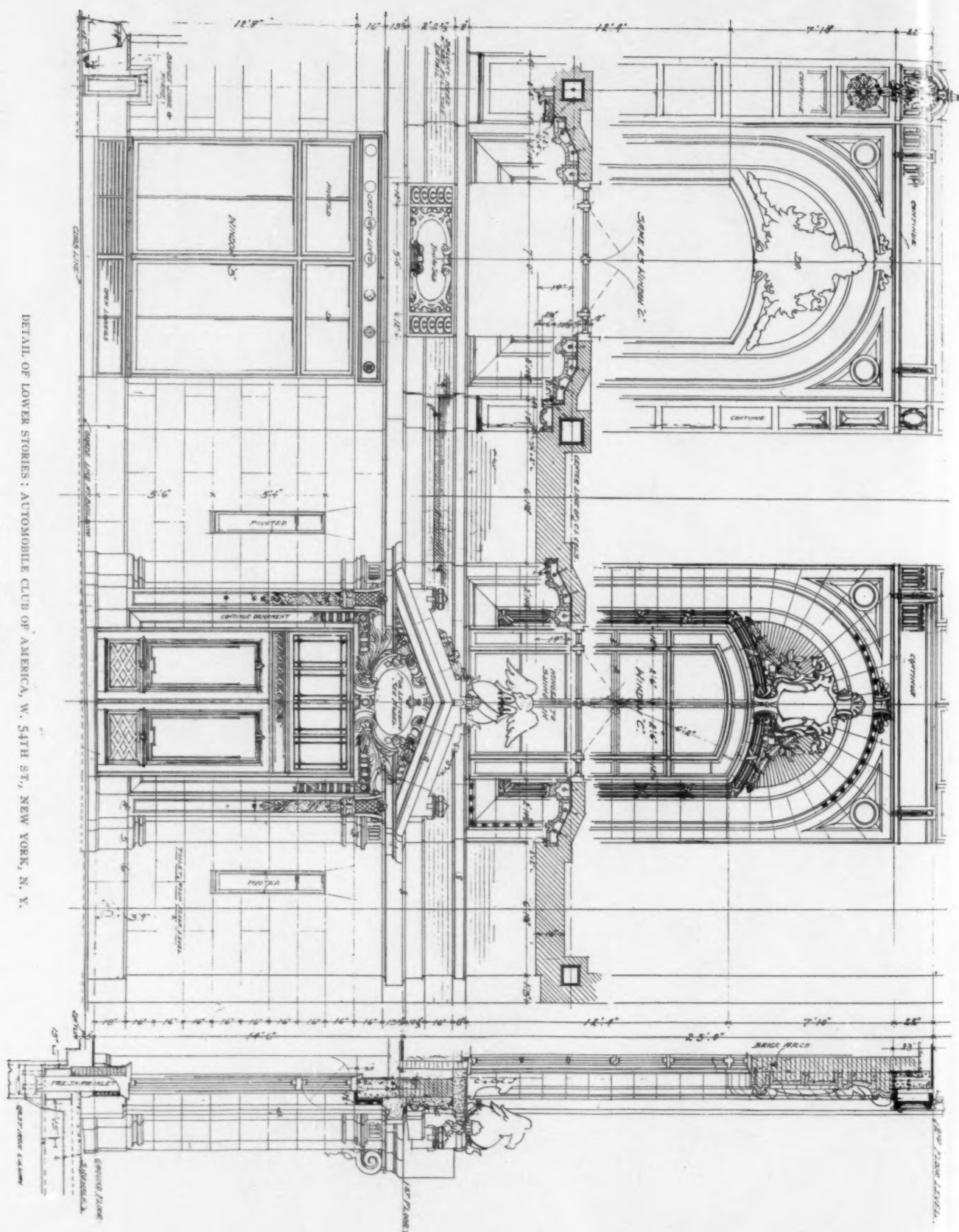
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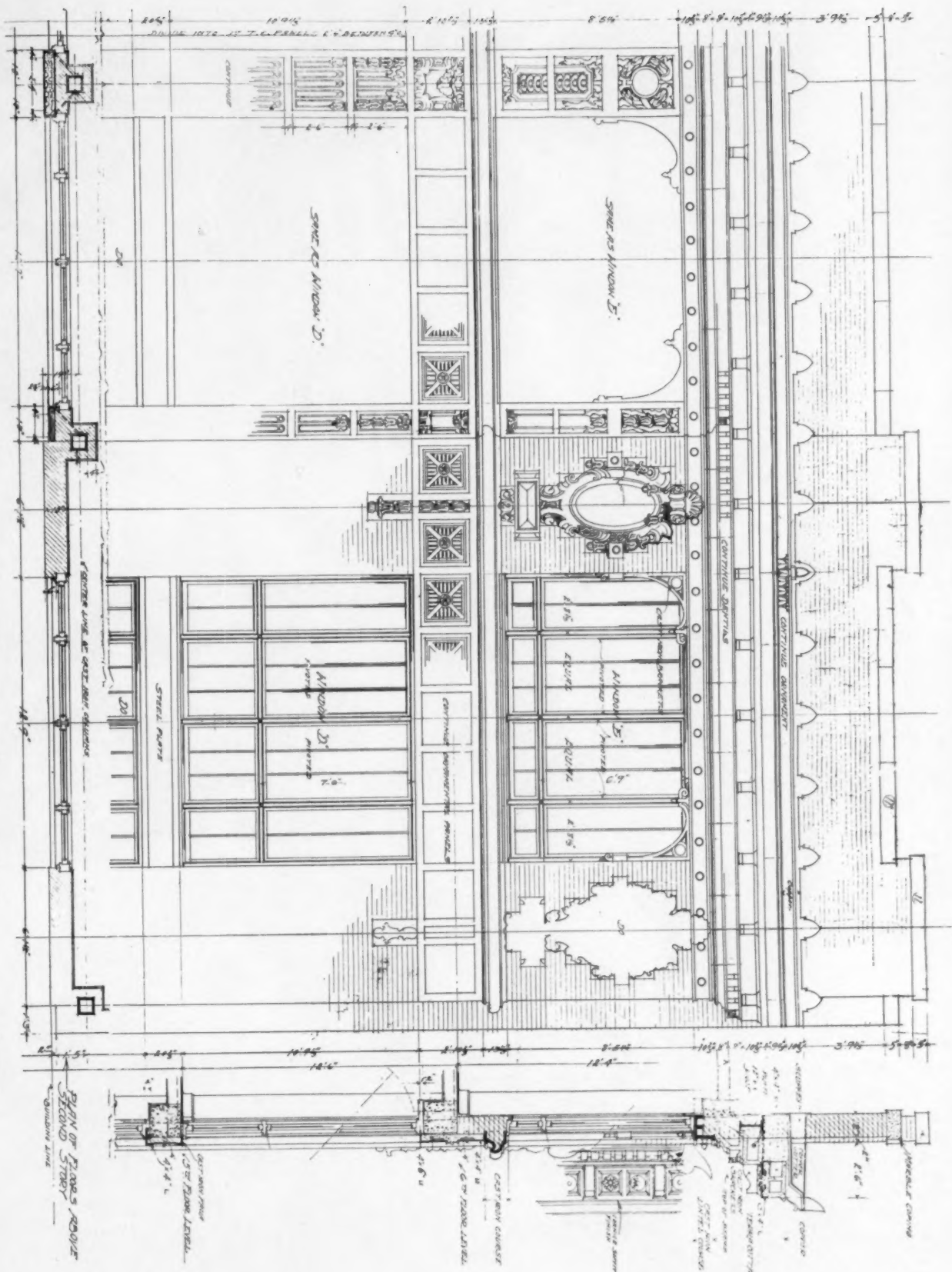
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Ernest FLAGG, Architect.

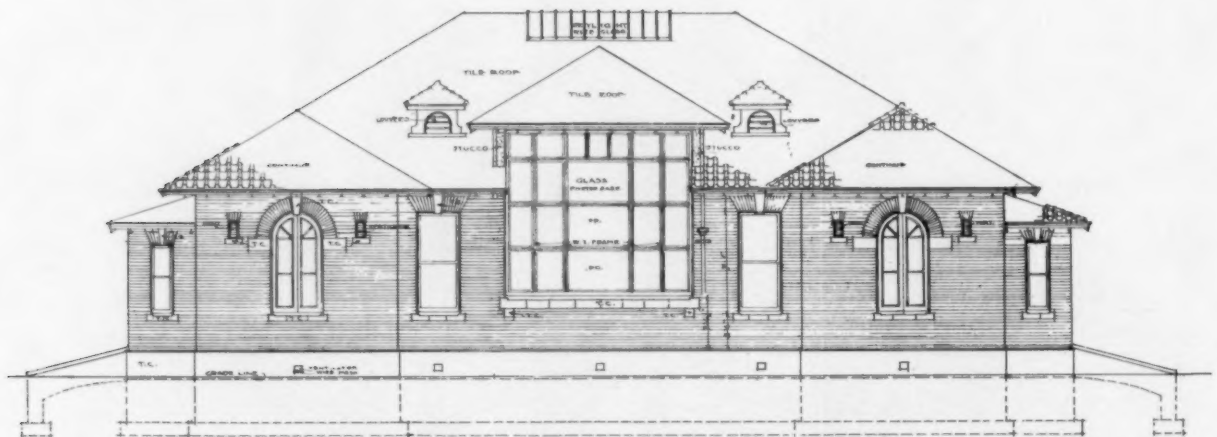
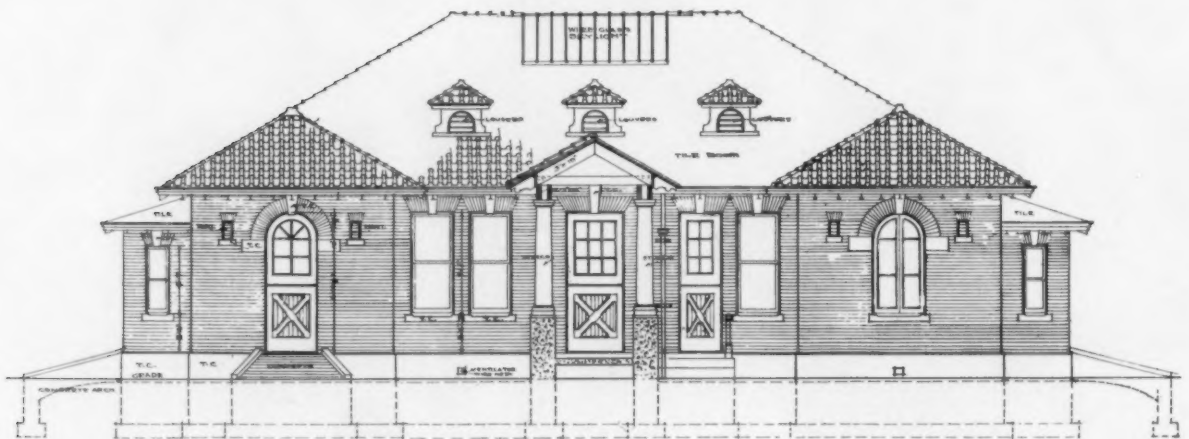
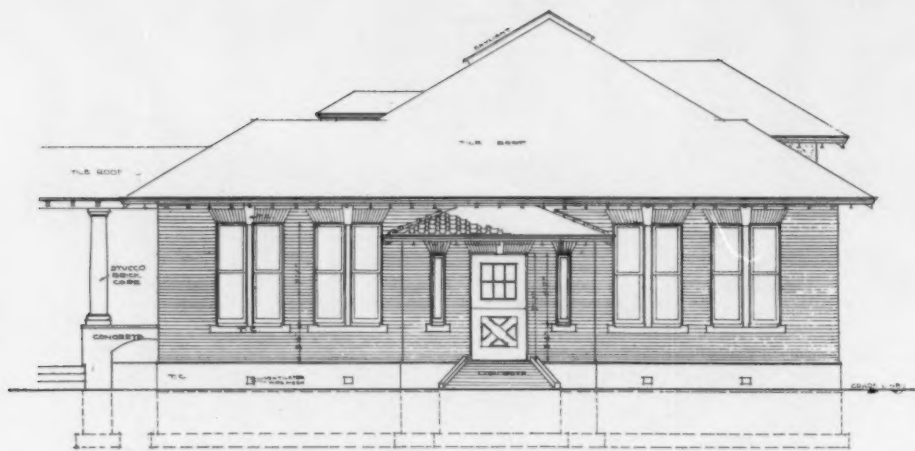
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DETAIL OF UPPER STORIES: AUTOMOBILE CLUB OF AMERICA, W. 54TH ST., NEW YORK, N. Y.

Ernest Flagg, Architect.



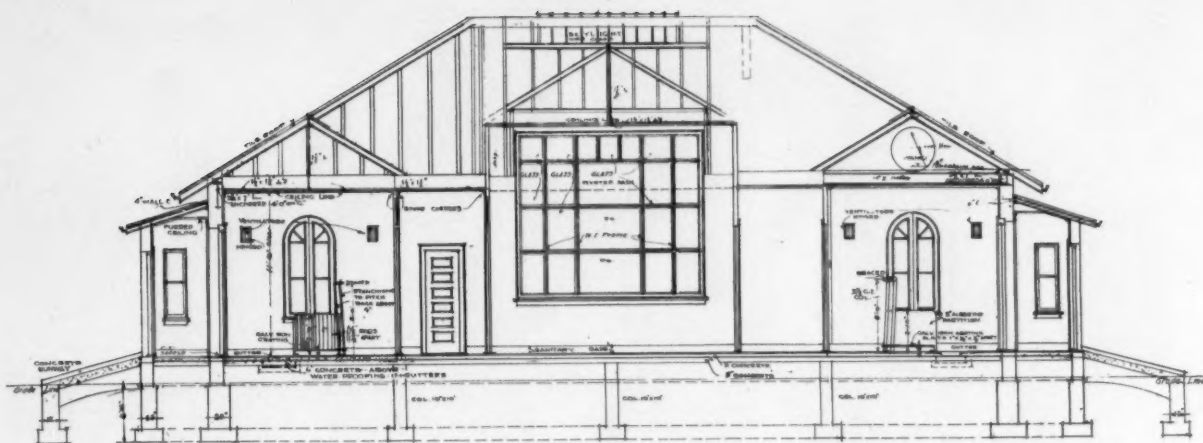
VACCINE STABLE FOR THE NEW YORK CITY BOARD OF HEALTH, WESTCHESTER, N. Y.

Snelling & Potter, Architects.

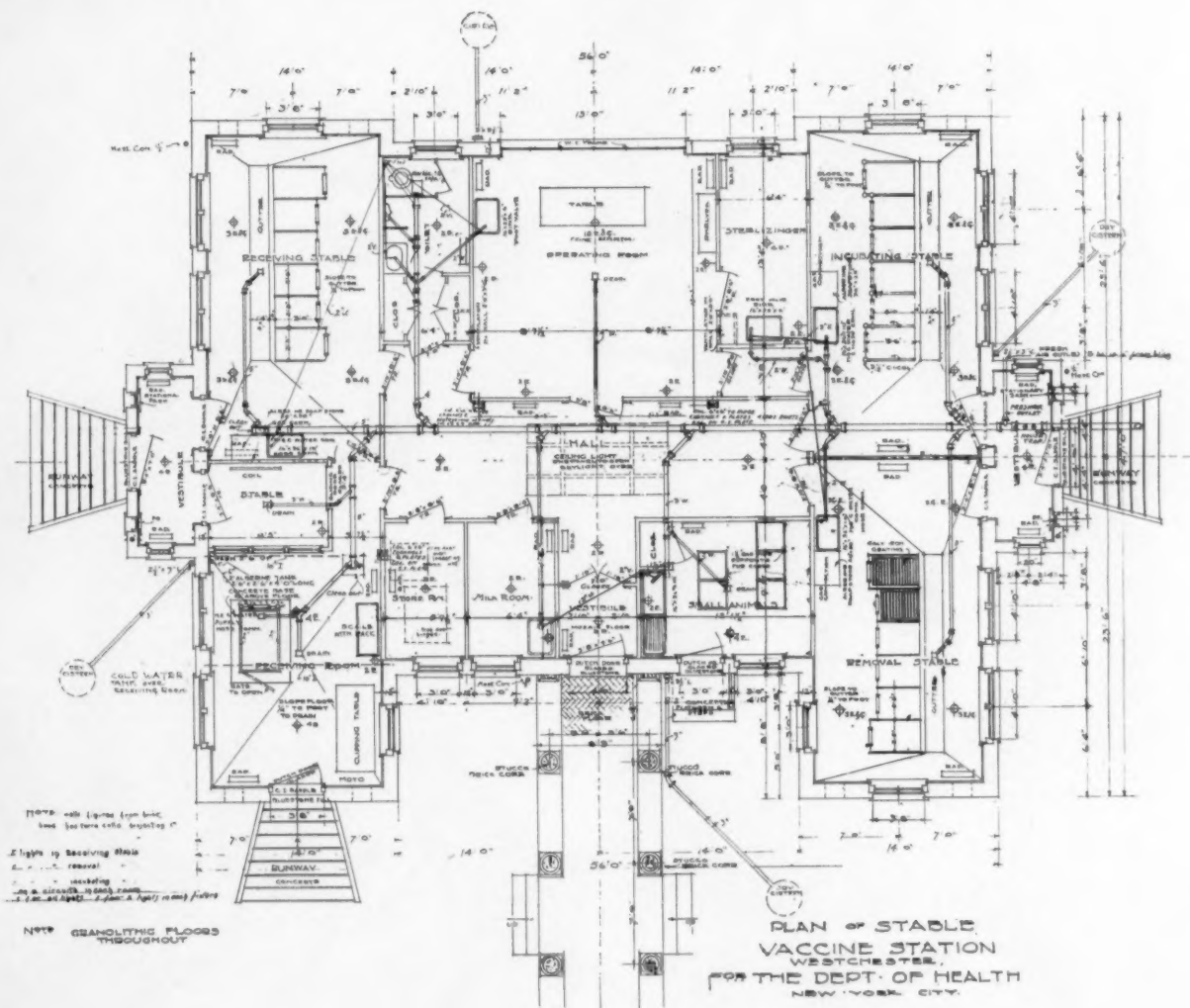
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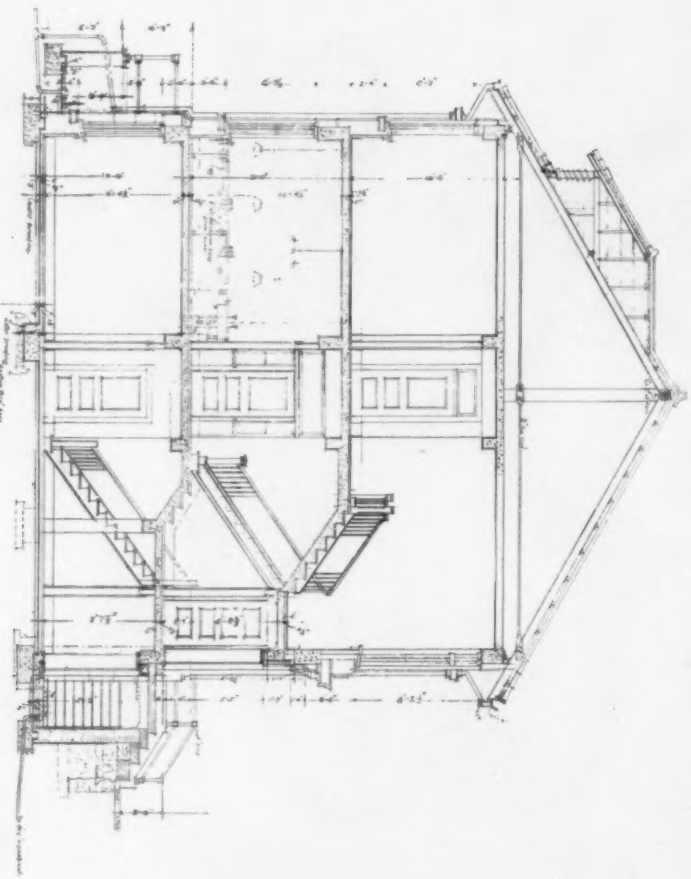
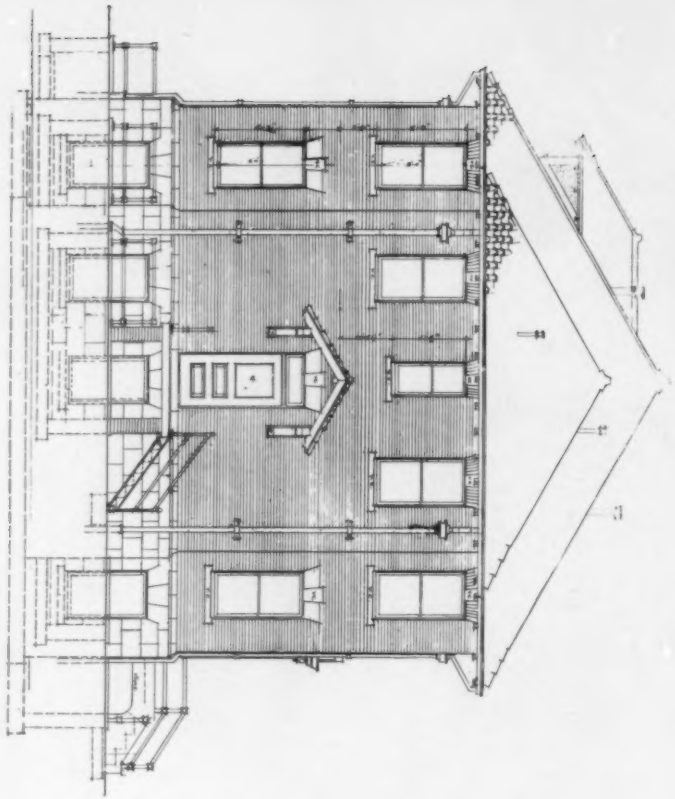
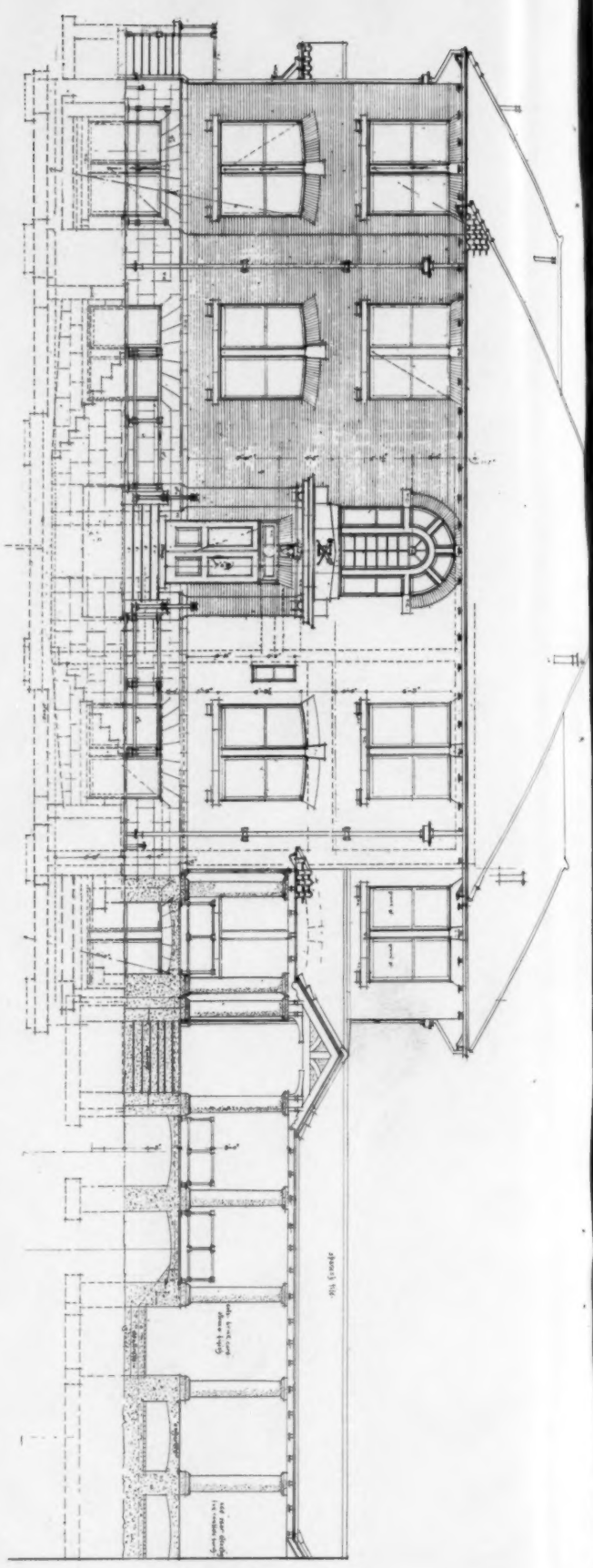


NOTE GRANOLITHIC FLOORS
KEENE'S CEMENT PLASTER THROUGHOUT
& SANITARY BASE IN ALL ROOMS



PLAN AND SECTION: VACCINE STABLE FOR THE NEW YORK CITY BOARD OF HEALTH, WESTCHESTER, N. Y.

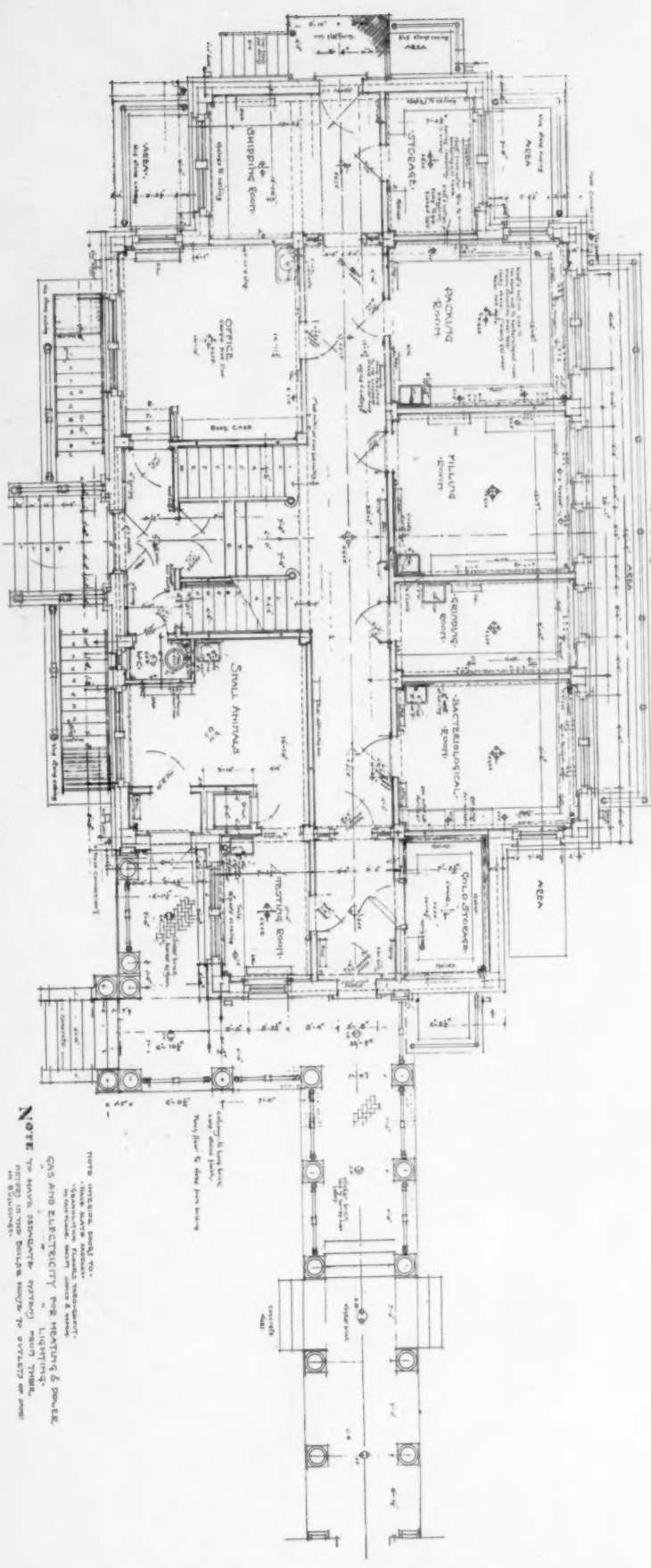
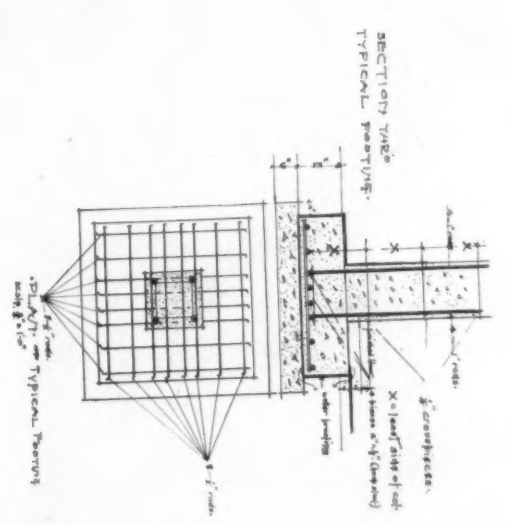
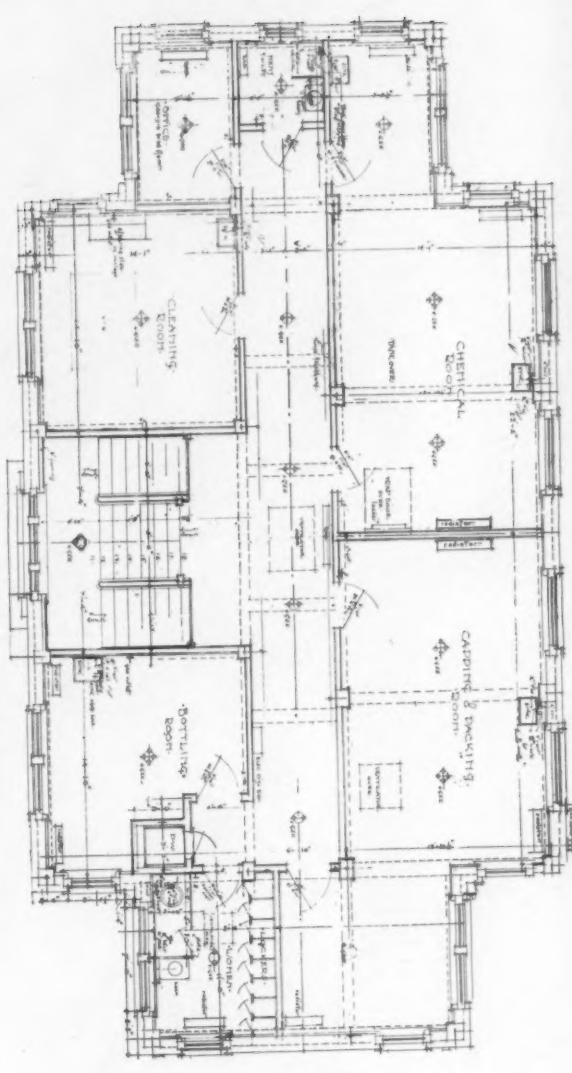
Snelling & Potter, Architects.



VACCINE LABORATORY FOR THE NEW YORK CITY BOARD OF HEALTH, WESTCHESTER, N. Y.

Shelling & Potter, Architects.

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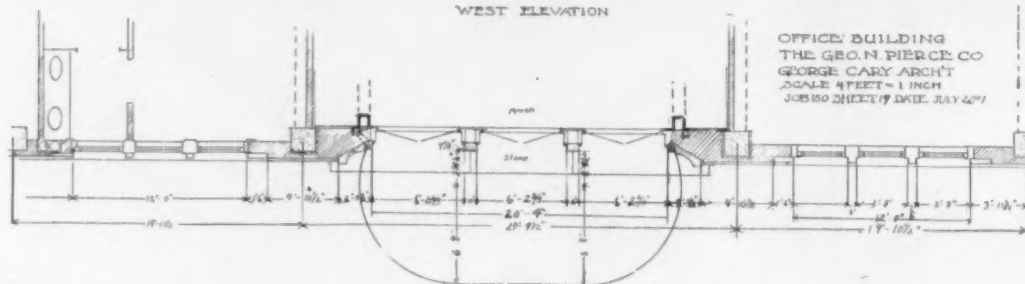
NOTE: THE FOLLOWING ROOMS ARE:
 1. HAVE SEVERAL ROOMS, SUBSTANTIAL
 2. IN THE BUILDING, SEVERAL ROOMS & STABLE
 3. GAS AND ELECTRICITY FOR HEATING & POWER
 4. THE MAIN LABORATORY ROOMS, SEVERAL THERE
 5. ENTERED IN THE BUILDING THROUGH THE OUTSIDE OF THE
 6. IN BUILDING.

PLANS OF THE VACCINE LABORATORY FOR THE NEW YORK CITY BOARD OF HEALTH, WESTCHESTER, N. Y.

Snelling & Potter, Architects.



WEST ELEVATION



WEST FRONT AND SECTION: ADMINISTRATION BUILDING OF THE GEORGE N. PIERCE CO., BUFFALO, N. Y.

George Cary, Architect.



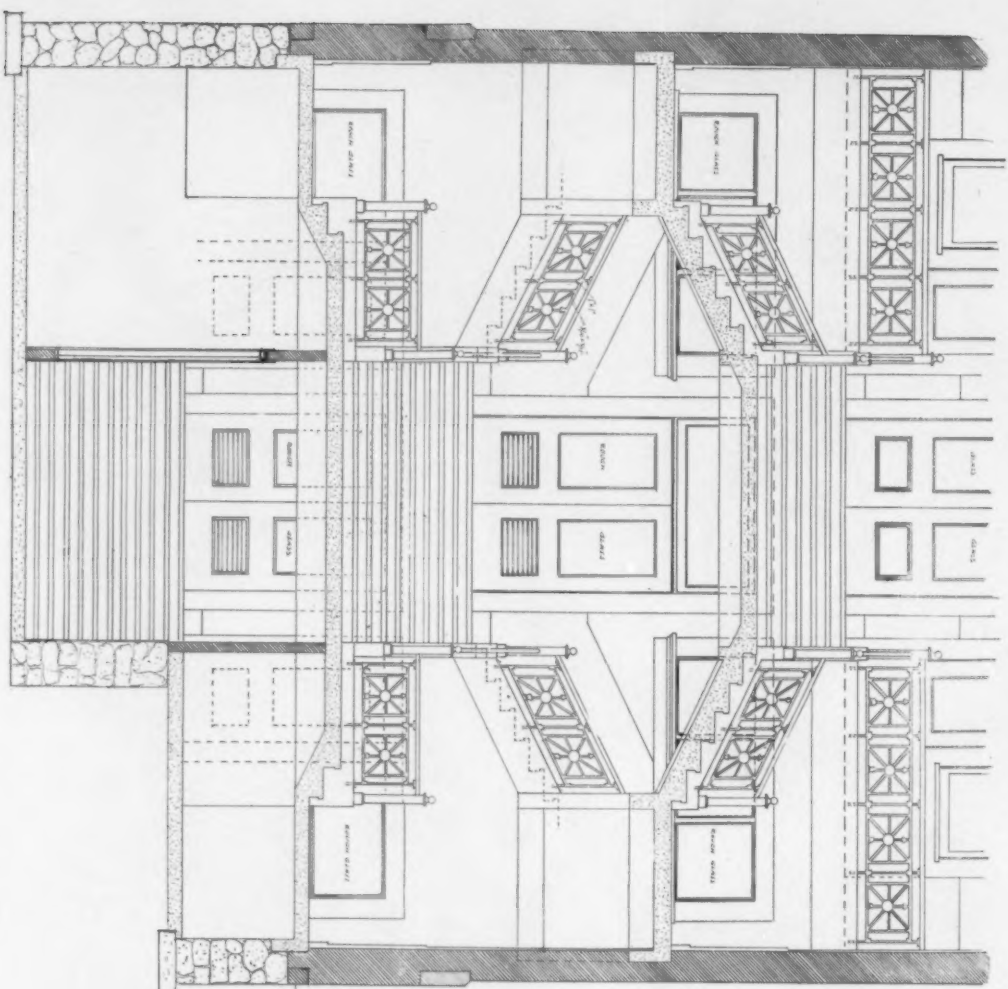
NORTH FRONT AND SECTION: ADMINISTRATION BUILDING OF THE GEORGE N. PIERCE CO., BUEFALO, N. Y.

George Cary, Architect.

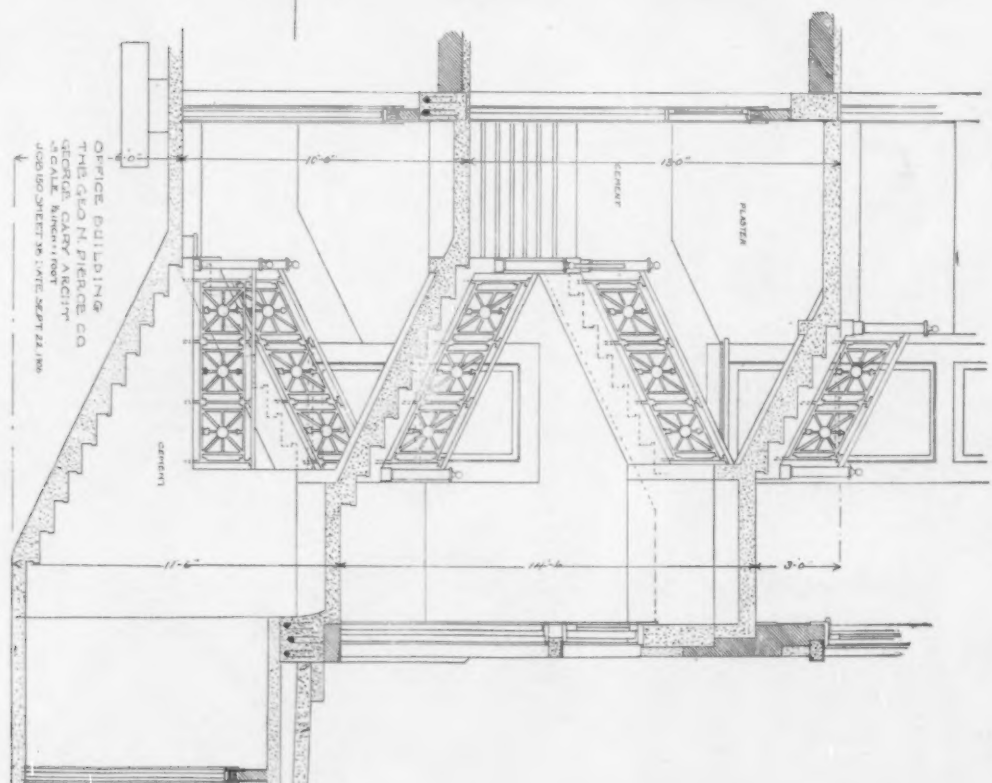
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SECTION, EAST ENTRY LOOKING WEST



SECTION, EAST ENTRY LOOKING NORTH

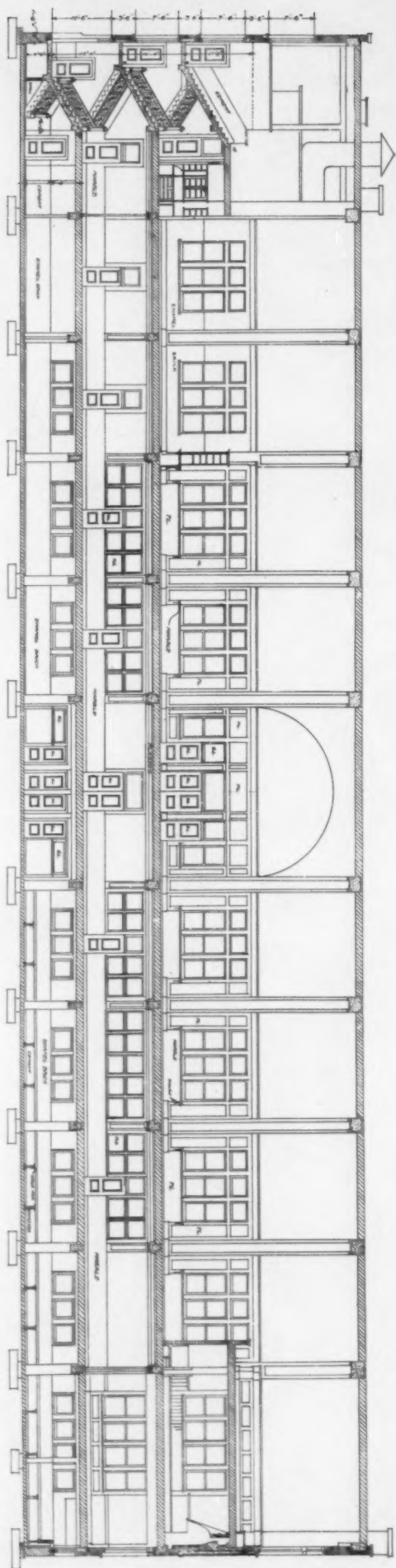
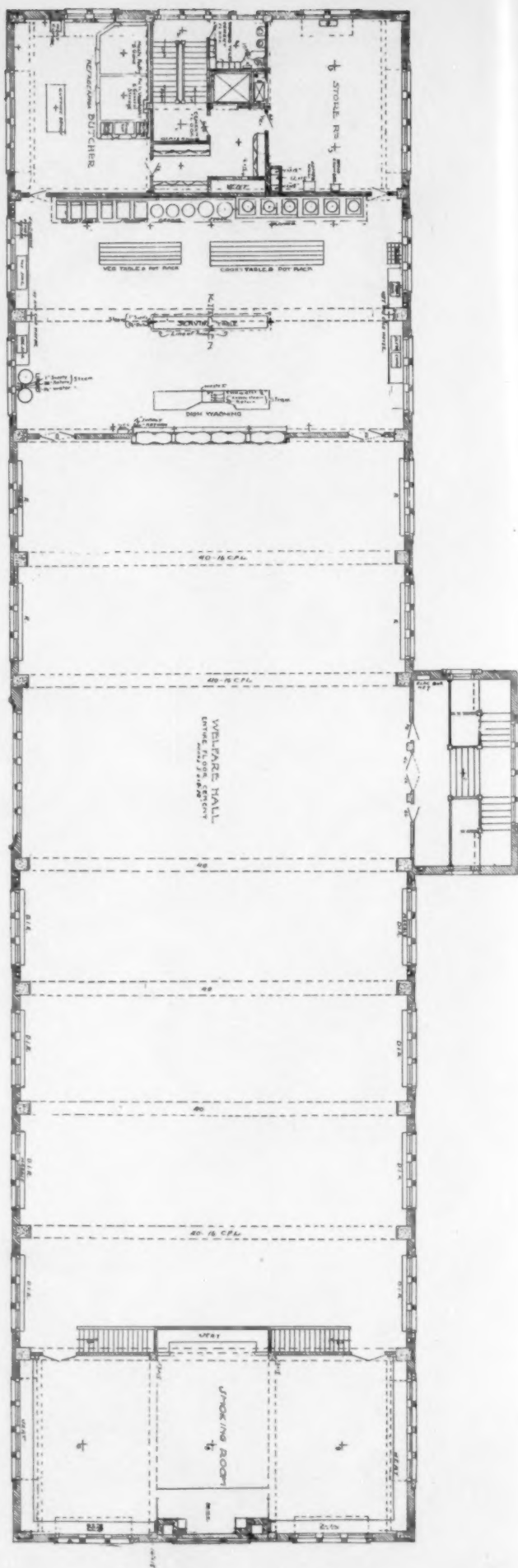
SECTIONS: ADMINISTRATION BUILDING OF THE GEORGE N. PIERCE CO., BUFFALO, N. Y.

George Cary, Architect.

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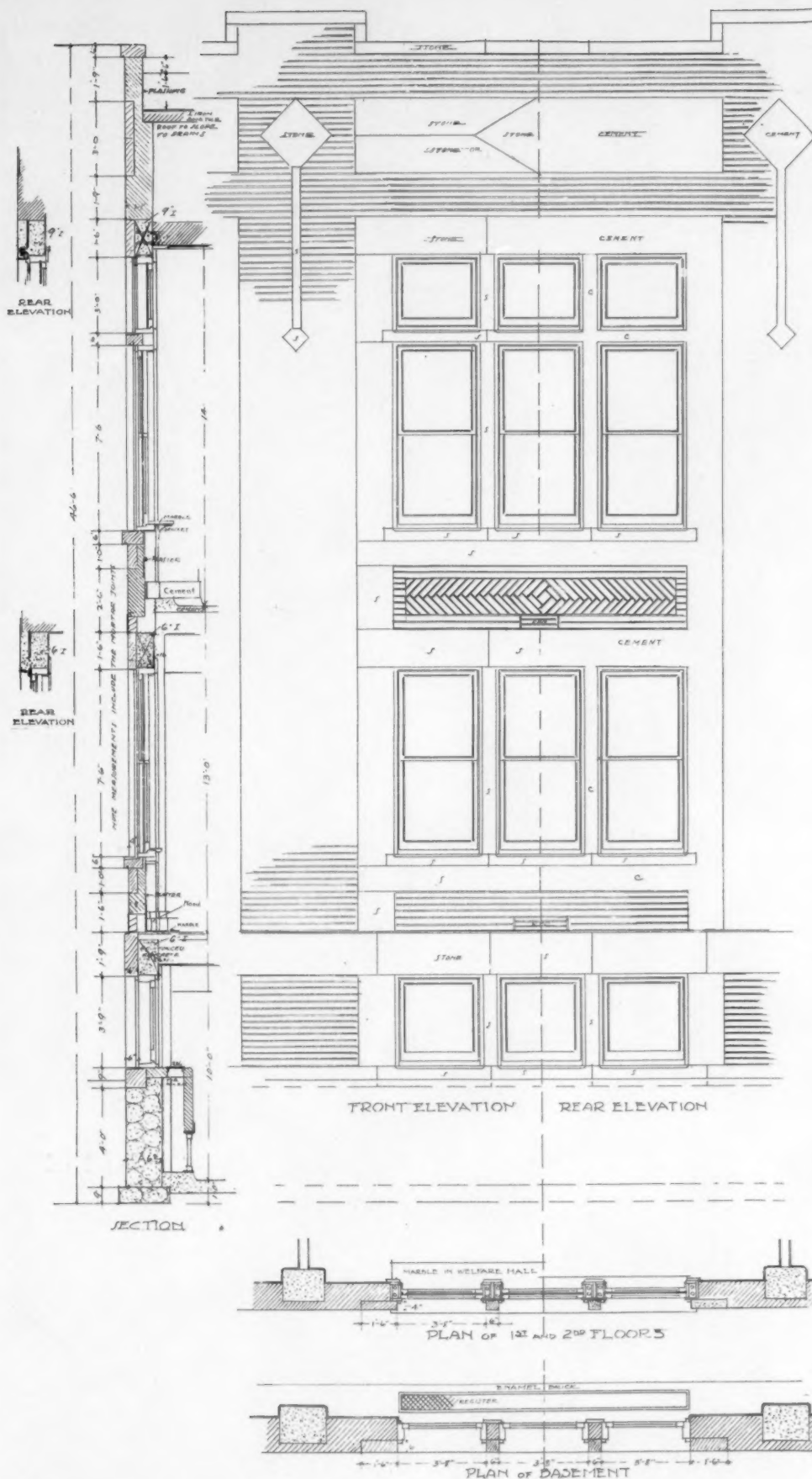
PLAN AND SECTION: ADMINISTRATION BUILDING OF THE GEO. N. PIERCE CO., BUFFALO, N. Y.

George Cary, Architect.

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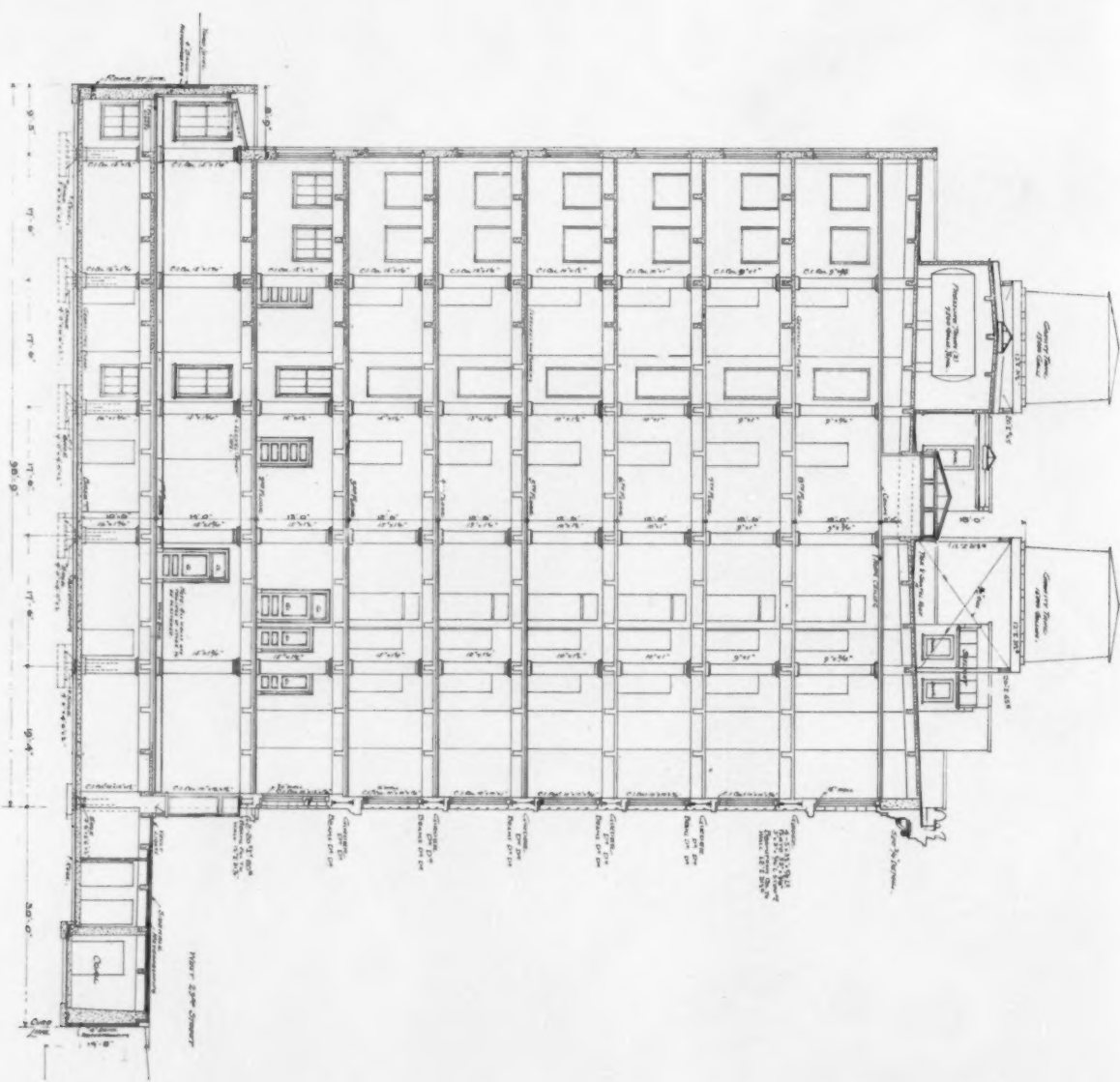
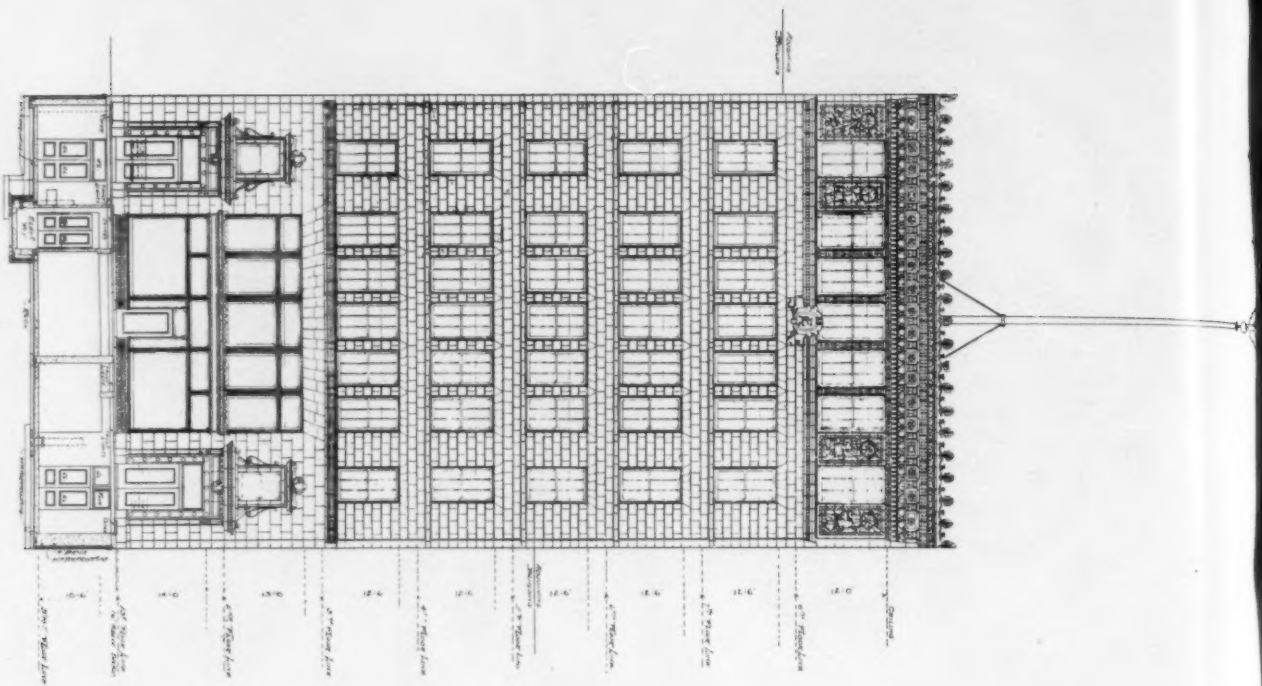
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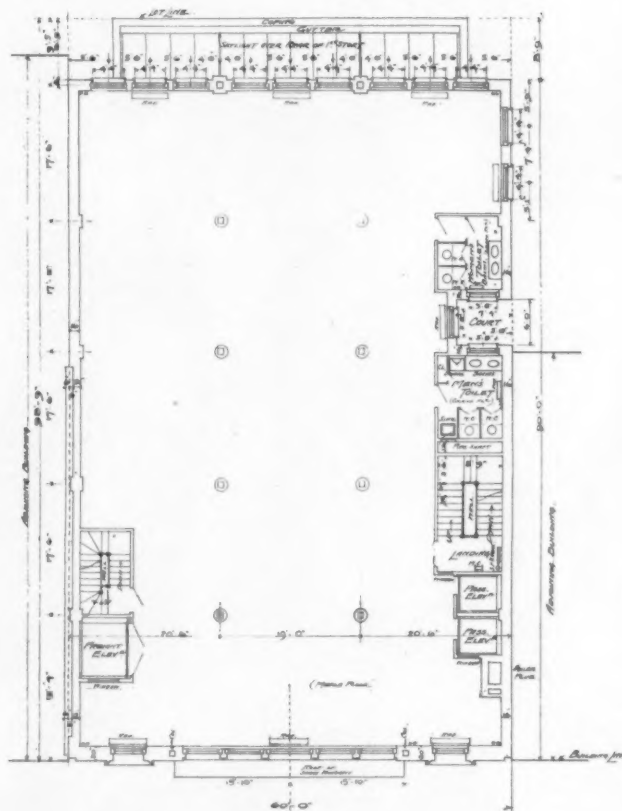
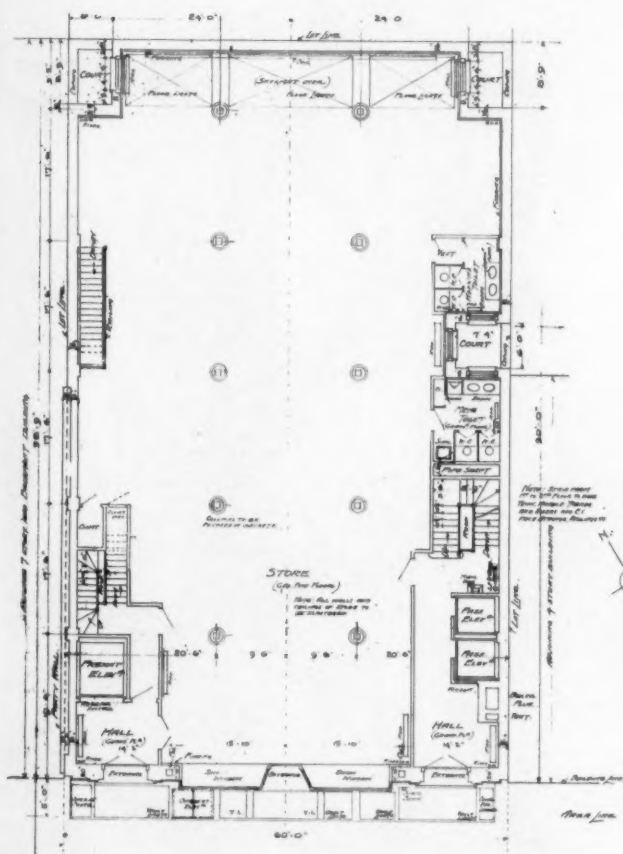
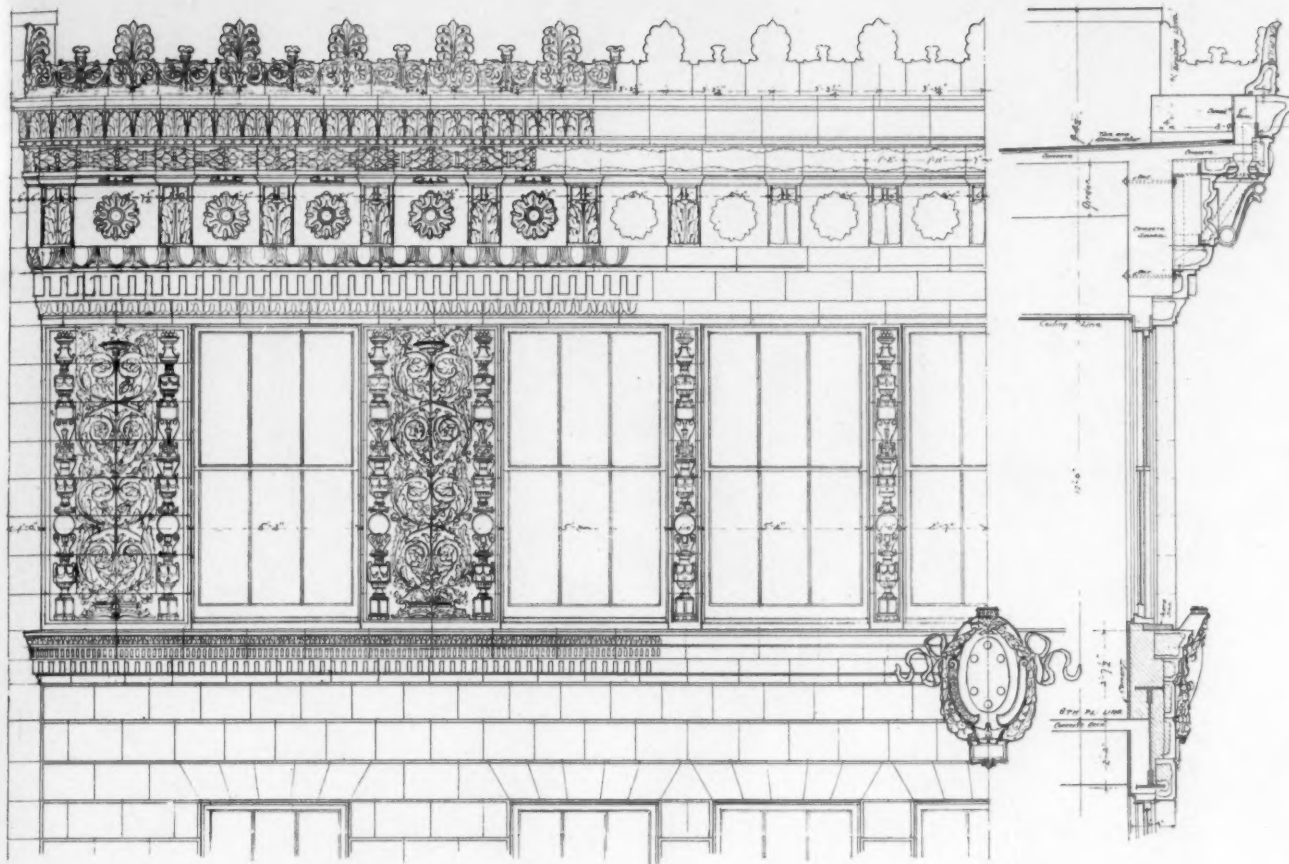
DETAIL OF WALL: ADMINISTRATION BUILDING OF THE GEO. N. PIERCE CO., BUFFALO, N. Y.

George Cary, Architect.



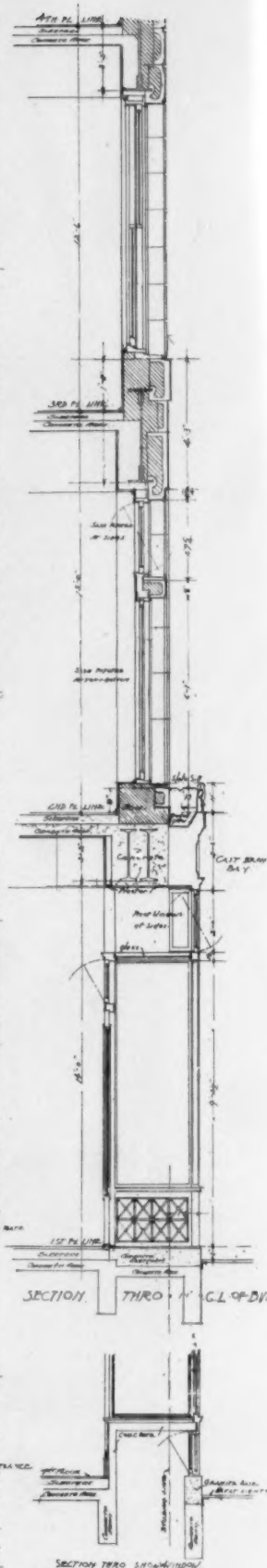
EASTMAN KODAK CO.'S BUILDING, WEST 23D STREET, NEW YORK, N. Y.

McKim, Mead & White, Architects.

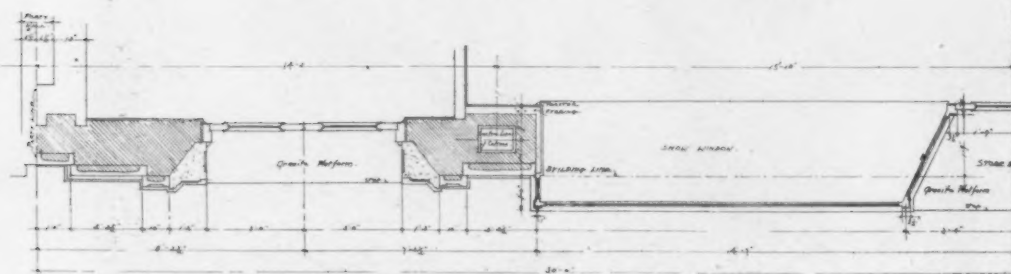


PLANS AND CORNICE: EASTMAN KODAK CO.'S BUILDING, WEST 23D STREET, NEW YORK, N. Y.

McKim, Mead & White, Architects.



SECTION.	THRO. N. G.L. OF BUILDING
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HALF PLAN OF BUILDING AT FIRST FLOOR

McKim, Mead & White, Architects.

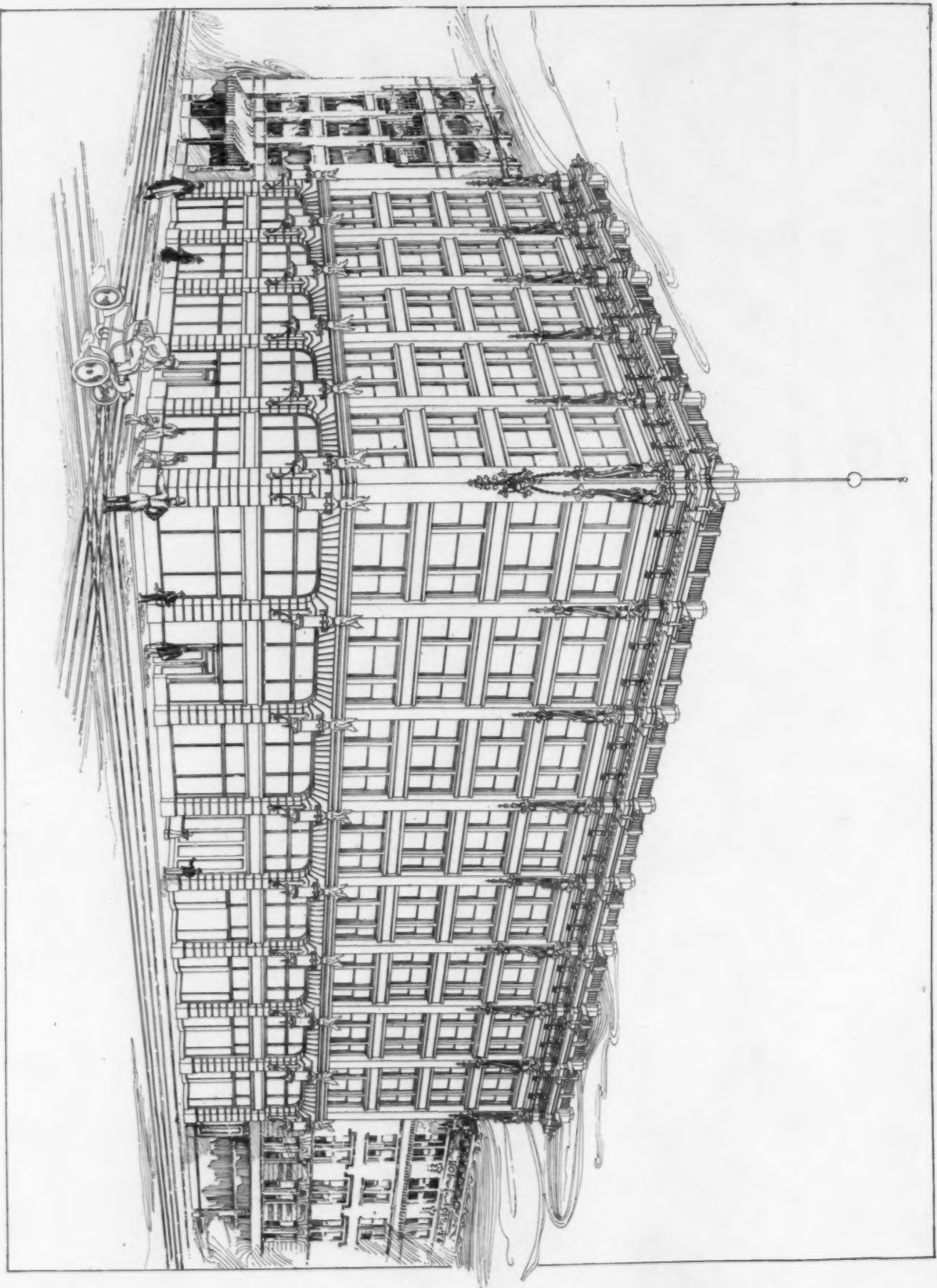
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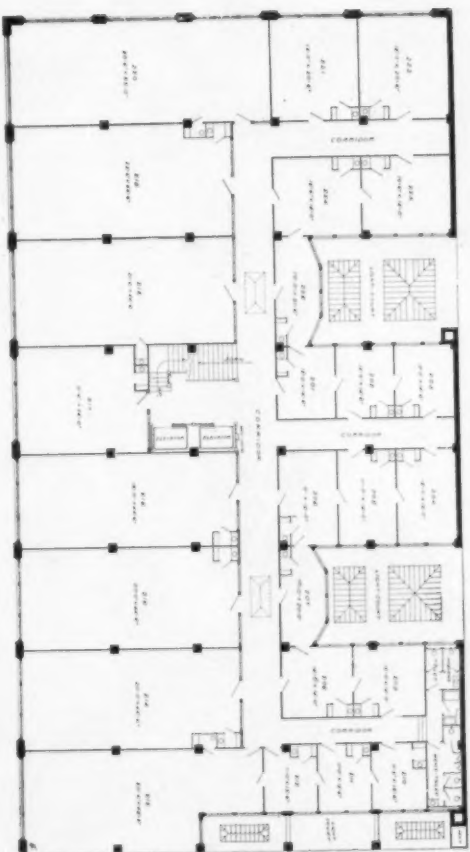
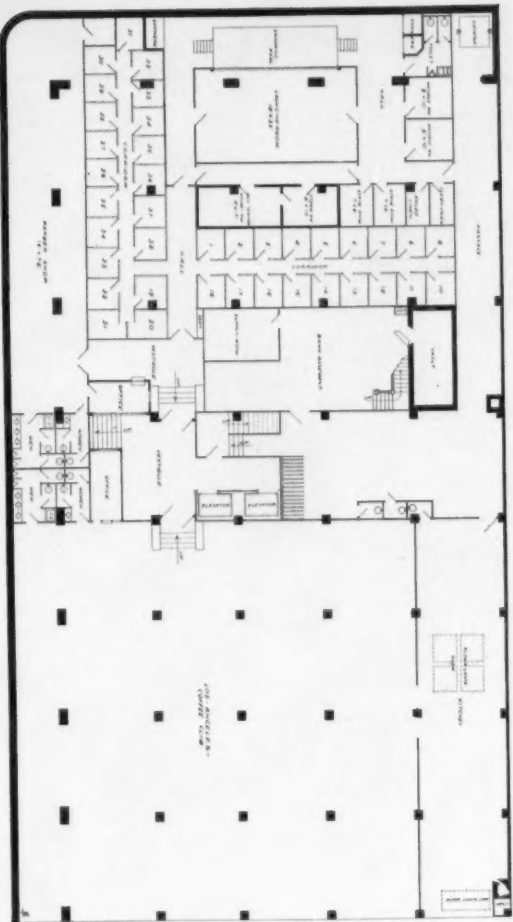
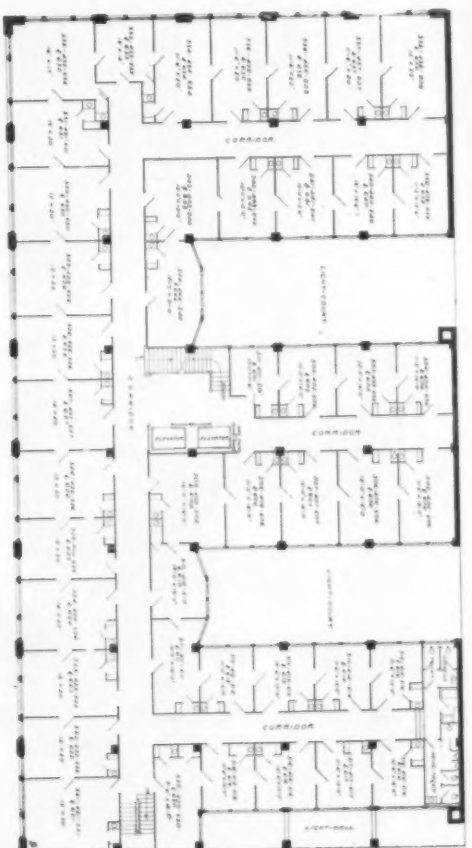
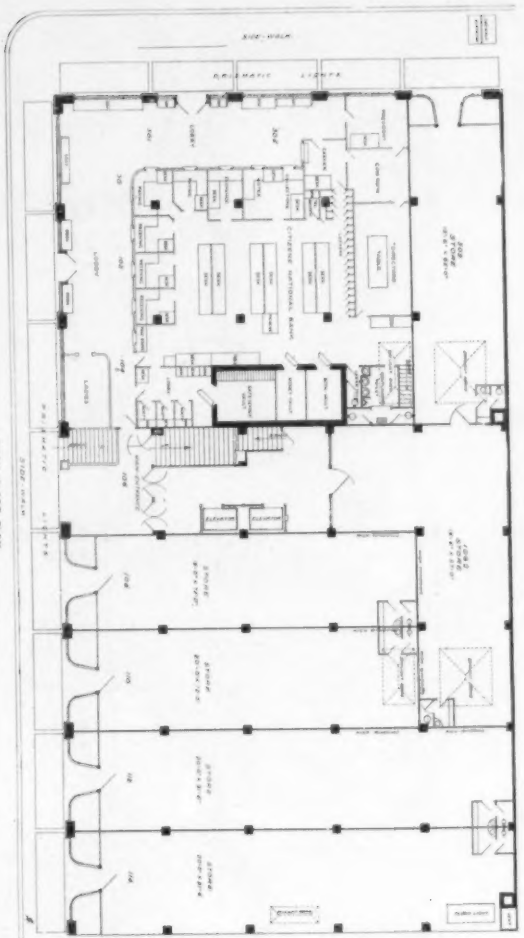
"FOLLY POINT": HOUSE OF ALFRED MITCHELL, ESQ., POINT ANTONIO, JAMAICA, W. I.

Chapman & Frazer, Architects.



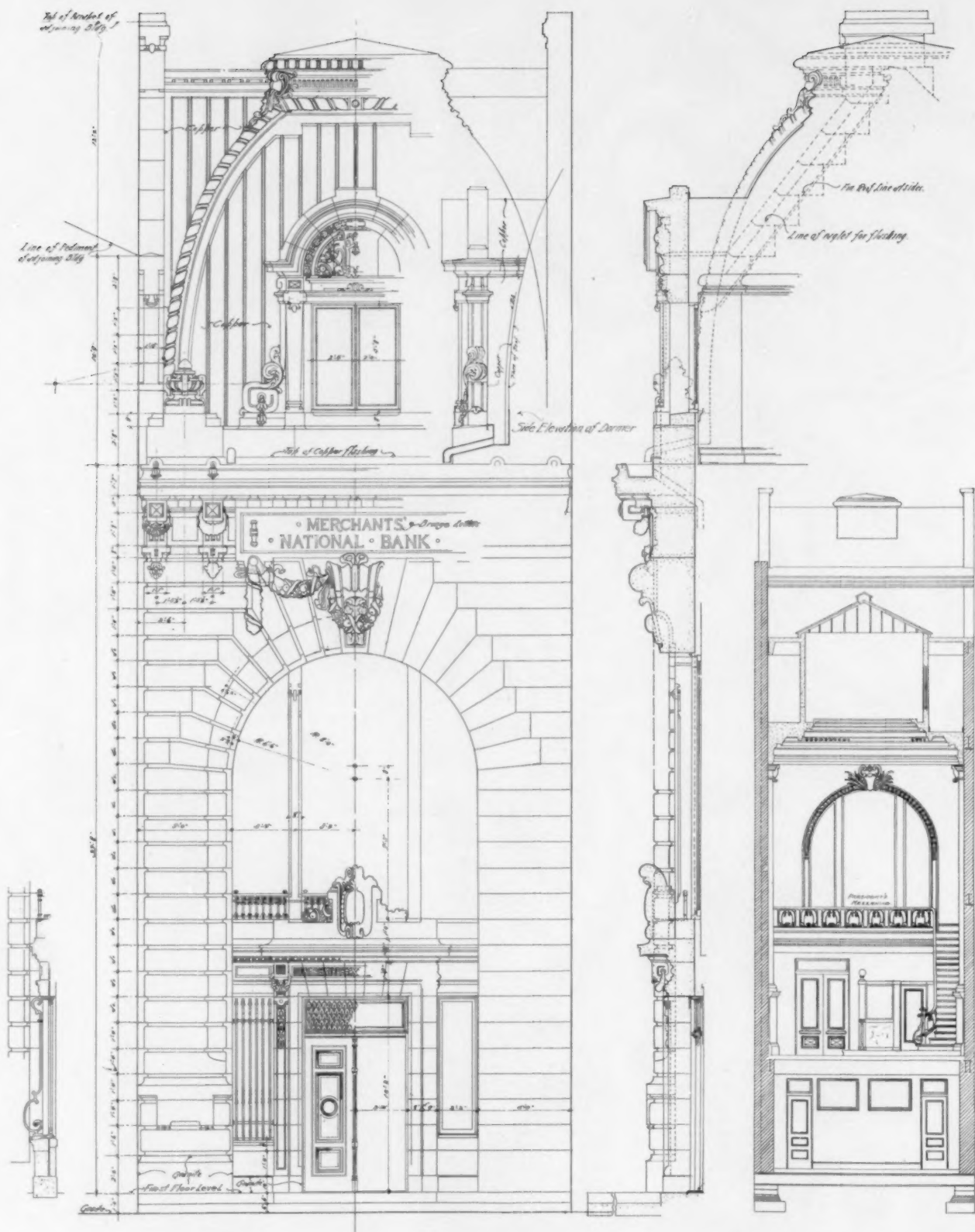
CITIZENS' NATIONAL BANK BUILDING, LOS ANGELES, CAL.

Harrison Albright, Architect.



PLANS: CITIZENS' NATIONAL BANK BUILDING, LOS ANGELES, CAL.

Harrison Albright, Architect.



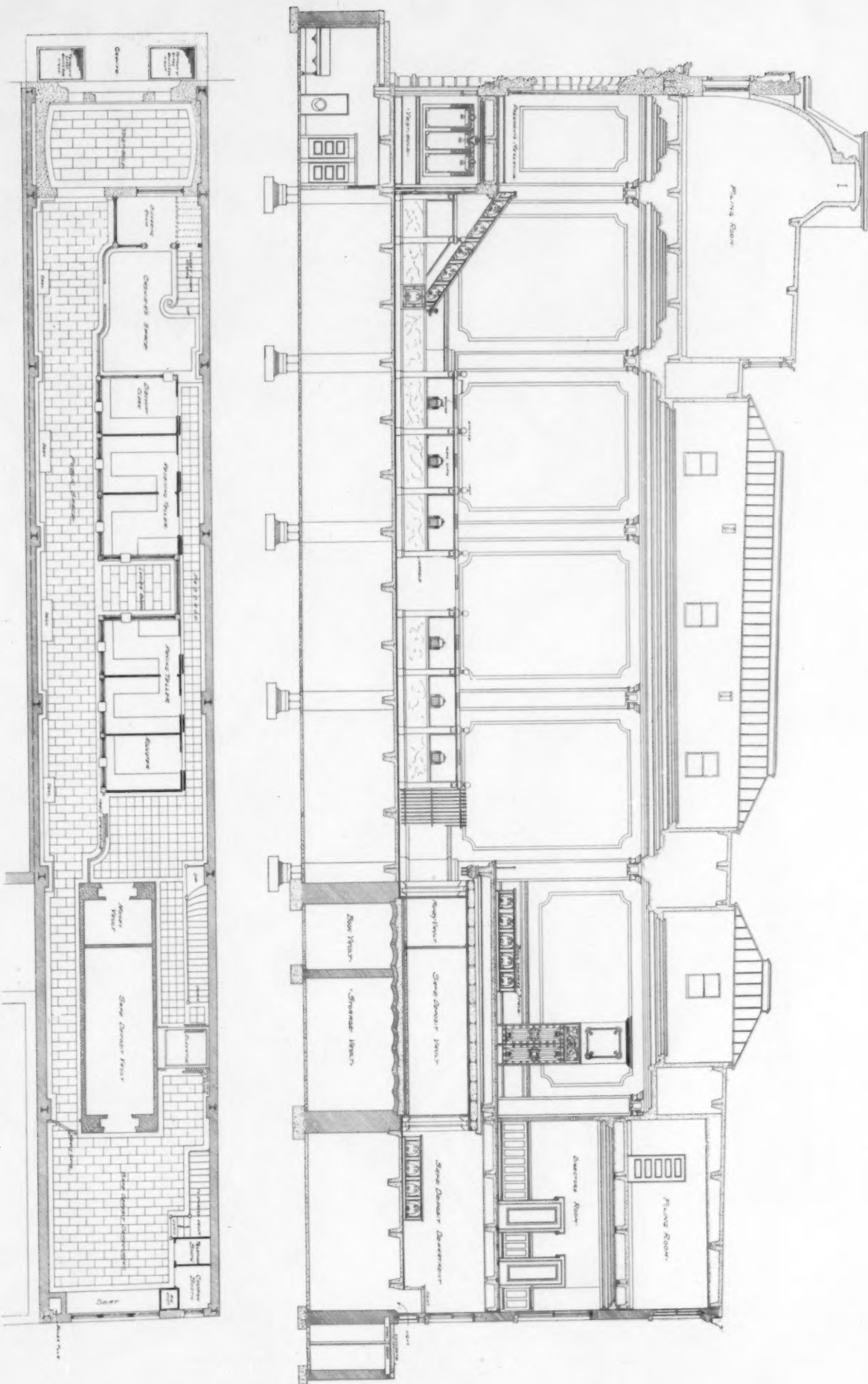
MERCHANTS' NATIONAL BANK, BROAD STREET, NEWARK, N. J.

Charles P. Baldwin, Architect.

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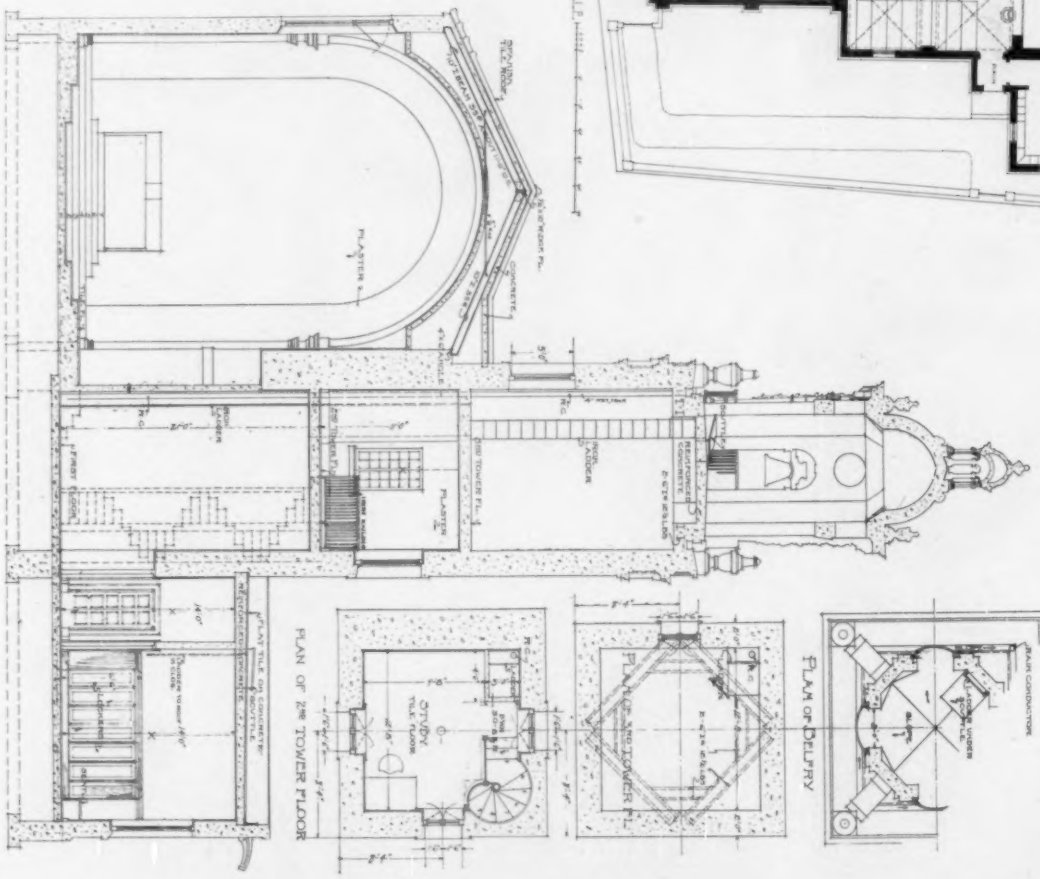
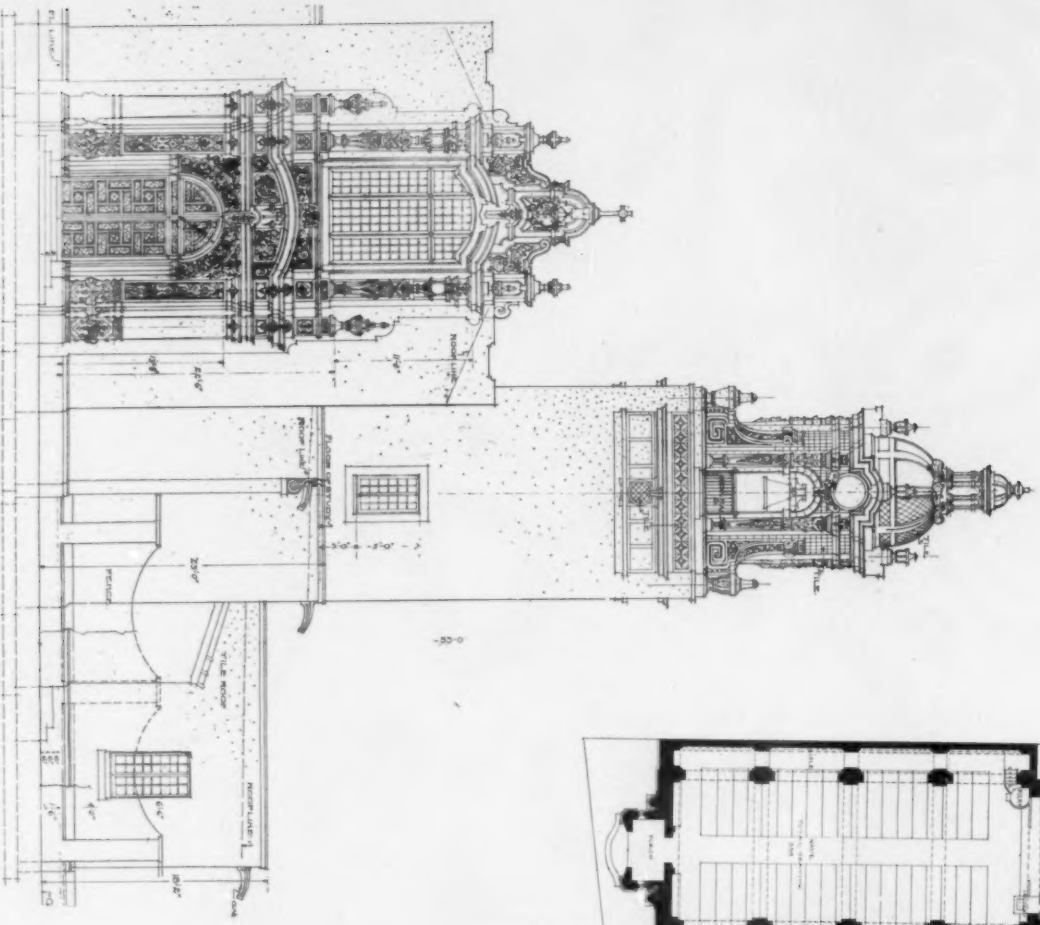
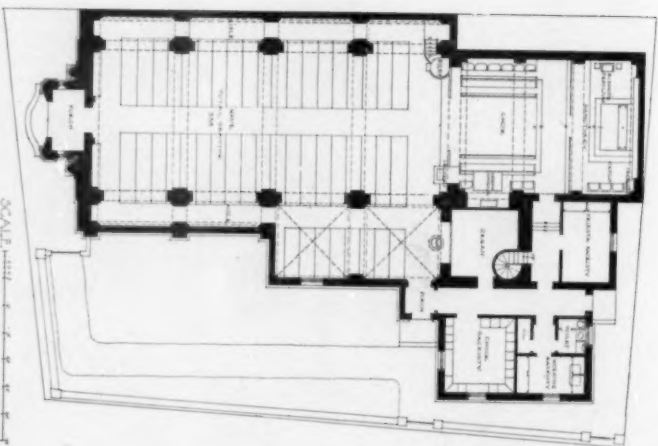
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PLAN AND SECTION: MERCHANTS' NATIONAL BANK, BROAD STREET, NEWARK, N. J

Charles P. Baldwin, Architect.

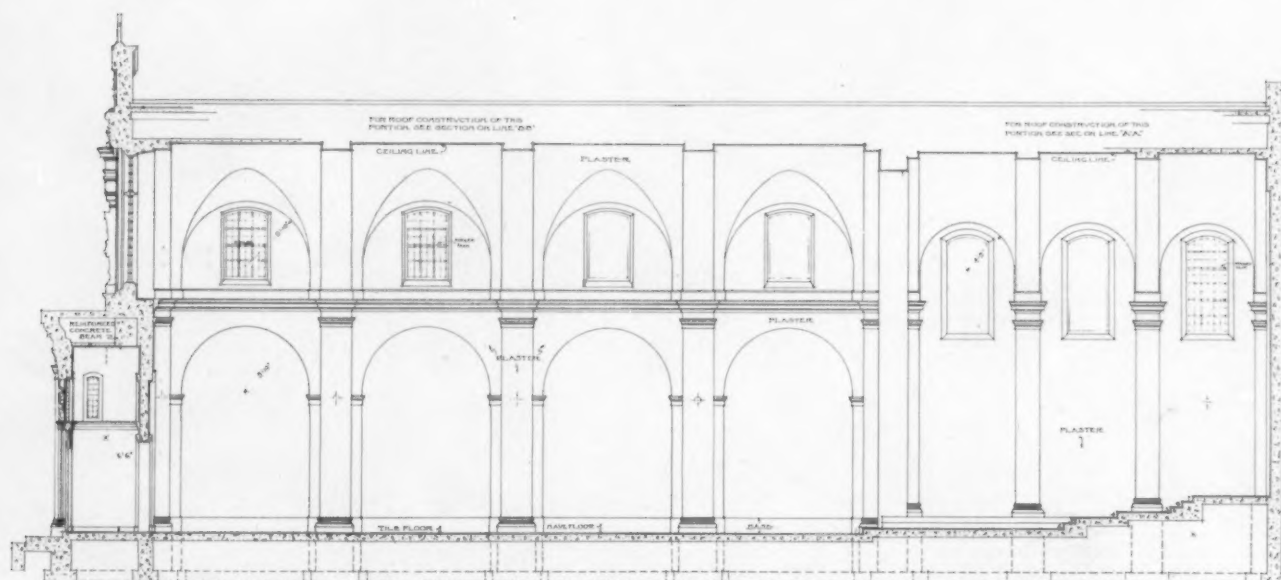


CHURCH OF THE HOLY TRINITY, HAVANA, CUBA.

Cram, Goodhue & Ferguson, Architects.

CHURCH OF THE HOLY TRINITY

HAVANA, CUBA
CRAM, GOODHUE & FERGUSON ARCHITECTS
NEW YORK & BOSTON



SIDE ELEVATION AND SECTION: CHURCH OF THE HOLY TRINITY, HAVANA, CUBA.

Cram, Goodhue & Ferguson, Architects.

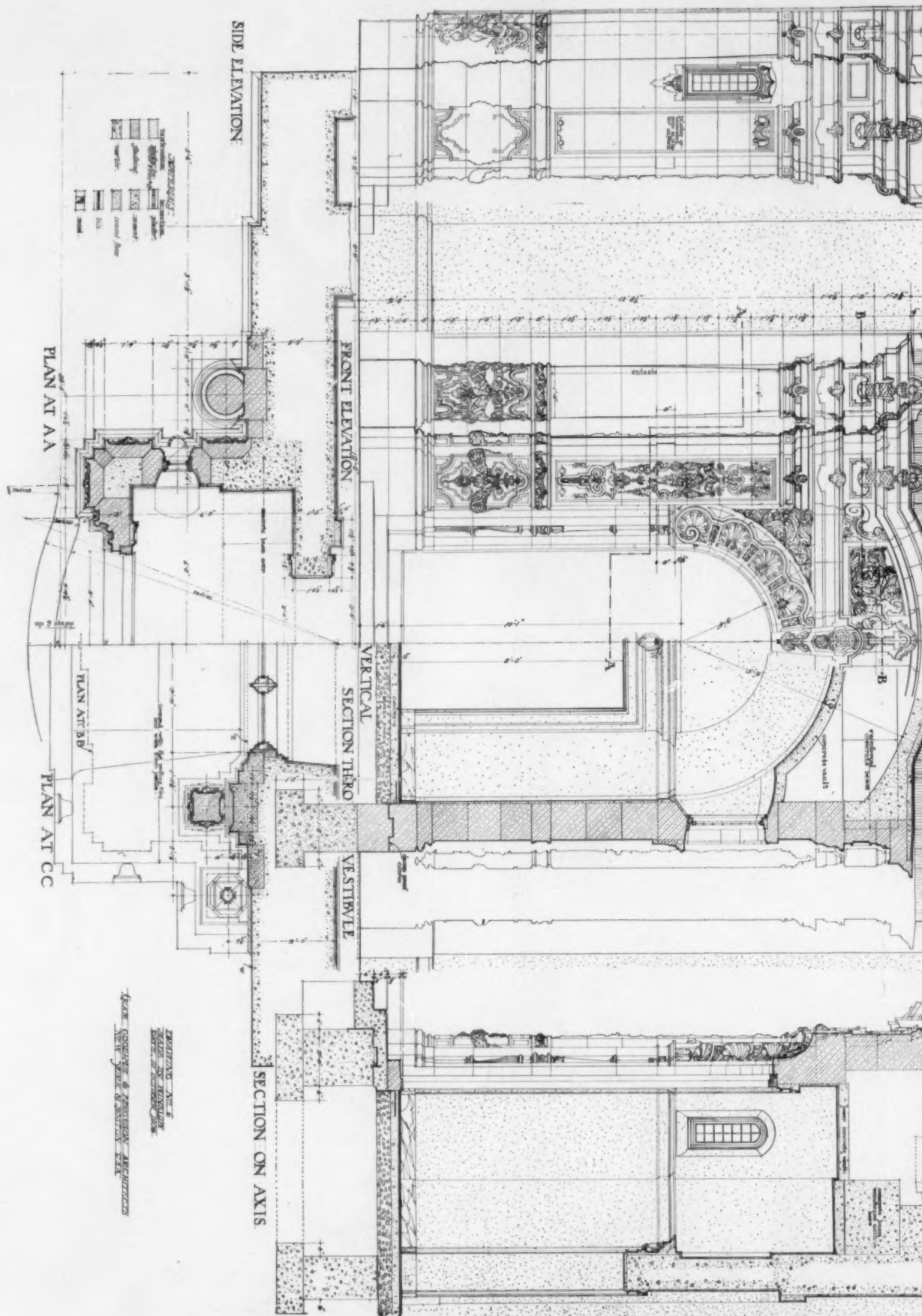
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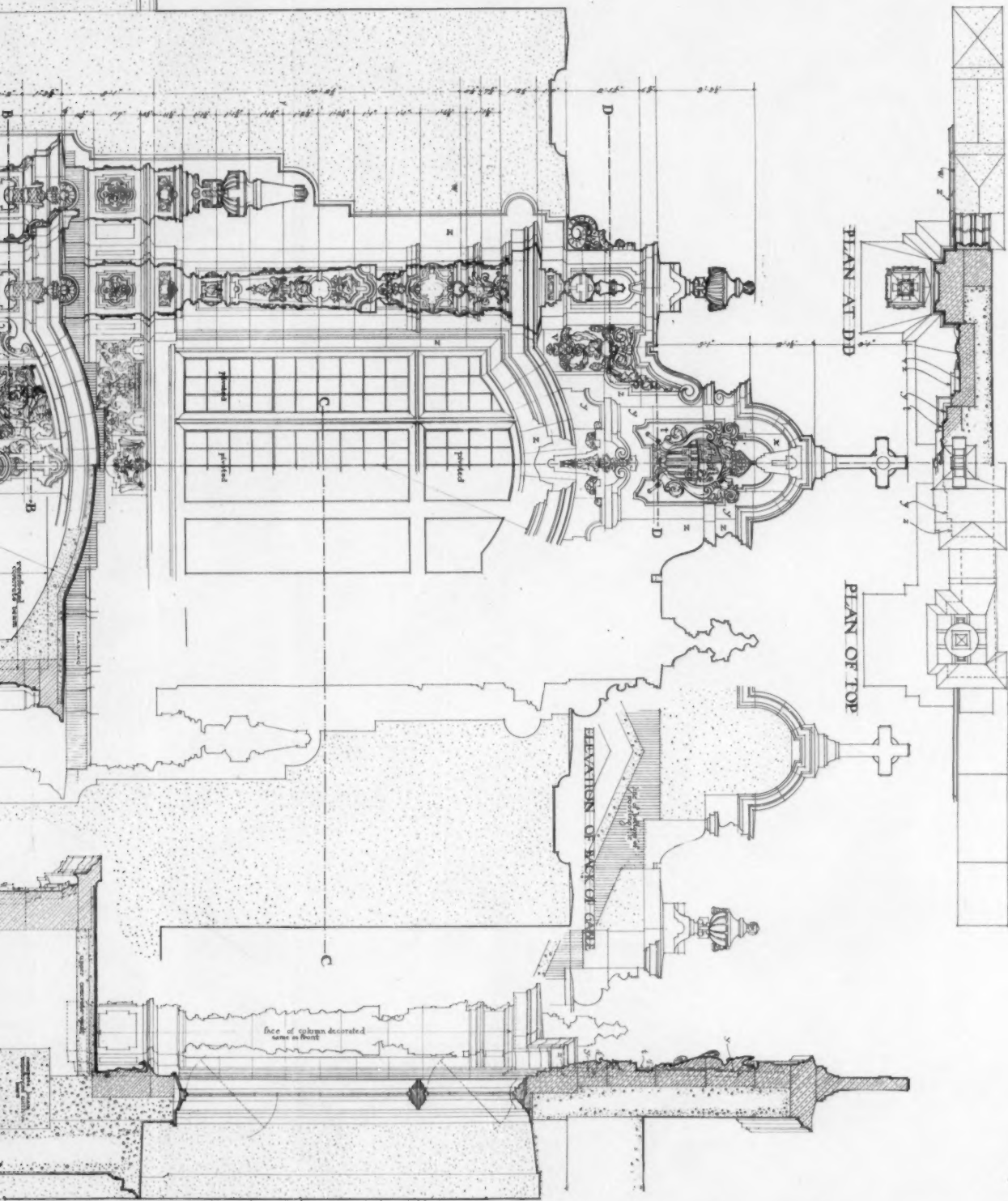
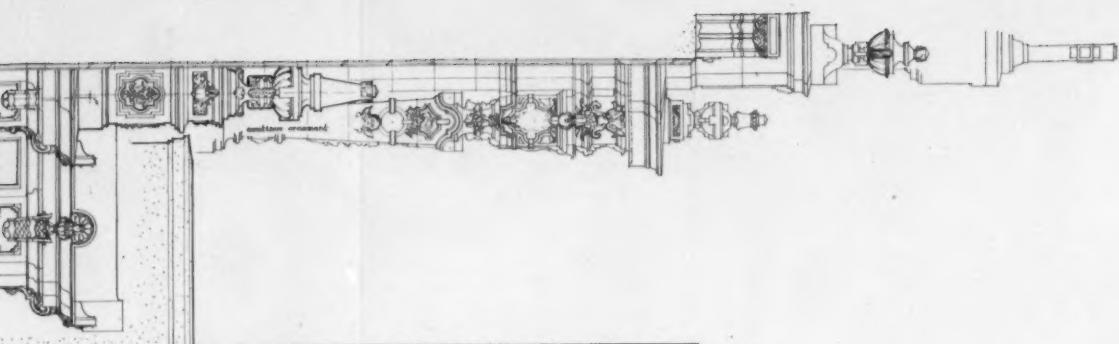
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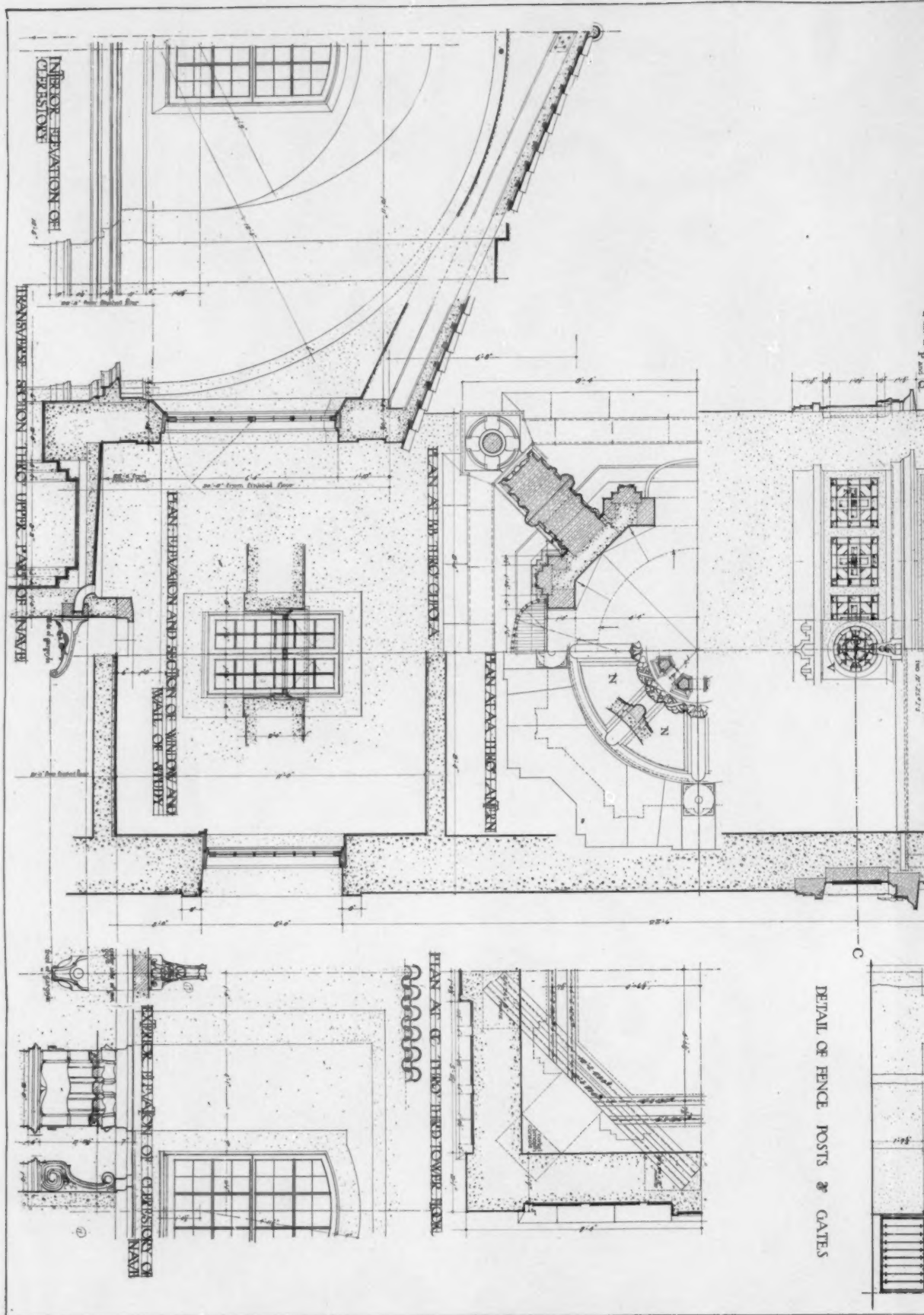
PLAN AT D D

PLAN OF TOP

ELEVATION OF BACK OF CHURCH

face of column decorated same as front

DETAIL OF FENCE POSTS & GATES



TOWER DETAIL: CHURCH OF THE HOLY TRINITY, HAVANA, CUBA.

Cram, Goodhue & Ferguson, Architects.

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THREE QUARTER INCH SCALE DETAIL OF TOWER NAVE & GATEPOSTS CHURCH OF THE HOLY TRINITY HAVANA CUBA

FROM COPIES OF DRAWING ARCHITECT
NEW YORK & BOSTON 1888.

DESIGNED BY J. H. WILSON
DATE OF OCTOBER 1888

- ARCHITECTURE
in elevation
in plan
in section
in detail
in perspective
in ground plan
in elevation
in plan
in section
in detail
in perspective
in ground plan

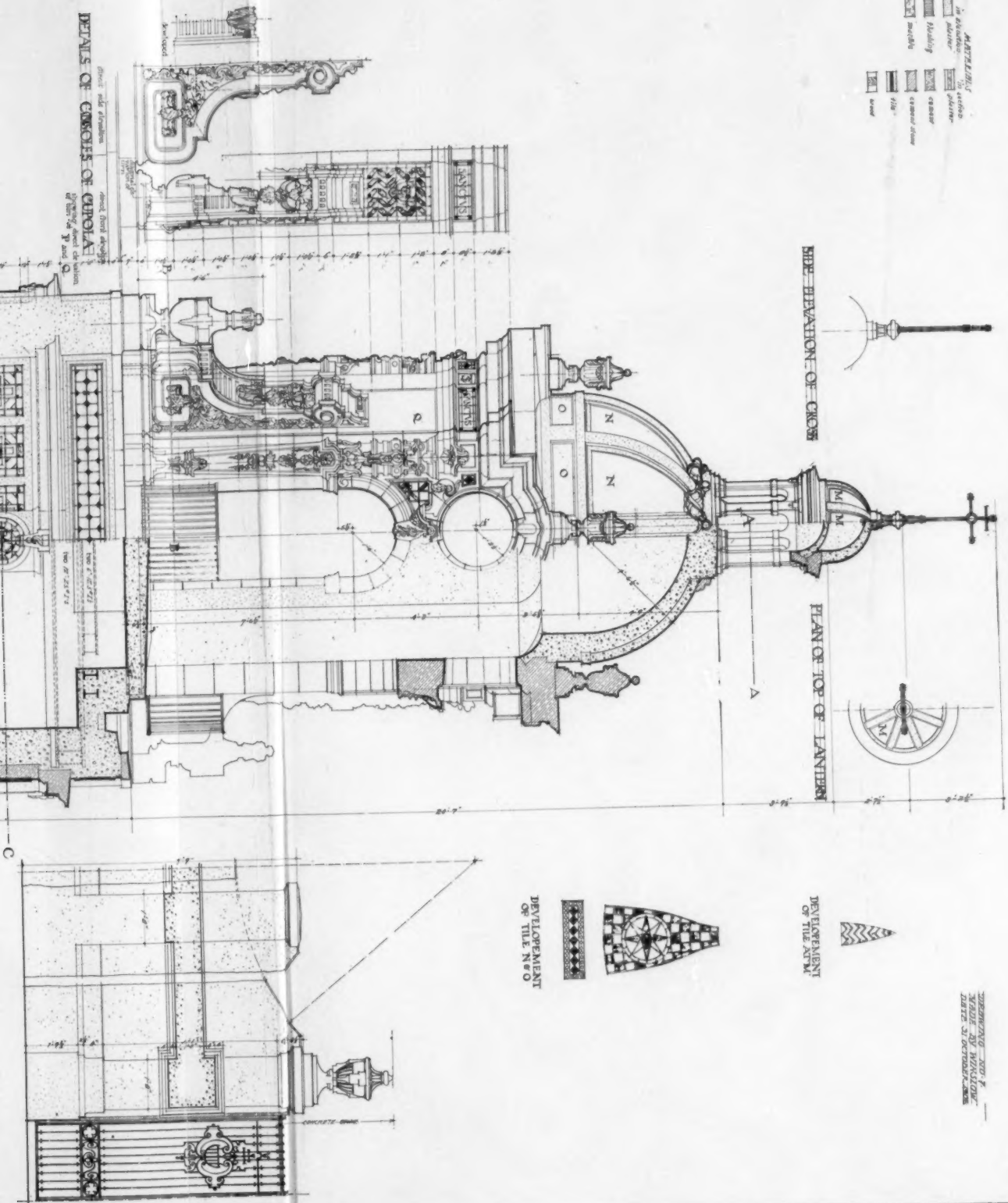
SIDE ELEVATION OF CROSS

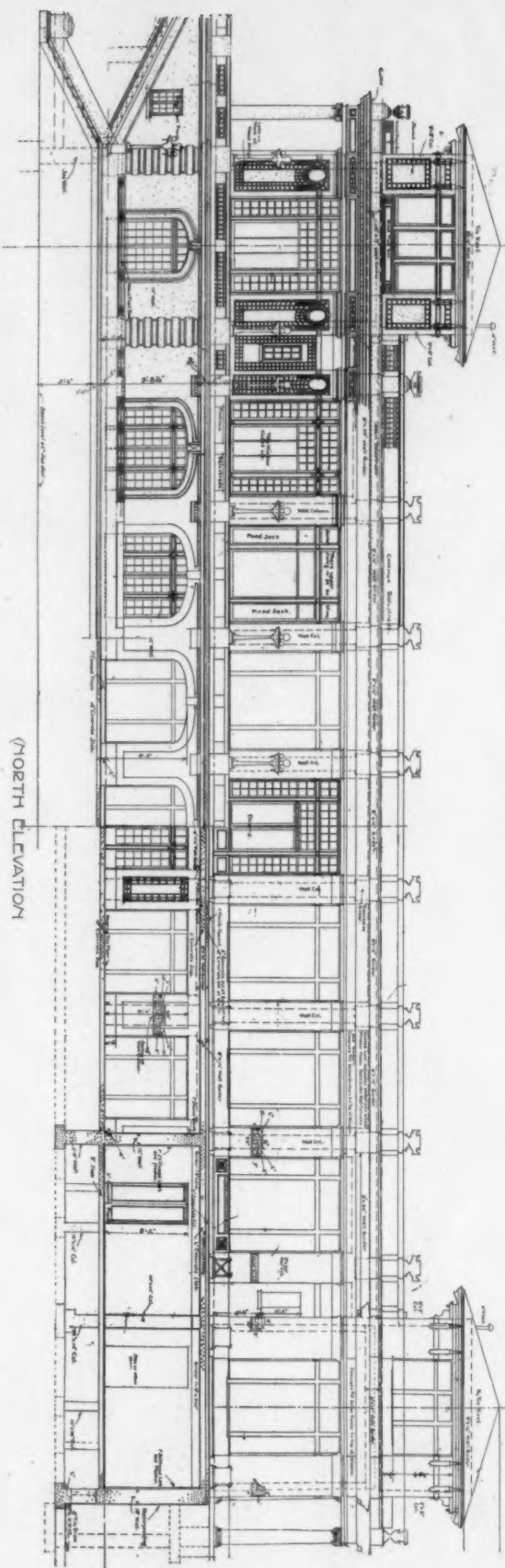
PLAN OF TOP OF LANTERN

DEVELOPMENT
OF THE NAVE

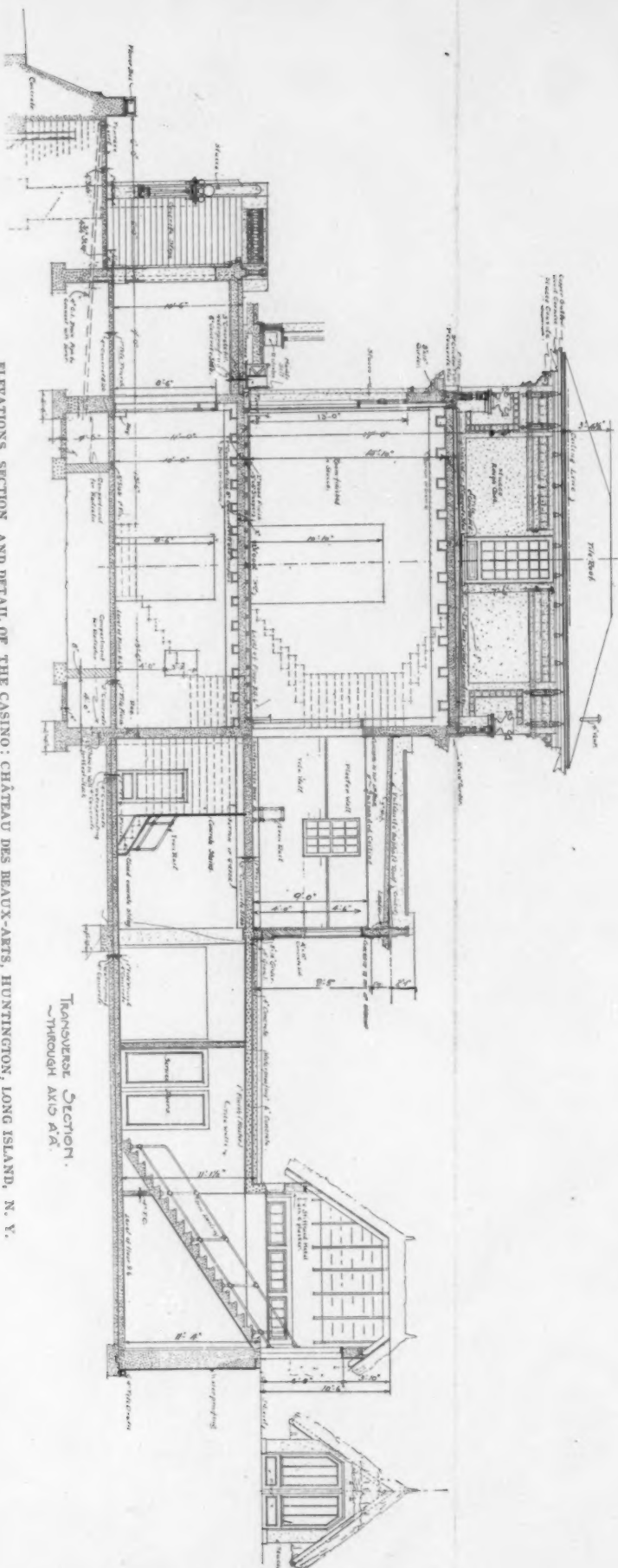
DEVELOPMENT
OF THE NAVE

DETAILS OF CHURCH OF CHURCH





NORTH ELEVATION



TRANSVERSE SECTION.
—THROUGH AXIS A-A.

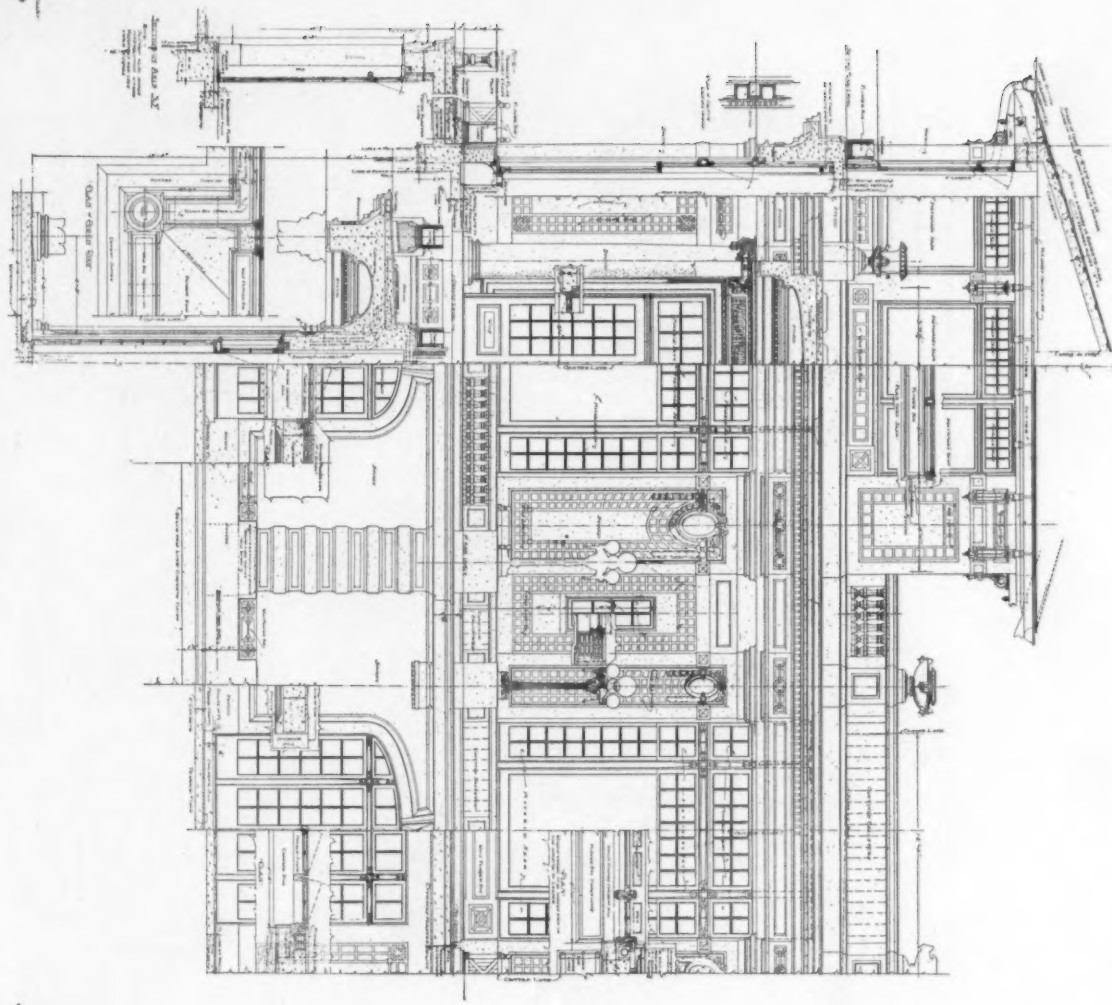
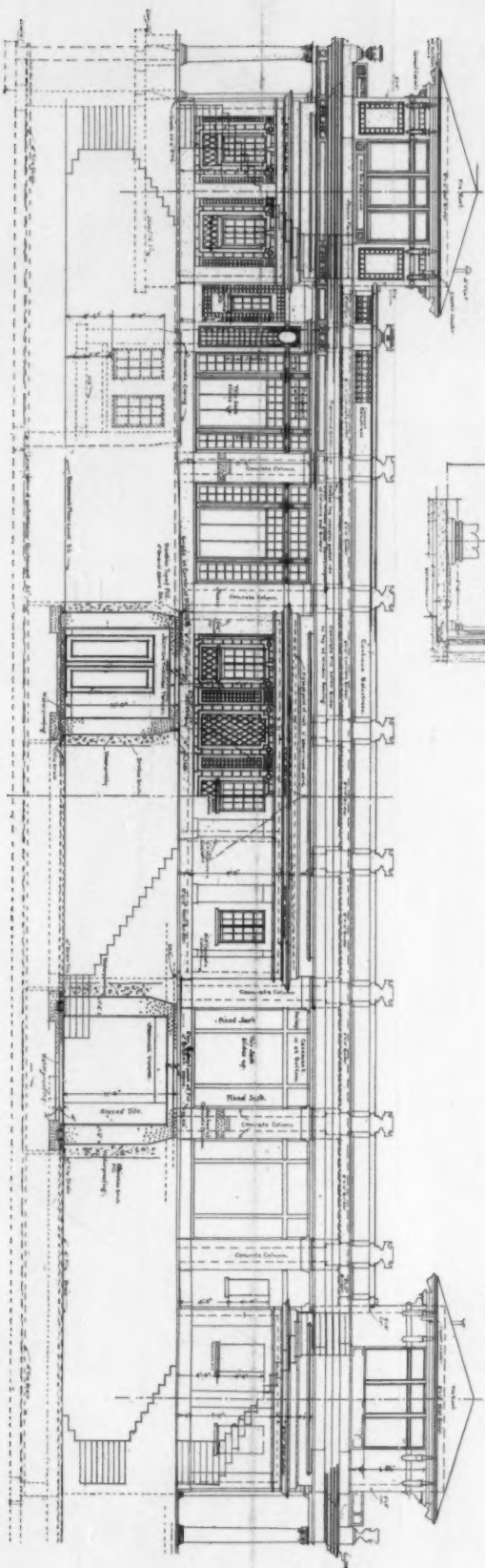
ELEVATIONS, SECTION AND DETAIL OF THE CASINO: CHATEAU DES BEAUX-ARTS, HUNTINGTON, LONG ISLAND, N. Y.

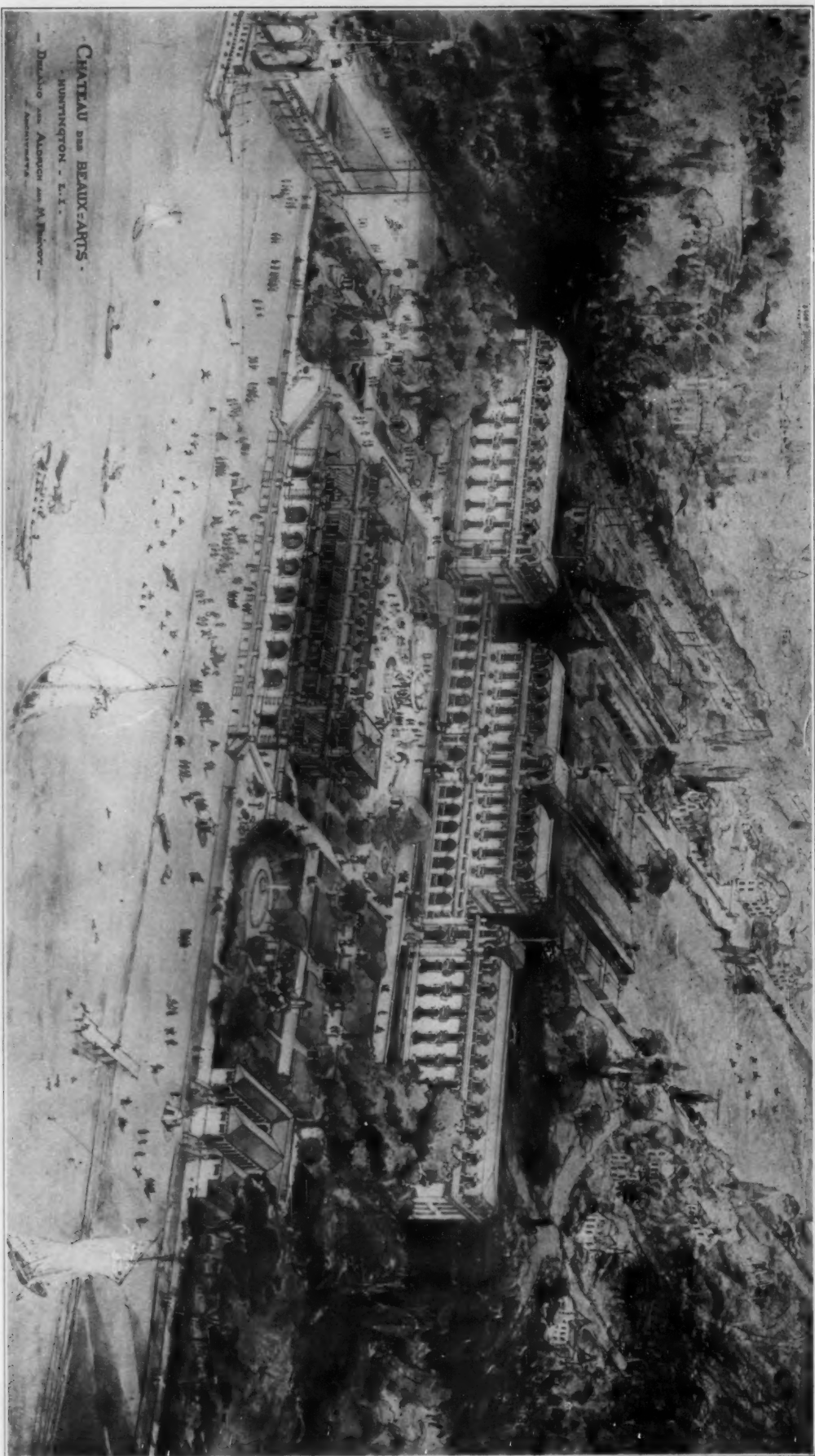
Delano & Aldrich and M. Prévot, Architects.

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CHATEAU DES BEAUX-ARTS.

HUNTINGTON - L. I.

- Designed and Adapted by M. Prévot -

Architects

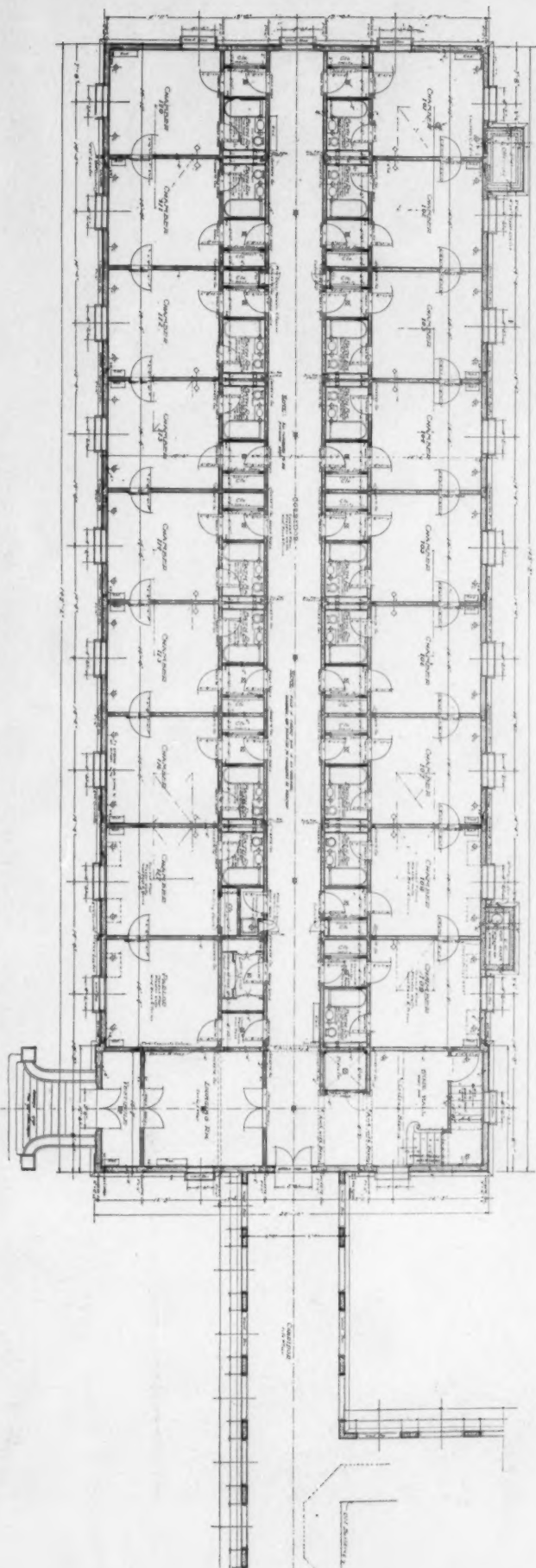
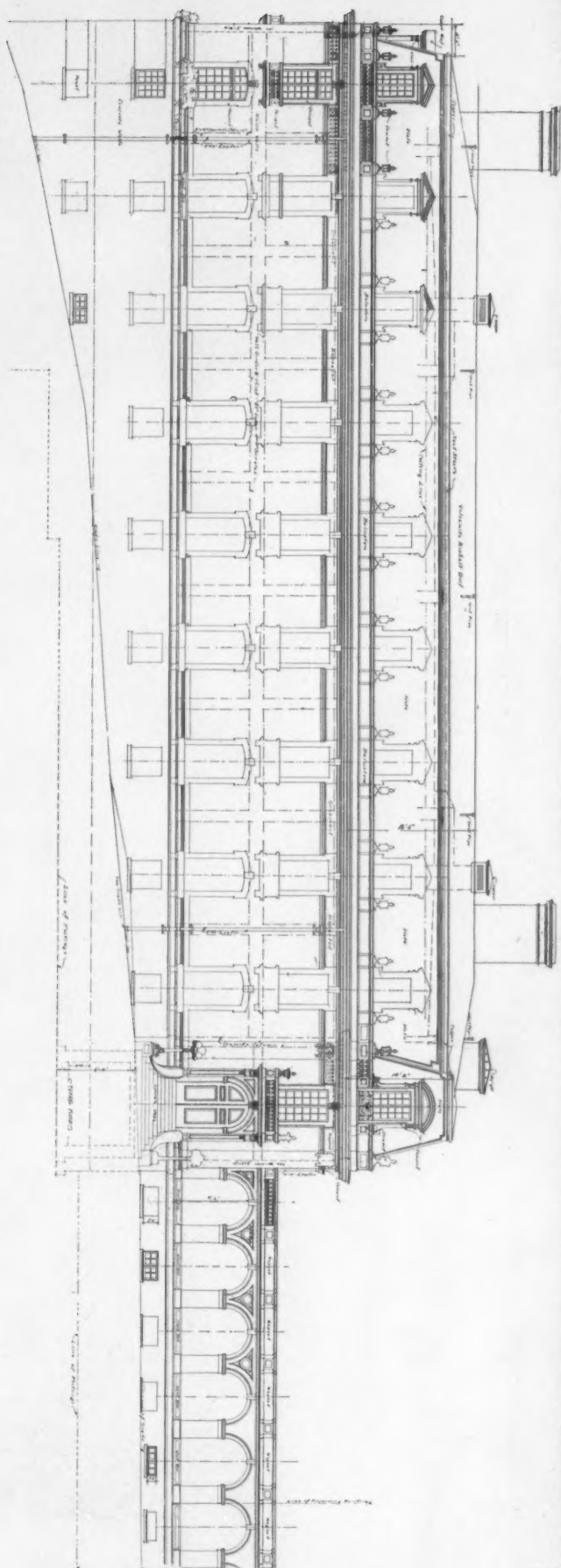
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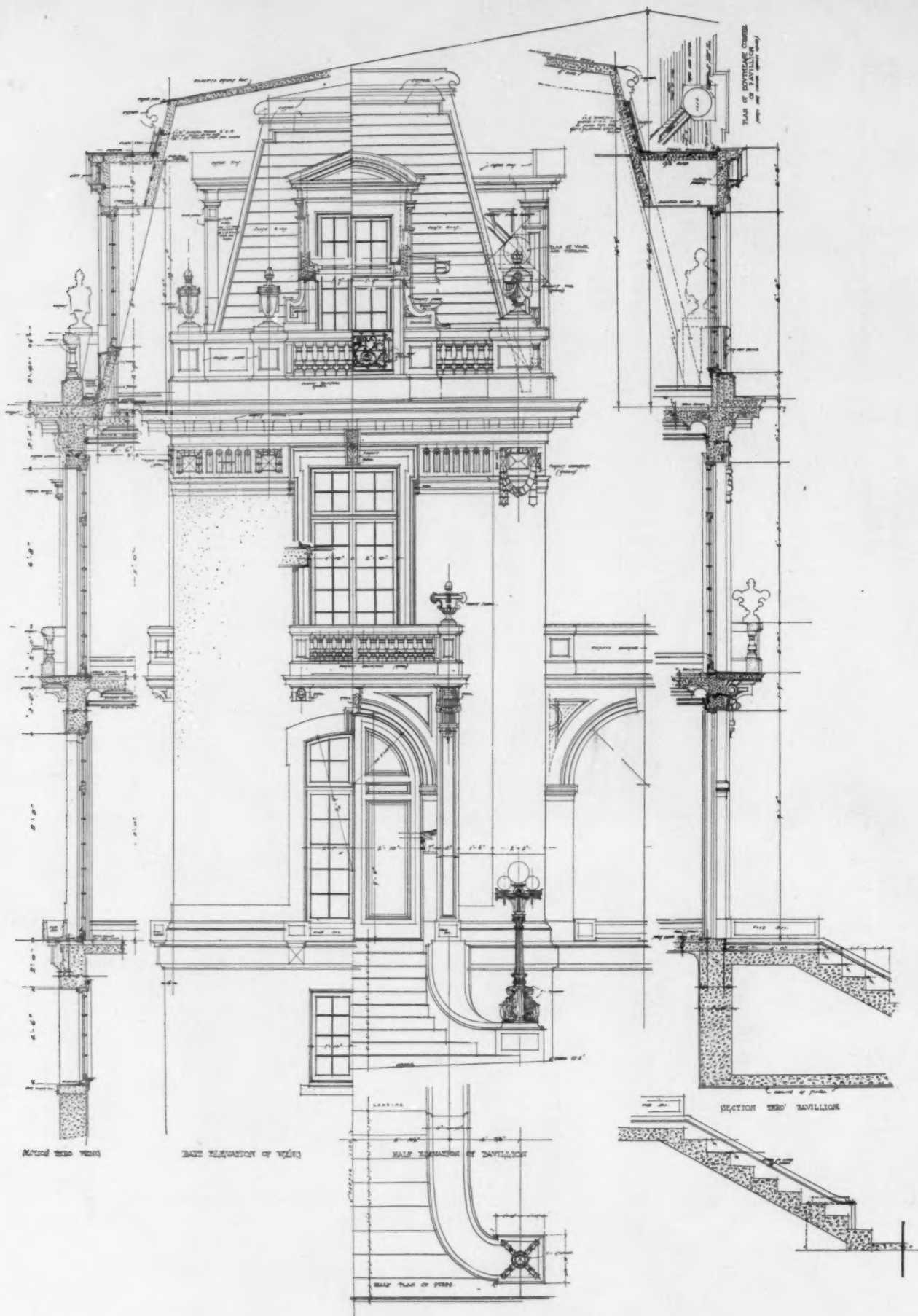
WEST WING OF THE CHÂTEAU DES BEAUX-ARTS, HUNTINGTON, LONG ISLAND, N. Y.

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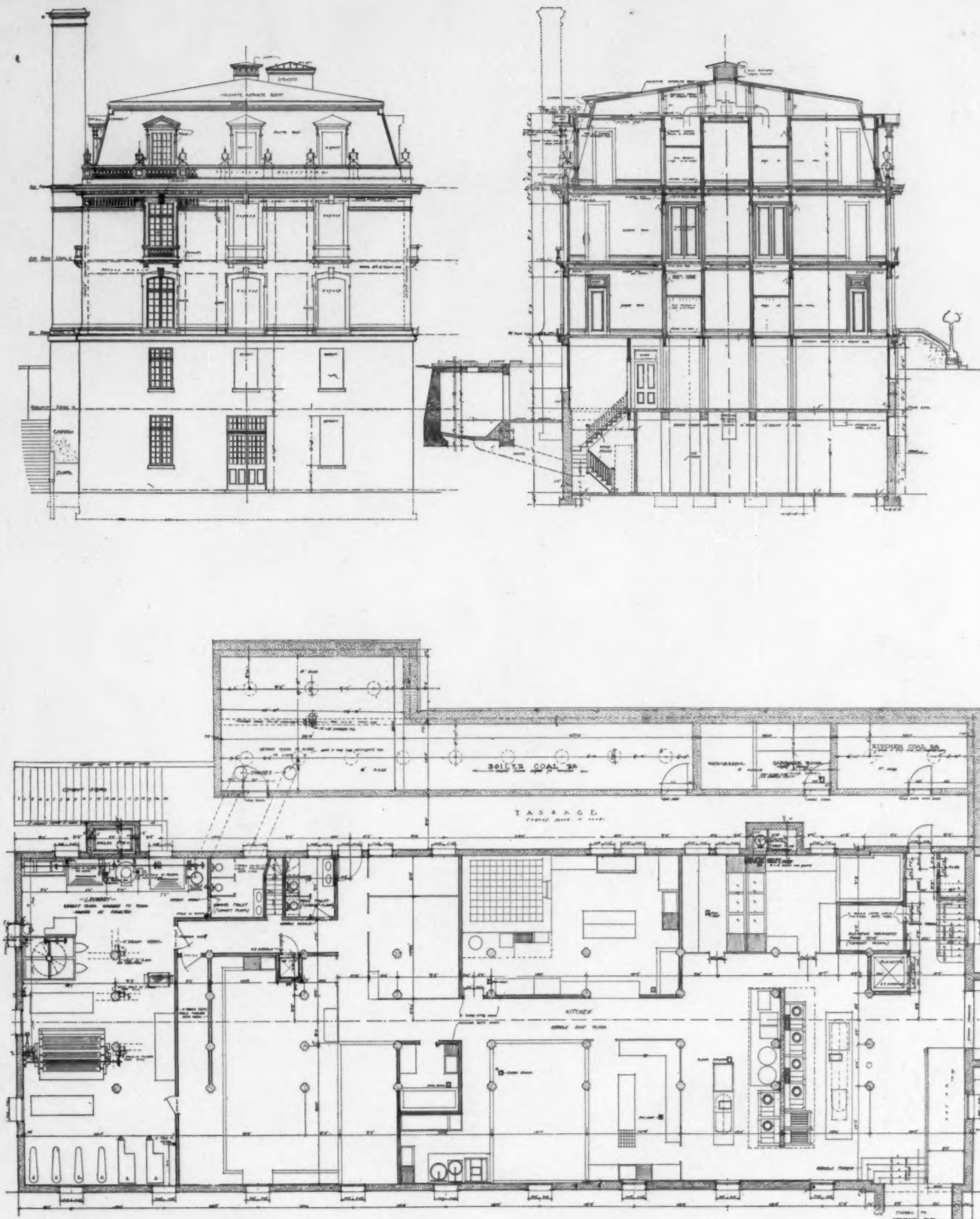
DETAIL OF WEST WING: CHÂTEAU DES BEAUX-ARTS, HUNTINGTON, LONG ISLAND, N. Y.

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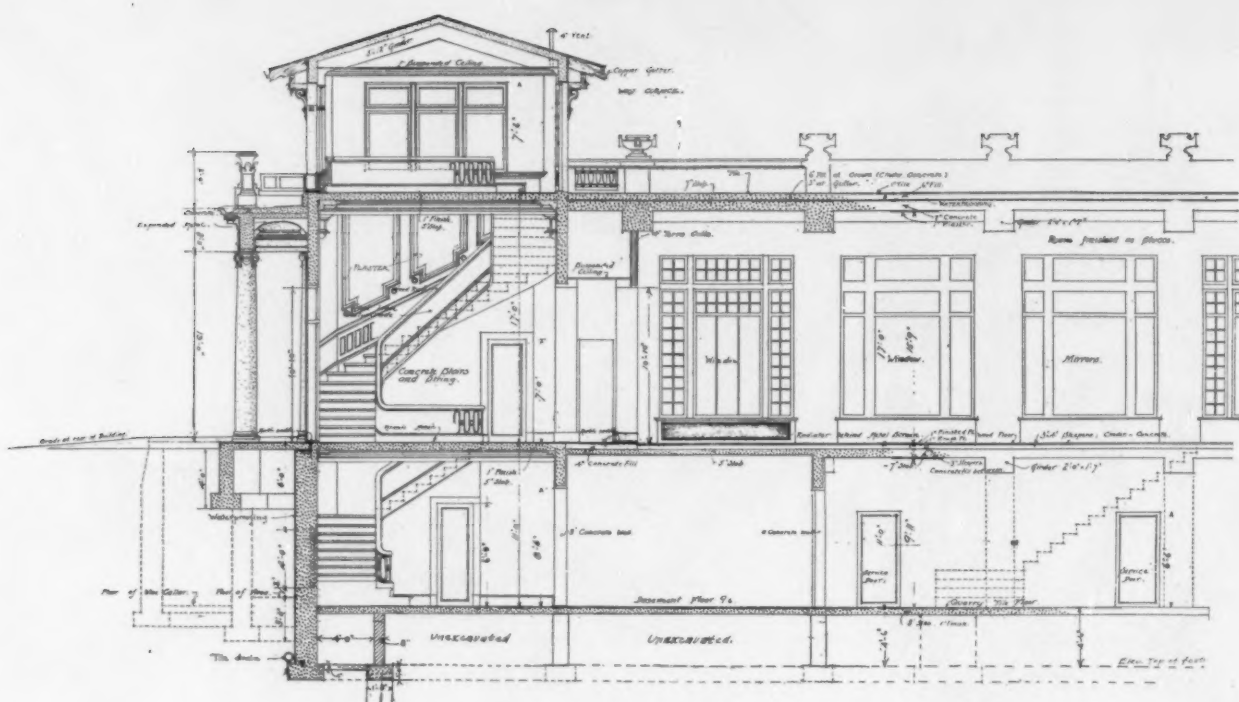
BASEMENT PLAN, ETC., OF WEST WING: CHÂTEAU DES BEAUX-ARTS, HUNTINGTON, LONG ISLAND, N. Y.

Delano & Aldrich and M. Prévot, Architects.

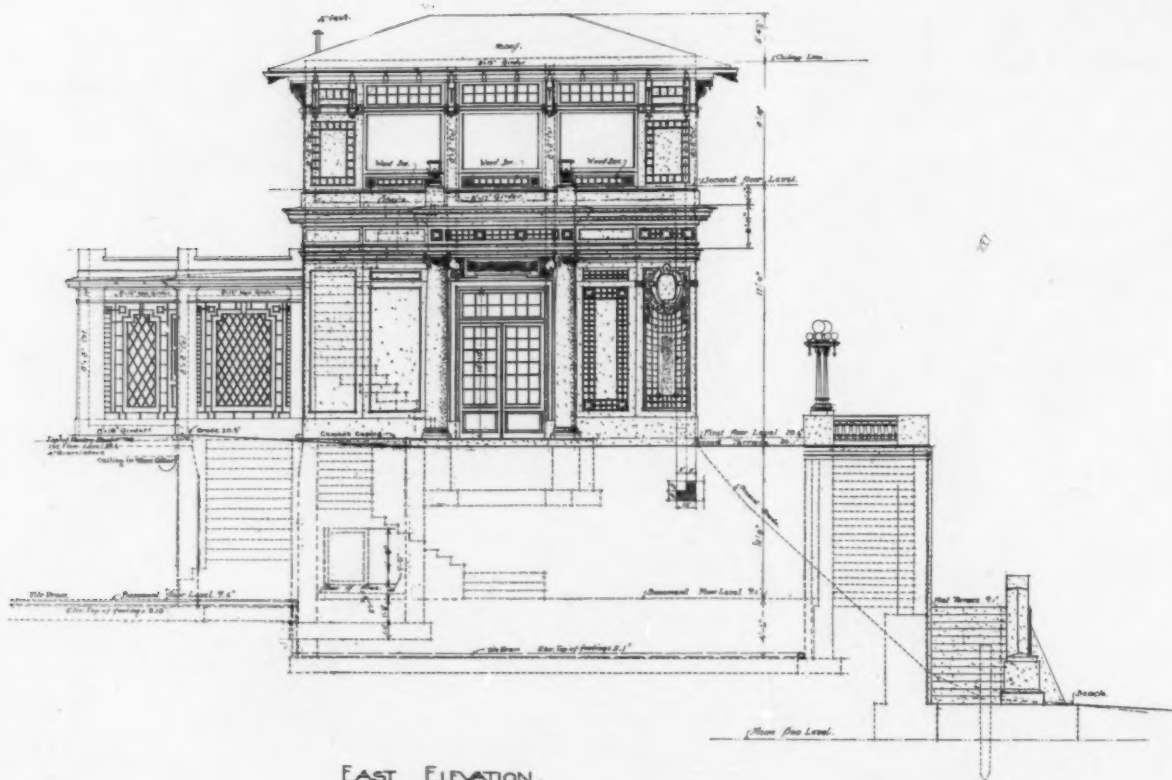
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LONGITUDINAL SECTION.



EAST ELEVATION.

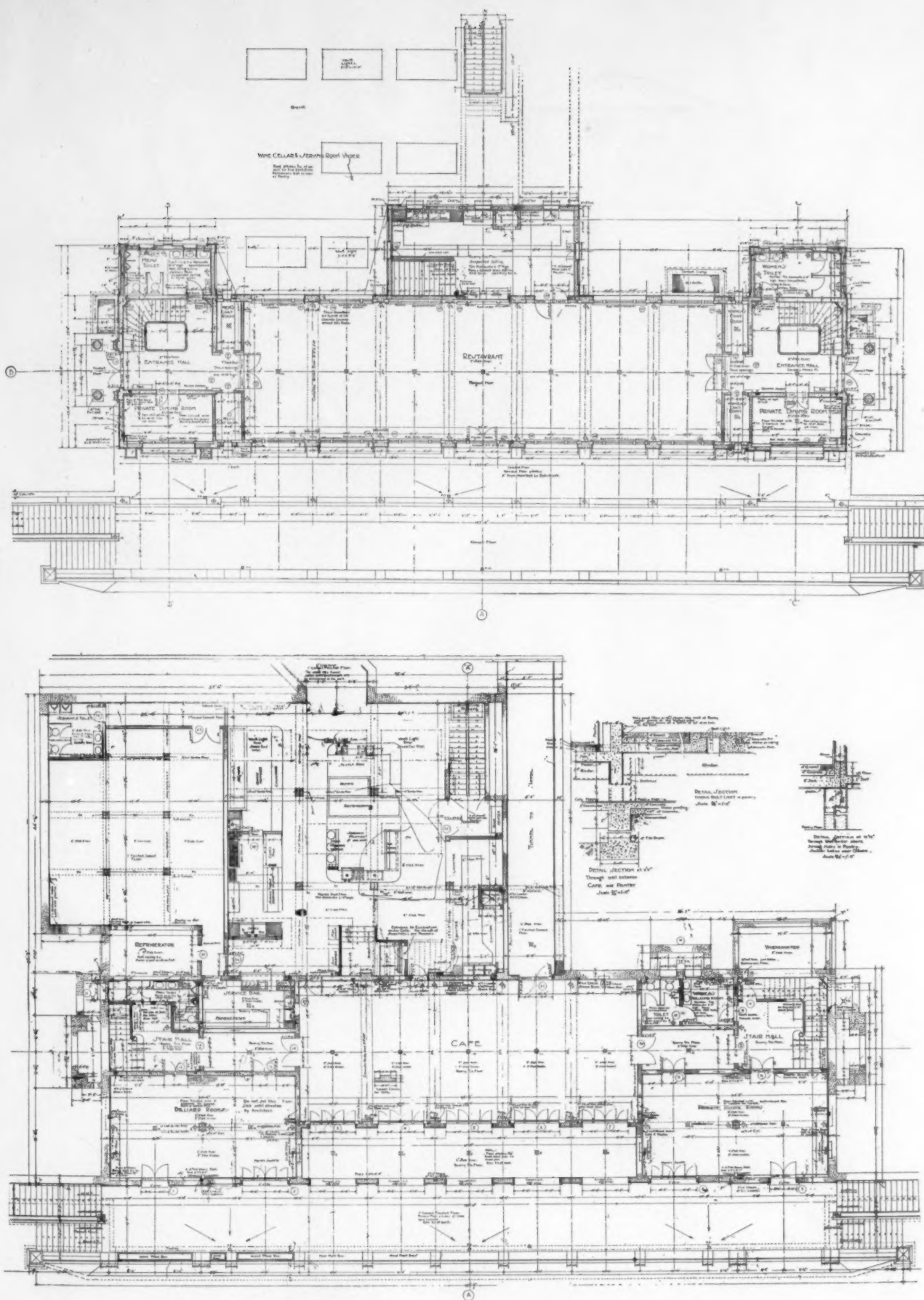
SIDE ELEVATION AND SECTION OF CASINO: CHATEAU DES BEAUX ARTS, HUNTINGTON, N. Y.

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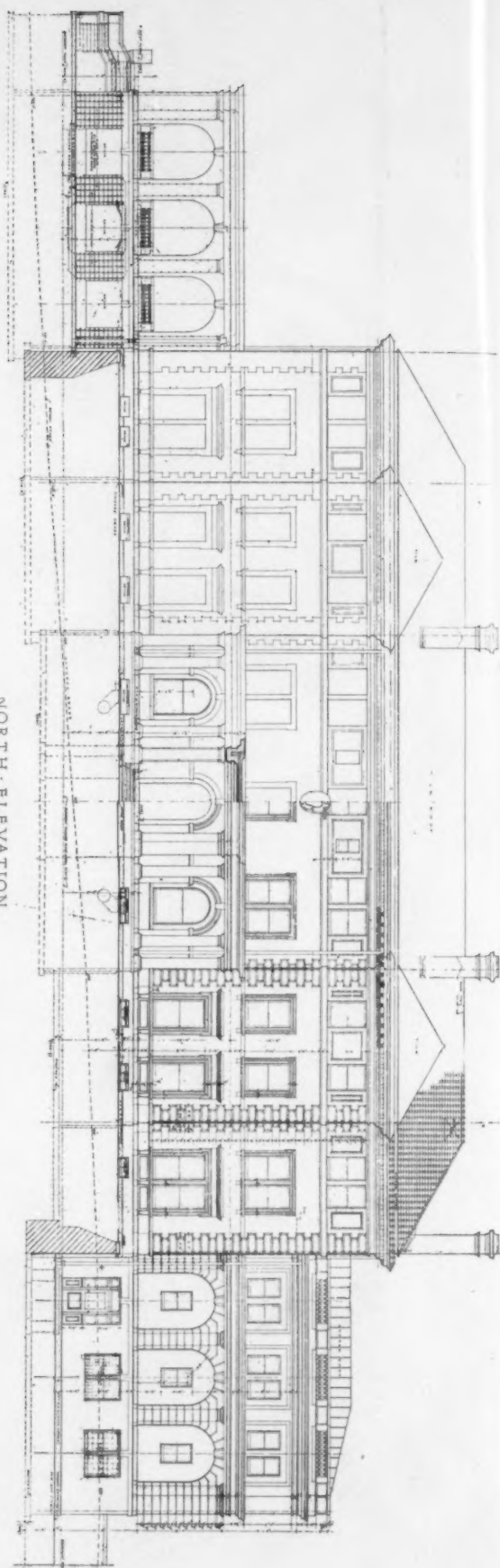
CASINO PLANS: CHATEAU DES BEAUX-ARTS, HUNTINGTON, L. I., N. Y.

Delano & Aldrich and M. Prévot, Architects.

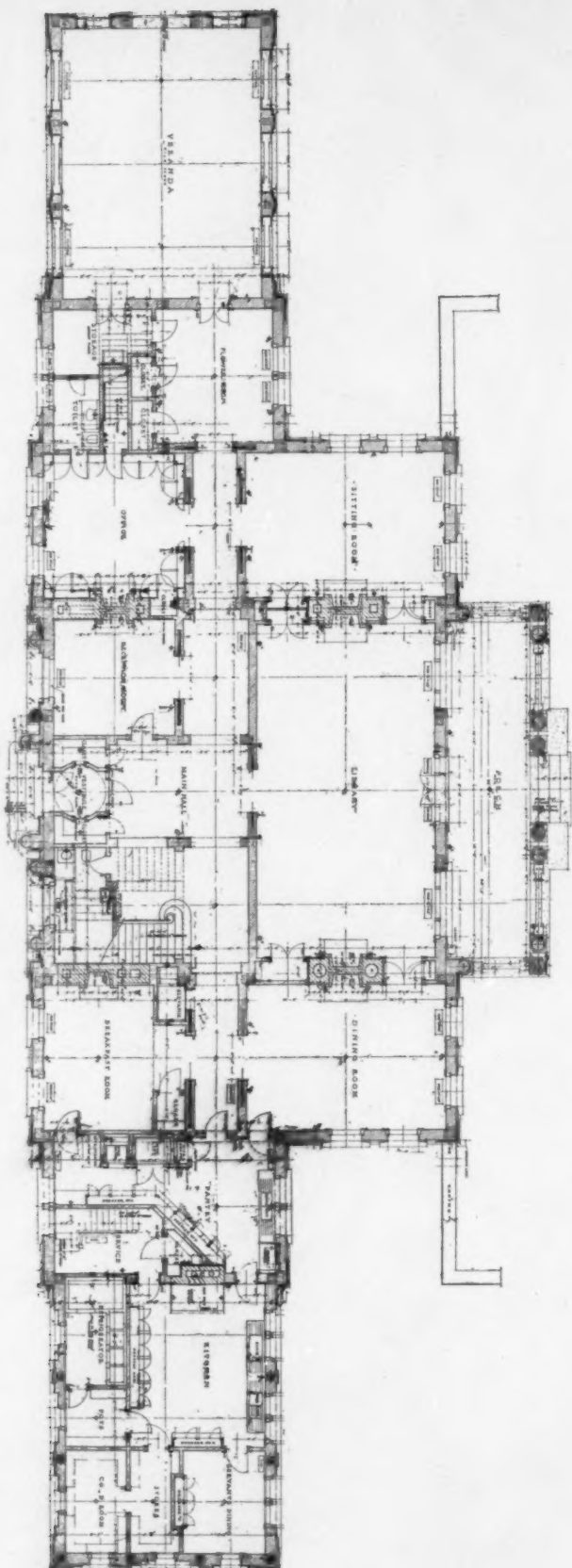
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NORTH ELEVATION



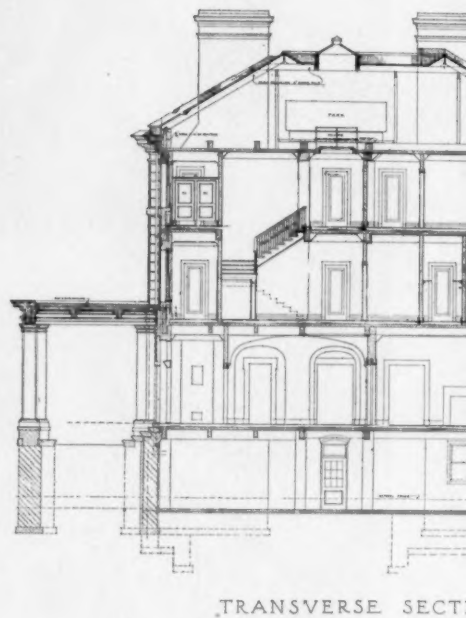
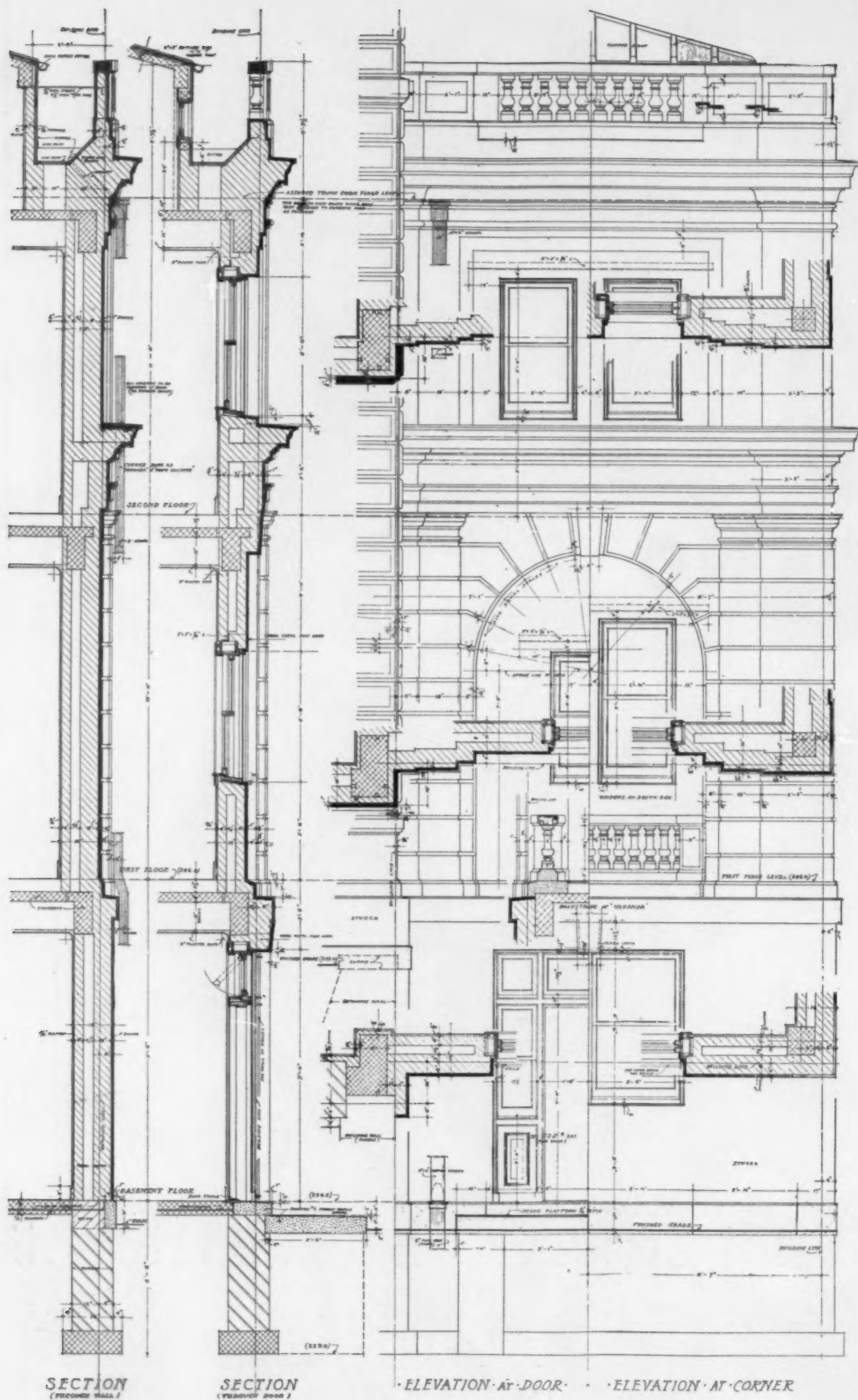
HOUSE OF F. A. ROCKEFELLER, ESQ., GREENWICH, CONN.

Hiss & Weeks, Architects.

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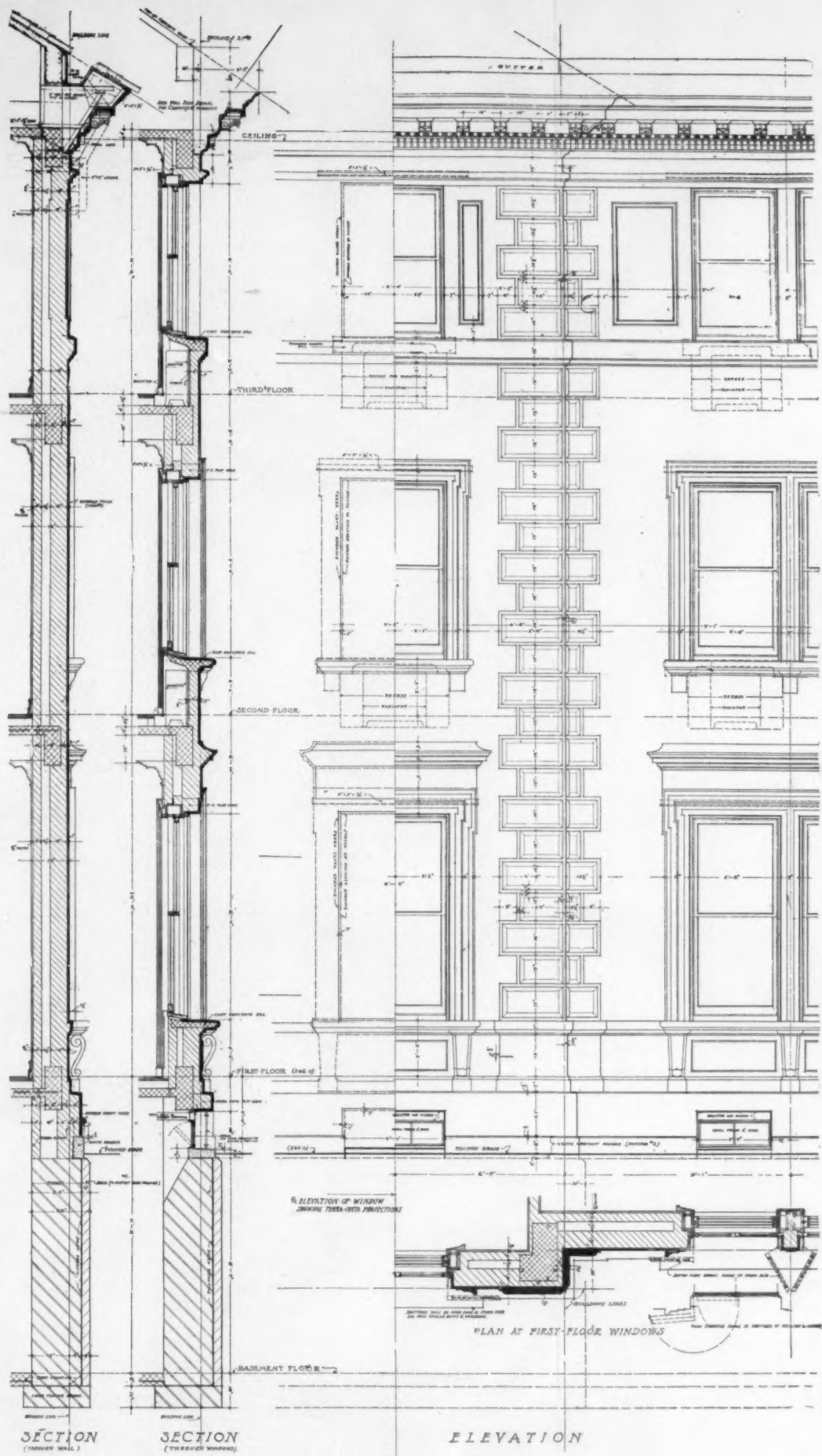
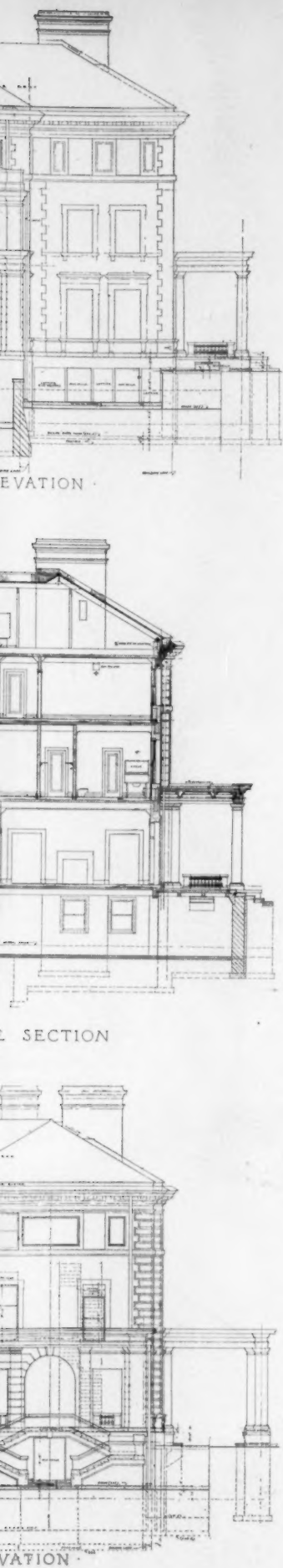
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SIDE ELEVATIONS AND DETAILS: HOUSE OF P. A. ROCKWELL

Hiss & Weekes, Architects

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A. A. ROCKEFELLER, ESQ., GREENWICH, CONN.

es, Architects.

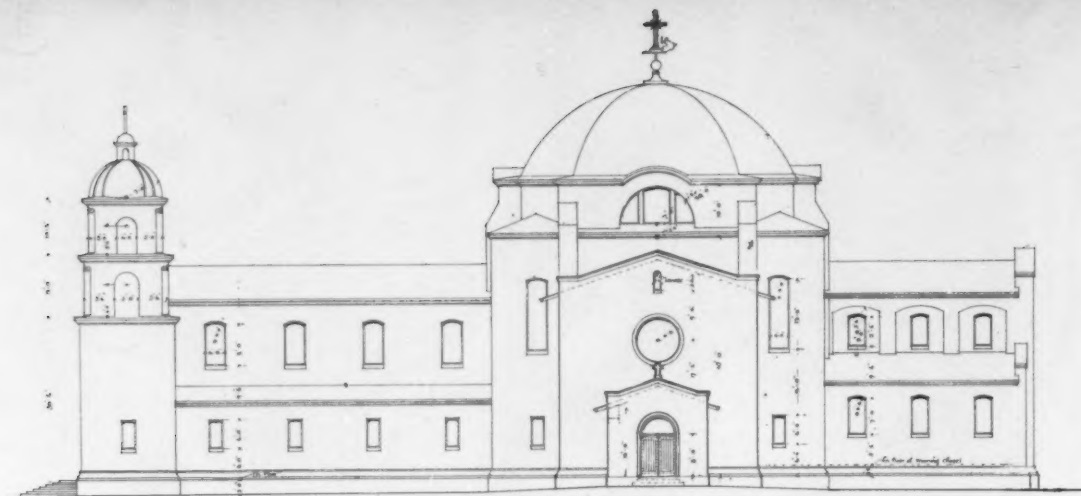
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EPISCOPAL CATHEDRAL, MANILA, P. I.

Sturgis & Barton, Architects.

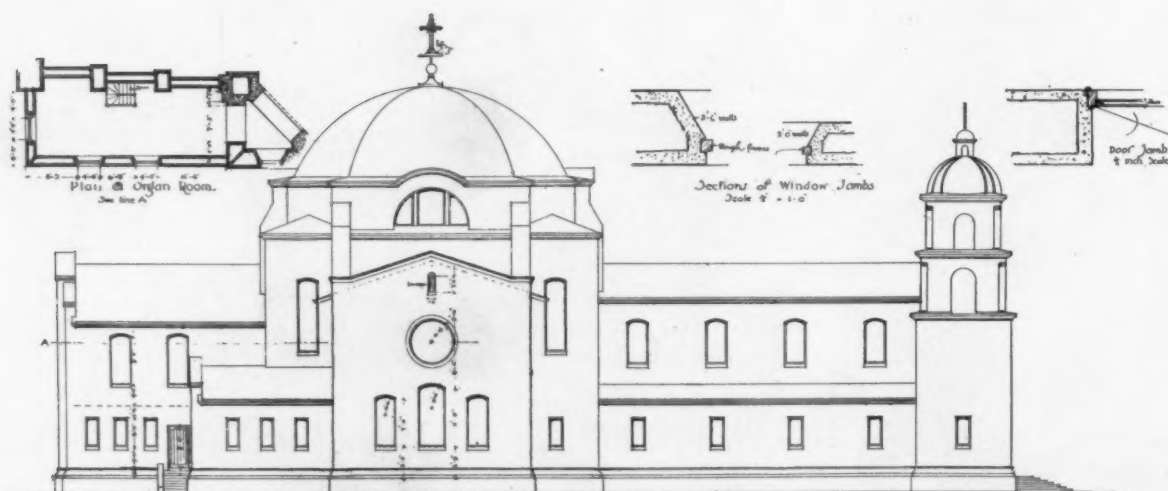


South Elevation.



West Elevation.

East Elevation.



North Elevation.

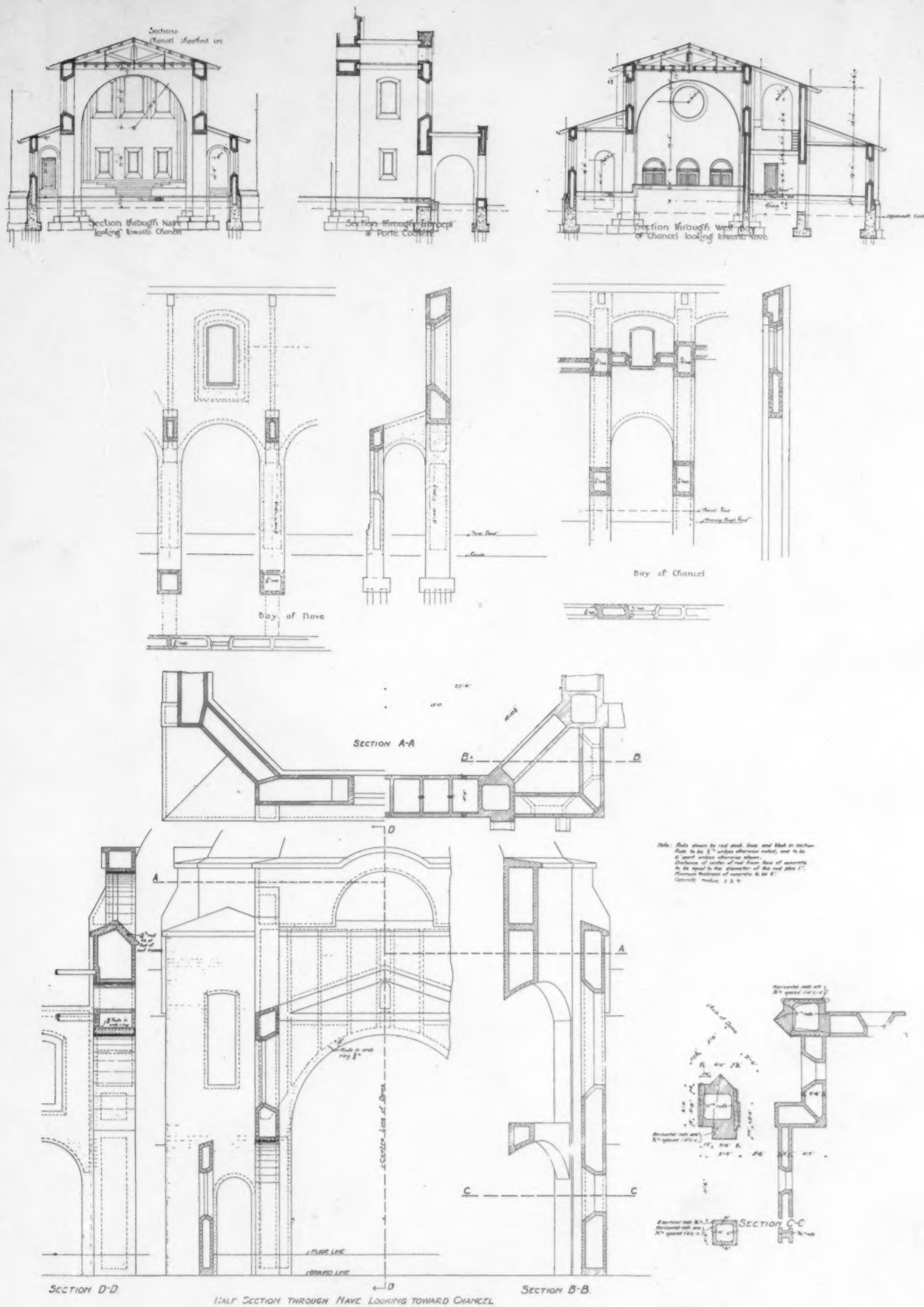
ELEVATIONS: EPISCOPAL CATHEDRAL, MANILA, P. I.

Sturgis & Barton, Architects.

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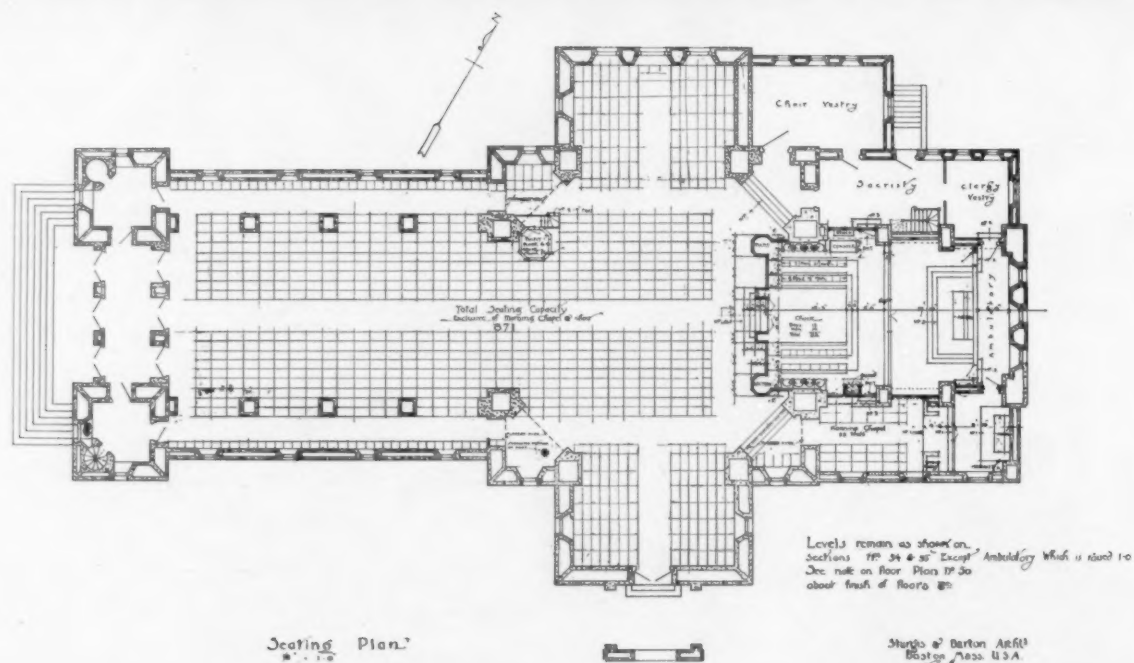
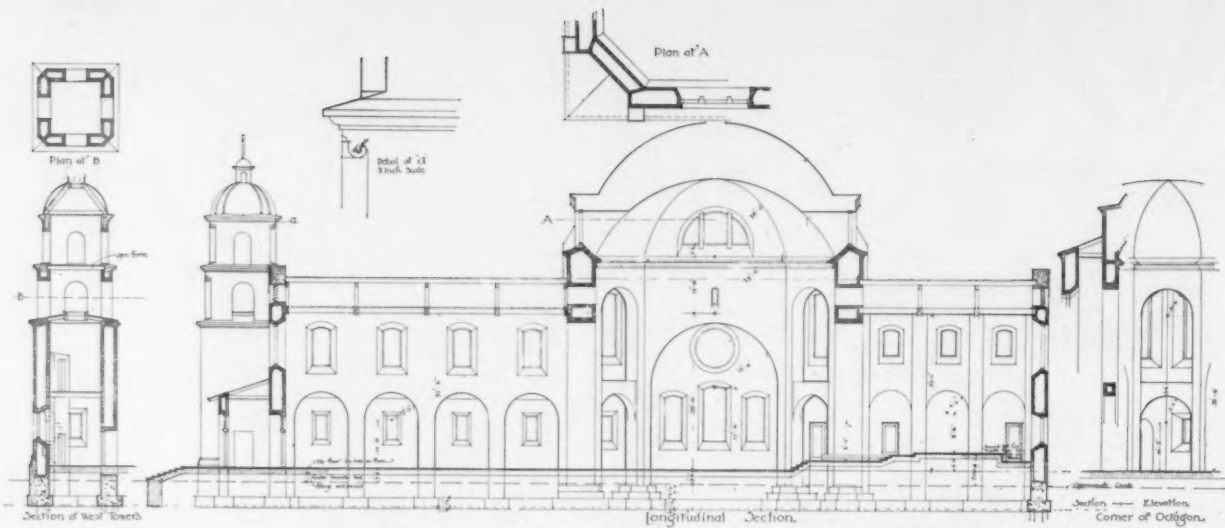
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SECTIONS AND DETAILS: EPISCOPAL CATHEDRAL, MANILA, P. I.

Sturgis & Barton, Architects.

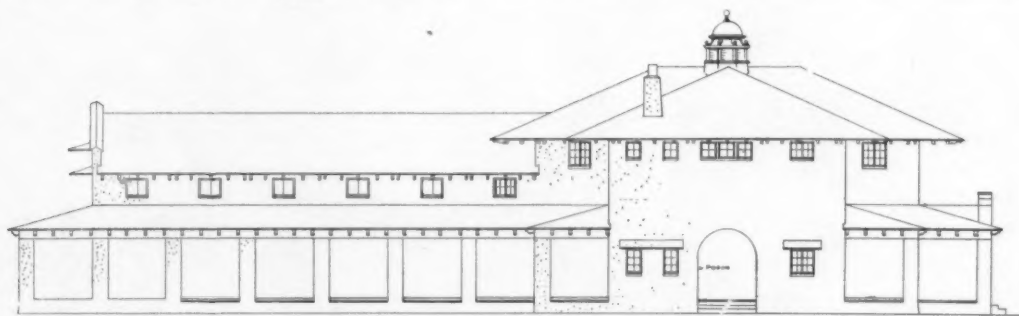
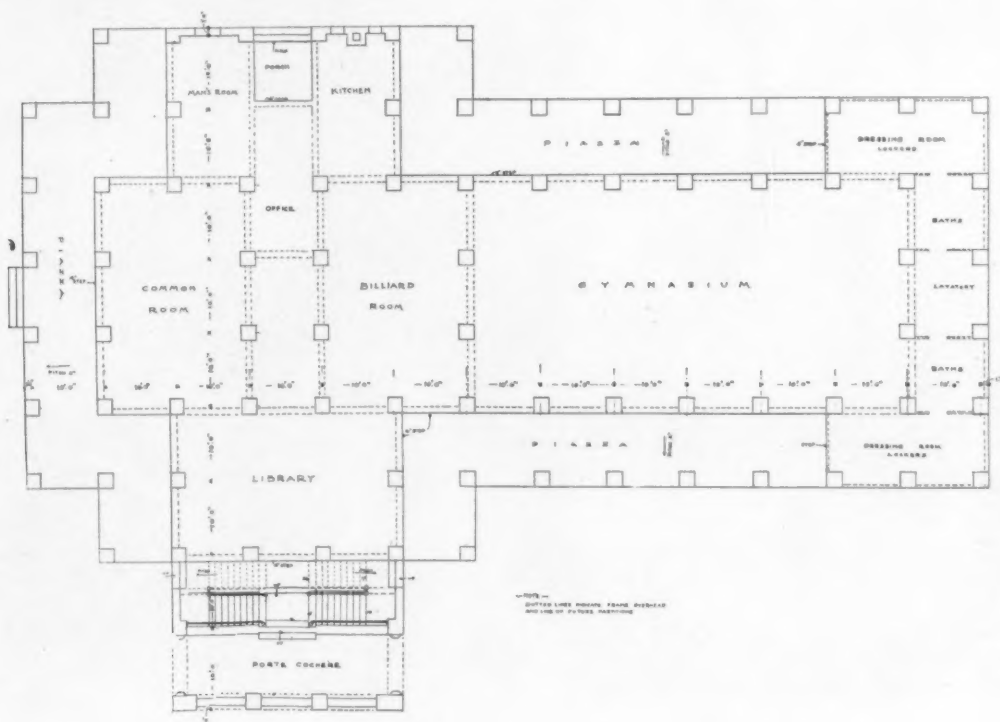


Seating Plan.

Sturgis & Barton, Architects
Boston, Mass. U.S.A.
Oct. 25, 1907

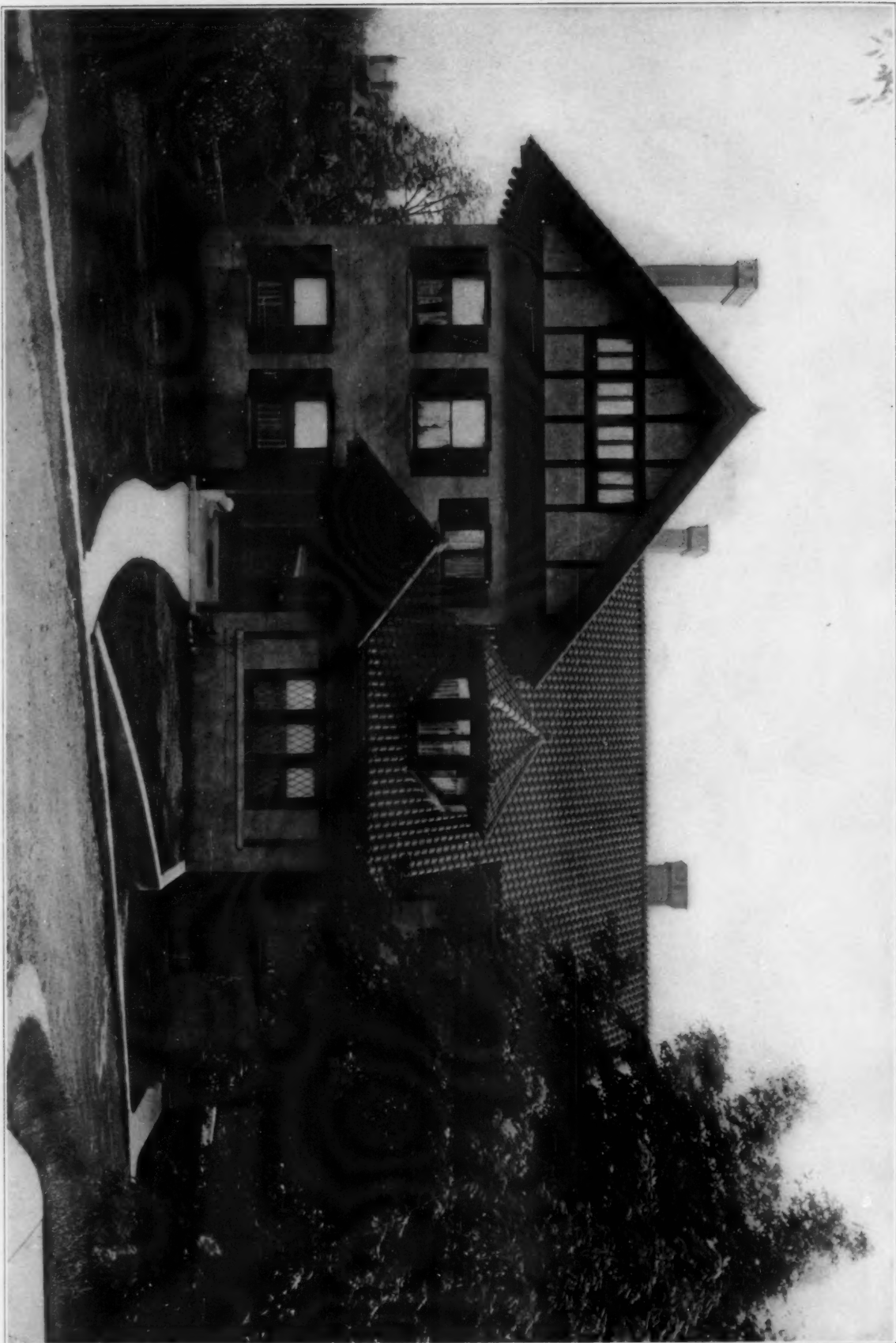
PLAN, SECTION AND VIEW: EPISCOPAL CATHEDRAL, MANILA, P. I.

Sturgis & Barton, Architects.



EPISCOPAL PARISH-HALL, MANILA, P. I.

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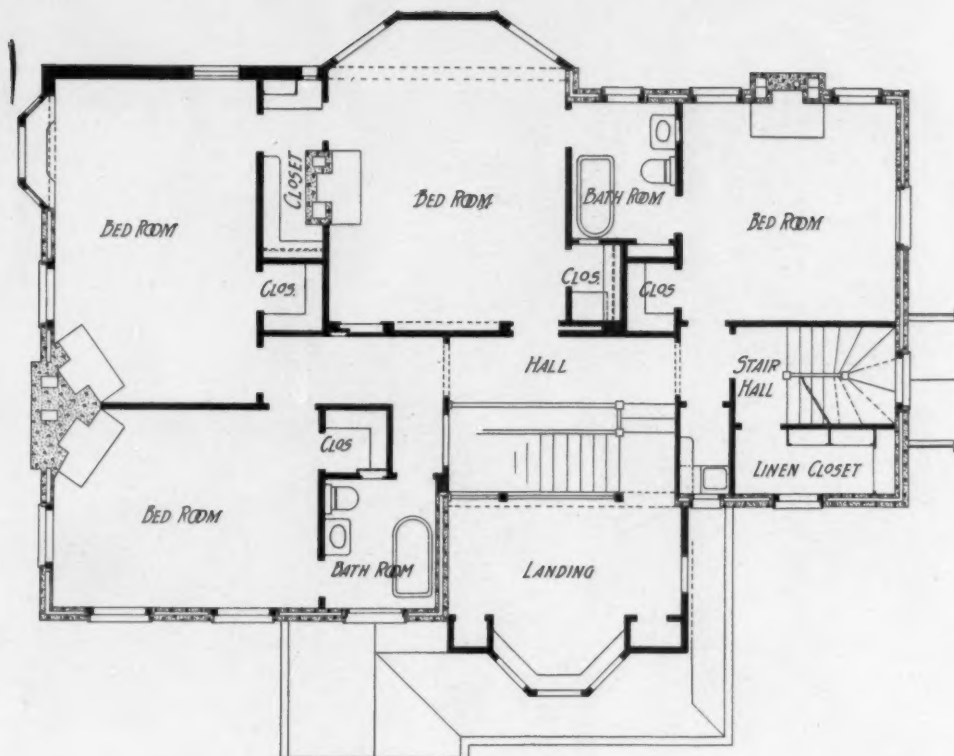
HOUSE OF ROBERT ANDERSON, ESQ., CINCINNATI, O.

Elzner & Anderson, Architects.

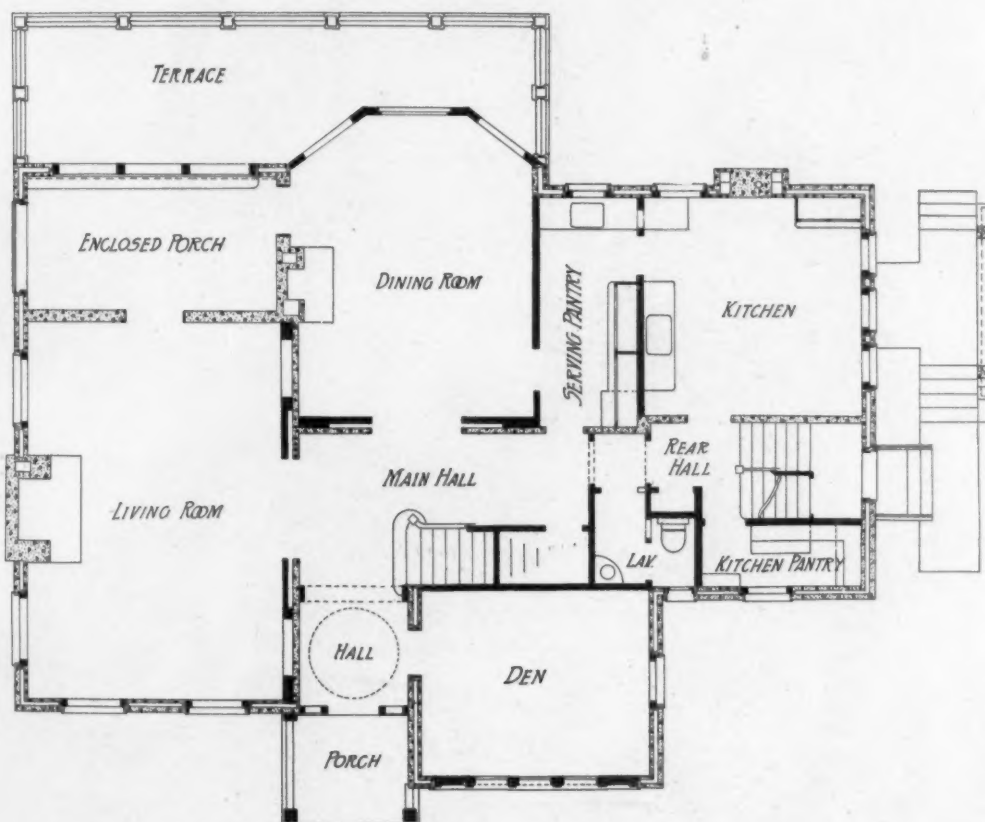
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Volume XCI, Number 1636
May 4, 1907.



SECOND FLOOR PLAN.



FIRST FLOOR PLAN.

PLANS: HOUSE OF ROBERT ANDERSON, ESQ., CINCINNATI, O.

Elzner & Anderson, Architects.



THE HERBIVORA BUILDING, ZOOLOGICAL GARDEN, CINCINNATI, O.

Elzner & Anderson, Architects.

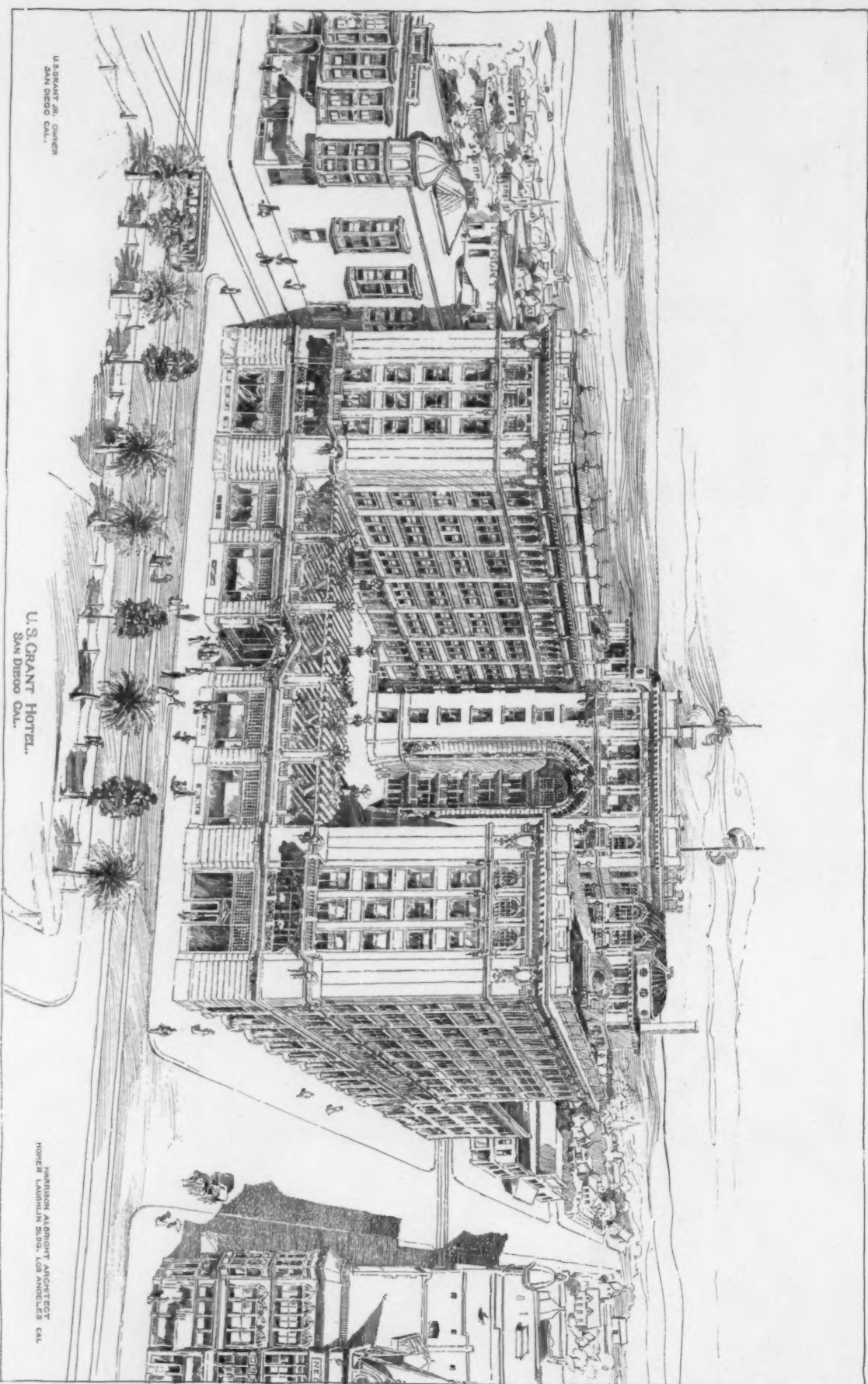


HOUSE OF MR. ALBERT KAHN, ARCHITECT, DETROIT, MICH.

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Volume XCI, Number 103.
May 4, 1907.

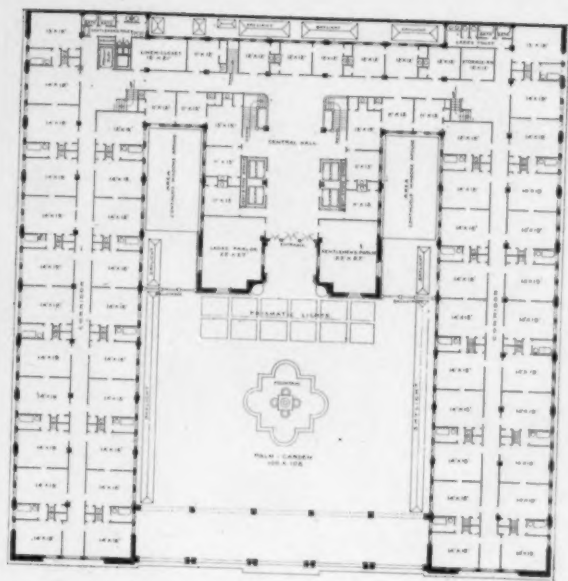


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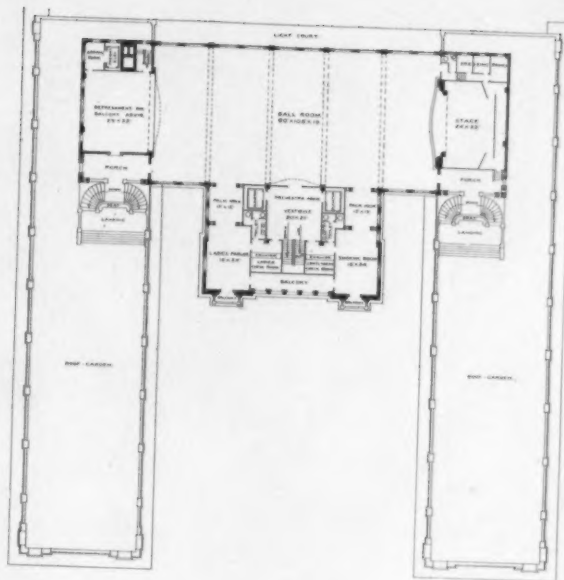
U. S. GRANT HOTEL, SAN DIEGO, CAL.
Harrison Albright, Architect.

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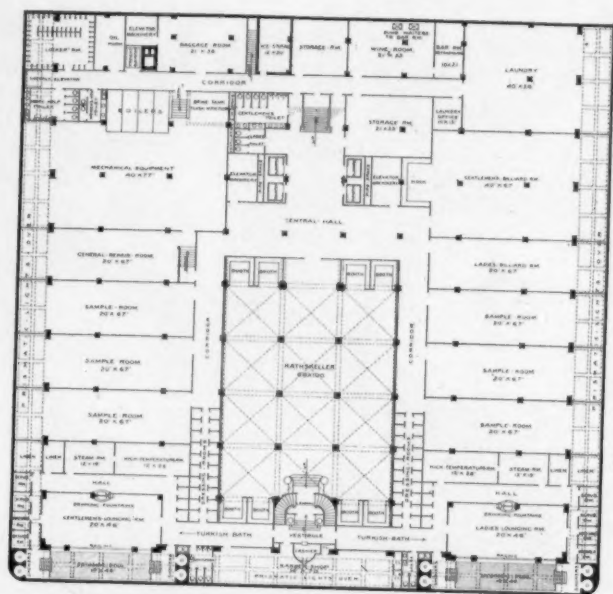
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May 4, 1907.



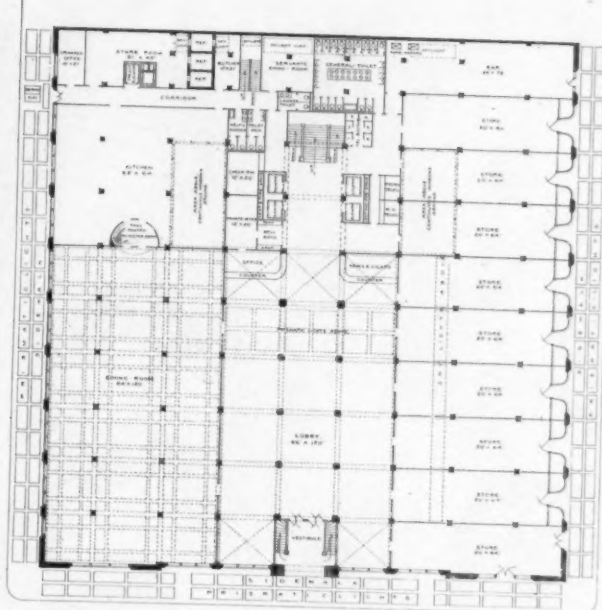
SECOND FLOOR PLAN



NINTH FLOOR PLAN AND ROOF



BASEMENT PLAN



FIRST FLOOR PLAN

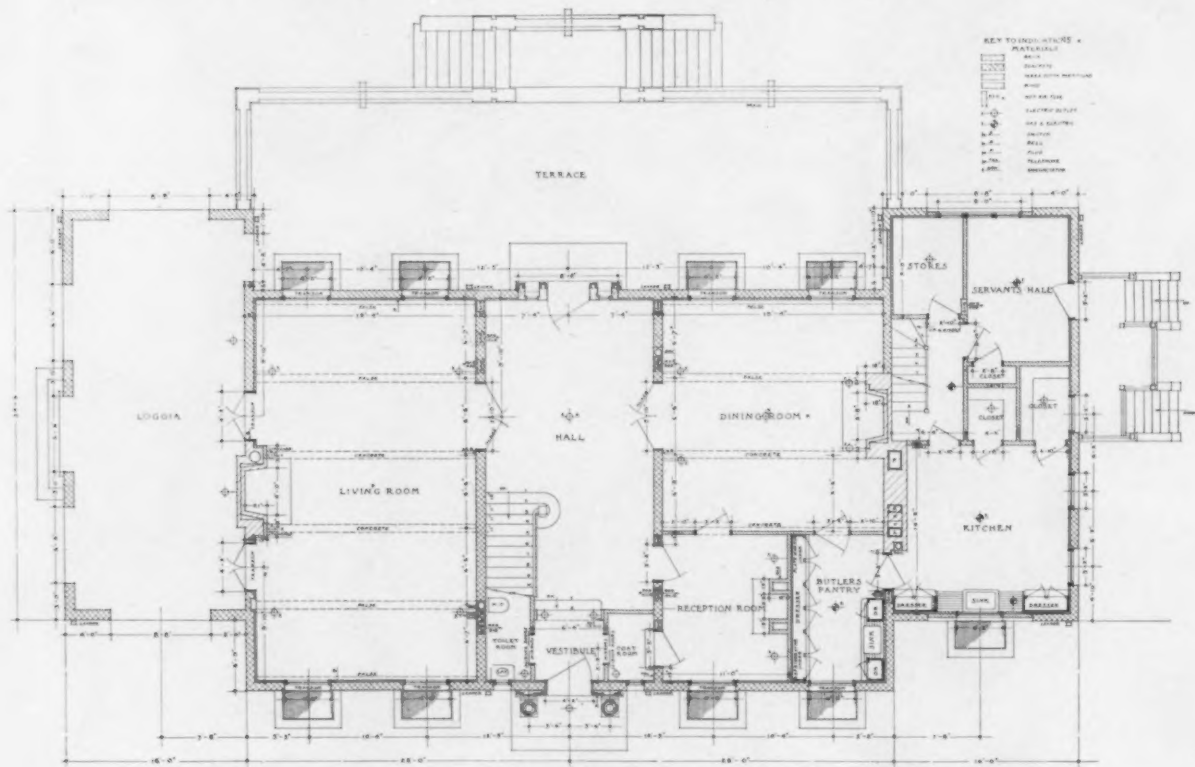
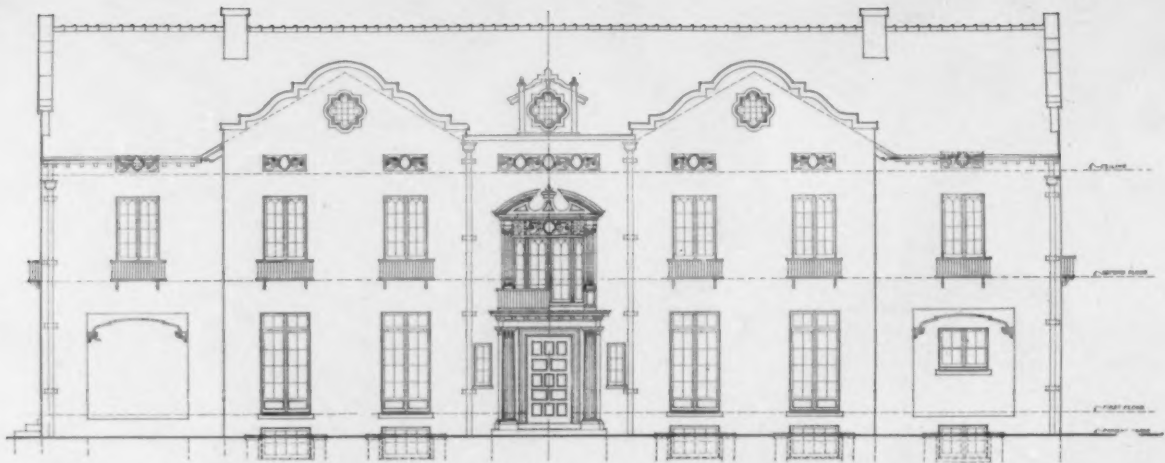
PLANS: U. S. GRANT HOTEL, SAN DIEGO, CAL.

Harrison Albright, Architect.

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Regular Edition.

Volume XCL, Number 1636.
May 4, 1907.

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FIRST FLOOR PLAN

HOUSE OF DANIEL BACON, ESQ., ARDSLEY-ON-THE-HUDSON, N. Y.

Oswald C. Hering, Architect.

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Volume XCL, Number 1636.
May 4, 1907.

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POSITIONS OPEN.

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WANTED—Architectural draughtsman, familiar with working plans for interior and exterior stone work. The Schilling Company, Albany, N. Y. (1636-1637)

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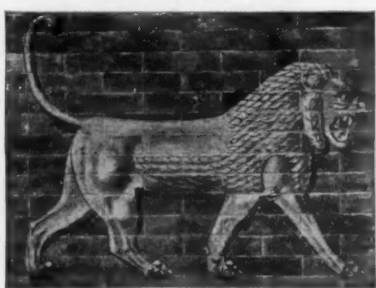
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PROPOSALS.

Treasury Department, Office of the Supervising Architect, Washington, D. C., April 17, 1907.—Sealed proposals will be received at this office until 3 o'clock p. m. on the 22d day of May, 1907, and then opened for an extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring to the U. S. Post Office and Custom House at Petersburg, Virginia, in accordance with drawings and specifications, copies of which may be had at this office or at the office of the Custodian at Petersburg, Virginia, at the discretion of the Supervising Architect.—James Knox Taylor, Supervising Architect. (1635-1636)

Treasury Department, Office of the Supervising Architect, Washington, D. C., April 24, 1907.—Sealed proposals will be received at this office until 3 o'clock p. m. on the 28th day of May, and then opened, for the construction (complete) of the Extension to the U. S. Post Office, Brooklyn, N. Y., in accordance with the drawings and specifications, copies of which may be had at this office or at the office of the Custodian at Brooklyn, N. Y., at the discretion of the Supervising Architect.—James Knox Taylor, Supervising Architect. (1635-1636)

Treasury Department, Office of the Supervising Architect, Washington, D. C., May 2, 1907.—Sealed proposals will be received at this office until 3 o'clock p. m. on the 12th day of June, 1907, and then opened, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) for the U. S. Post Office building at Bedford, Indiana, in accordance with the drawings and specifications, copies of which may be had at the office of the Custodian of the site, at Bedford, Indiana, or at this office, at the discretion of the Supervising Architect.—James Knox Taylor, Supervising Architect. (1636-1637)

Treasury Department, Office of the Supervising Architect, Washington, D. C., May 1, 1907.—Sealed proposals will be received at this office until 3 o'clock p. m. on the 6th day of June, 1907, and then opened, for the construction complete of the extension to the U. S. Post Office and Court House, at Wichita, Kansas, in accordance with the drawings and specifications, copies of which may be had at this office or at the office of the Custodian at Wichita, Kansas, at the discretion of the Supervising Architect.—James Knox Taylor, Supervising Architect. (1636-1637)

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SOCIETIES

SOUTHERN CALIFORNIA CHAPTER, A. I. A.

Members of the Southern California Chapter, American Institute of Architects, dined at Levy's Tuesday evening, April 9, and held their monthly meeting. Mr. Brown presided in the absence of Mr. Rosenheim, who is in the East. Others in attendance were Messrs. Hudson, Train, Hunt, Wackerbarth, Albright, Norton, Ehlers, Hillman and Preston. A number of important matters were suggested for discussion, but action was deferred until a larger representation can be secured.

BROOKLYN CHAPTER, A. I. A.

The Brooklyn Chapter of the American Institute of Architects will hold its seventh annual exhibition at the Pouch Gallery in Clinton Avenue from May 8 to May 18, inclusive. Exhibits of drawings, photographs, sculpture, and objects of industrial art are desired from all interested.

To stimulate the artistic development of the pupils in the art schools of Brooklyn, the Chapter has instituted a competition for a cover design for the catalogue of the 1907 exhibition, to be limited to the pupils of these schools. A prize of \$25 for the first, and \$15 for the second best designs will be awarded.

All competitive designs should be sent to Walter L. Cassin, 375 Fulton Street, Secretary of the Exhibition Committee, who will furnish detailed information to all intending competitors and exhibitors.

The Chapter will give an invitation reception and press view on the evening of May 6, and the exhibition will be open to the public free on May 7.

PERSONAL MENTION

NEW YORK, N. Y.—John Campbell, 26 years old, an architect, was found dead in his room at the boarding-house, 238 West Eleventh Street, April 21.

DAYTON, O.—The firm of Peters & Burns, architects, has been reorganized and will hereafter be known as Peters, Hermann & Brown. The new members of the firm are George Hermann and Clifford C. Brown.

CHELSEA, MASS.—Mr. William Hart Taylor, architect, has opened a branch office near Bellingham Station, upstairs.

PITTSBURGH, PA.—Mr. Henry Hornbostel, who successfully competed for the new Soldiers' Memorial Hall, has appointed R. Maurice Trimble as consulting architect for the new building. This action was taken as the result of the law authorizing the construction of the Memorial, which required that a local architect be employed as assistant in drawing the plans for the building.

INDUSTRIAL INFORMATION

The catalogue of the **Aberthaw Construction Company**, 8 Beacon Street, Boston, Mass., is interesting as showing the numerous uses to which reinforced-concrete may be put—from retaining walls, staircases and floors, to such stupendous structures as the Harvard Stadium, which was built by the Aberthaw Construction Company, and which an architect whose opinion is printed in another column of this issue cites as one of the best examples of concrete finish.

The Clinton System of Fireproofing by the use of Clinton Electrically Welded Fabric and Clinton Wire Lath is fully described in the hundred-page catalogue of the **Clinton Wire Cloth Company**, of Clinton, Mass. Working drawings of floors for light or heavy loads, and of roofs, columns and partitions are plentifully provided, and also illustrations of important buildings in which the system has been used.

The **General Fireproofing Company**, of Youngstown, O., has brought out a reinforcing bar which they call the "Cold Twisted Lug Bar." This, as its name implies, is a bar of twisted steel provided with lugs or excrescences which prevent slipping, and so tend to retain the bond between concrete and metal. The same company makes a pin-connected girder frame which not only insures the proper distribution of the reinforcement, but also provides in an ingenious way for the continuity of the steel over the columns which support the ends of the girders. Expanded metal, herringbone steel lath and a new design of reinforcing metal called "Trussit," which allows the user to dispense with wood forms in many cases, are also manufactured by this company.

The latest pamphlet of the **Reinforced Concrete Construction Company**, Tobin Building, St. Louis, Mo., is a clever and enthusiastic brief for the use of reinforced concrete. The company act as consulting engineers and as contractors, using what they call the "Standard System" of reinforcement.

NEW CATALOG—Just off the Press

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THE above illustration is a reproduction of the cover-page of our new 64-page, complete, illustrated catalog. It tells about the Kewanee System of Water Supply, and is filled from cover to cover with valuable information on the water supply subject. This catalog shows how the Kewanee System of Water Supply is applied to farms, country and city residences, public buildings, hospitals, country clubs, apartment houses, sky scrapers, manufacturing plants, villages and small cities. Write for this catalog today. It is worth asking for. Ask for catalog No. 40.

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The interesting results of the tests, made by Prof. De Puy, at Lewis Institute, Chicago, on various styles of reinforcing bars, are set down in the latest catalogue of the **Expanded Metal and Corrugated Bar Company**, of St. Louis, Mo. The value of corrugated bars in aiding the adhesion of concrete to steel and in preventing the formation of large cracks is carefully explained. Illustrations are given of the three styles of bars made by this company and of many of the structures in which these forms of reinforcing metal have been used. The last dozen of the hundred pages in the pamphlet are devoted to formulas and tables for use in designing.

The New Century System of modern fireproof concrete and hollow tile construction is the system which was used in the well-known and well-designed Marlborough-Blenheim Hotel at Atlantic City, N. J. A pamphlet describing this construction method in some detail and showing its applicability to ordinary residence work may be obtained from the **New Century Contracting Company**, 1 Madison Avenue, New York.

It is by looking through publications such as that of the **Standard Concrete Steel Company**, 100 Broadway, New York, that the extended use of reinforced concrete can best be realized. This one contracting company is able to make reference to some four score buildings all in or near New York City into the construction of which reinforced concrete has largely entered. The various systems of floors and partitions recommended by this company are fully illustrated in the catalogue.

Mr. Ross F. Tucker, M. Am. Soc. C. E., in a paper on "The Necessity for Greater Accuracy in Concrete Construction," makes a strong plea for the use of ready assembled reinforcement for girders and columns as a safeguard against carelessness or incompetence. The system advocated by Mr. Tucker is the so-called "Unit System," which is controlled by **Tucker & Vinton**, of New York, and their licensees, the **Unit Concrete Steel Co.**, of Chicago.

The **Turner Construction Co.**, 11 Broadway, New York, makes use of the Ransome system and has executed under this system some of the most notable of reinforced-concrete buildings. Their catalogue shows illustrations of a number of these and details the results of tension tests on bars and of the fire and water tests on their construction which resulted in its approval for use in Manhattan and Brooklyn.

The **Garry Iron and Steel Co.**, Cleveland, O., send out with their catalogue actual samples of their plain and galvanized metal lath which they particularly recommend for exterior stucco work.

High carbon steel bars for reinforcing concrete are supplied by the **Inland Steel Company**, First National Bank Building, Chicago, Ill. They describe both plain and twisted bars in their latest circular.

The **Berger Mfg. Co.**, of Canton, O., best known in the past for their sheet

metal work, are putting on the market a number of products that have to do with fireproofing and concrete work. Their "Multiplex" steel plates are used for floors, and can be concreted without centering. Their "Ferro-lithic" plates are applicable as a reinforcement for roofs, walls and floors, or, when curved, for floor and bridge arches. Their "Prong Lock" system of steel studs and furring makes an effective fireproof partition.

"Ferro-inclave," which is sheet steel crimped into a dovetail section, is manufactured by the **Brown Hoisting Machine Company**, Cleveland, O. Illustrated catalogues showing the application of this material to the construction of fireproof roofs and floors may be obtained from the manufacturers.

Wall ties of galvanized steel, suitable for attaching veneering of any sort to a concrete wall, are described in a little pamphlet issued by **O. D. Levering**, 82 North Fourth Street, Columbus, O.

Chas. Mulvey Mfg. Co., 16 South Jefferson Street, Chicago, are sending out leaflets showing their stirrups, hangers, and anchors. They make a special hanger for use with concrete blocks.

"Building for Economy" and "The Cold Truth" are titles of two pamphlets published by the **Union Fibre Company**, of Winona, Minn. The former explains the use of Linofelt as a non-conductor and sound defener, and gives instructions for applying it. The latter deals with the uses of "Lith" and "Linofelt" for the insulation of cold storage plants, icehouses, etc., and as pipe and boiler coverings. It also gives the results of tests of these materials made by the **Starr Engineering Company**, of New York.

The use of concrete walls makes it desirable to provide means to render them impervious to water and to prevent the unsightly efflorescence and hair cracks which so often spoil the appearance of concrete work. The "Medusa Water-proof Compound," made by the **Sandusky Portland Cement Company**, is guaranteed to have the desired qualities. The method of using this and its cost are given in the company's pamphlet.

The **Waterproofing Company**, 147 East 35th Street, New York, using the Winslow system of waterproofing by the application of Hydrolithic Cement to the inner surfaces of brick, stone or concrete walls, guarantee to make these proof against the percolation of water, even under a pressure of 140 pounds a square inch. This little pamphlet on the subject of waterproofing makes interesting reading.

Another effective system of waterproofing is made by the **A. C. Horn Company**, New York. They make a "liquid concrete," called "Symentrex," to give uniformity of color to concrete surfaces; and a "No. 2 Dehydratine" to render the concrete impermeable to water.

Concrete Country Residences.—With the exception of a short introductory chapter on the use of concrete for residence building, this publication of the **Atlas Portland Cement Company** consists of about a hundred pages of illustrations of houses, the exterior surfaces of which are of concrete or stucco. Floor plans accompany the photographic views in many instances and the subjects are, on the whole, well chosen.

The **Universal Portland Cement Co.**, the Rookery, Chicago, Ill., has obtained permission to reprint the chapter on The Process of Concreting from Taylor & Thompson's "Concrete, Plain and Reinforced," and issues it, with their compliments, in the form of a neatly bound little book.

The **Vulcanite Portland Cement Co.**, of New York and Philadelphia, is sending out several interesting pamphlets. One treats of Fireproof Hotel Construction as Exemplified by the Marlborough-Blenheim Hotel at Atlantic City, N. J. This was written by Mr. Albert Moyer, Assoc. Am. Soc. C. E., and is an interesting and well illustrated description of the notable building. Another deals with Cement Sidewalk Paving and gives suggestions as to the best methods and specifications for sidewalks, floors and curbs and gutters. A third is devoted to the selection and proportion of aggregates for cement concrete, and a fourth tells of the best means of avoiding the annoying haircracks or crazing which are so apt to disfigure the surface of concrete.

COMPETITIONS

DECATUR, ILL.—The Pythian Home Board of the Grand Lodge, Knights of Pythias of Illinois, it is reported, has decided to call for plans or sketches for a building to be erected on the ground and cost not to exceed \$125,000, the plans to be in the hands of the secretary, E. R. Wright, Taylorville, Ill., not later than June 8. The committee will meet again in Decatur on the 10th of June to select a plan from among those submitted.

BUILDING NEWS.

(The editors greatly desire to receive information from the smaller and outlying towns as well as from the larger cities.)

ADRIAN, MICH.—W. Stearns, Secretary of the School Board, writes that it is proposed to erect a school, to cost about \$70,000. Architect, R. A. Bradley, of Ft. Wayne, Ind.

ALBANY, GA.—A post-office and courthouse, to cost \$112,500, will be erected by the United States Government in Dougherty County. James Knox Taylor, Supervising Architect, Washington, D. C.

ALEXANDRIA, LA.—It is said that the city is planning the erection of library building. Site has been chosen and plans and specifications will be wanted as soon as preliminaries are arranged; W. B. Turner, Mayor.

It is reported that plans are being solicited by the Mayor for the City Hall. The

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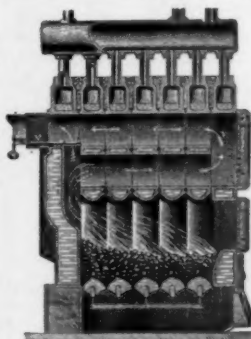
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cost, including furnishings, is not to exceed \$75,000.

ALLEGHENY, PA.—The Allegheny General Hospital, it is said, proposes to build a nurses' home at Sandusky Street and Stockton Avenue, Allegheny, to cost \$150,000. Address superintendent.

Thomas Hannah, architect, Diamond Bank Building, Pittsburgh, has completed plans for an eight-story store and office building to be erected by the Real Estate Savings and Trust Company, in Federal Street, near Park Way, Allegheny, at an approximate cost of \$160,000.

E. J. Linnekin Company, 902 Federal Street, will erect dyeing and cleaning plant on Craig Street. Cost, \$65,000. Structure will be three stories, brick and concrete, 55x100. Plans are being drawn by Architect R. G. Vandevort, First National Bank Building, Allegheny, Pa.

ATLANTA, GA.—W. G. Raoul is reported to be planning the erection of an apartment-house costing about \$80,000.

AUGUSTA, ME.—Plans are being prepared for an extension to the post-office in Kennebec County. Cost, \$150,000. James Knox Taylor, Washington, D. C., Supervising Architect.

BATTLE CREEK, MICH.—Fred Wells, Secretary Board of Education, writes that bids will probably be called for in about thirty days for a high school, to cost about \$150,000. Architects, Mills & Pruitt, of Columbus, O.

BEAVER DAM, WIS.—It is said that plans have been prepared by Buemming & Dick, architects, Milwaukee, for a three-story brick hotel to cost \$50,000.

BELOIT, WIS.—The city has voted for the erection of a \$100,000 addition to the high school. Plans by William B. Ittner, architect, of St. Louis, Mo., have been accepted.

BERKELEY, CAL.—Reports state that the Board of Regents of the University of California, at its meeting, recently voted to begin at once the erection of a new library building. The plans of John Galden Howard were submitted and approved. They call for a fireproof structure of white granite-like that of California Hall. The new structure will cost \$575,000 and will be paid for by the Charles Franklin Doe estate. The building will be located between the North Hall and California Hall.

BIRMINGHAM, ALA.—It is stated that the Farmers' Union of Alabama contemplates erecting a warehouse to cost about \$100,000.

BROOKLYN, N. Y.—The members of Unity Church, Gates Avenue and Irving Place, it is stated, contemplate erecting a new edifice on the present site, to cost \$55,000.

BRYN MAWR, PA.—Reports state that J. S. Cornell & Son, Land Title Building, Philadelphia, have been awarded a contract to construct a residence at this town for W. Hinckle Smith. It will be built of brick, four stories high, and will cost \$750,000.

BUFFALO, N. Y.—Plans are being devised by the Church of Christ, Scientist, for building this year a larger edifice than the church now occupies. Several sites are under consideration.

CHICAGO, ILL.—The A. J. Bradford Company, it is reported, will build a three-story apartment building on Monroe Street, near California Avenue. It will front 66 feet,

with a depth of 125, and will contain twenty-four apartments. It will cost \$80,000.

Shepley, Rutan & Coolidge, 84 Van Buren Street, are preparing plans for a residence to be built at Lake Shore Drive and North Avenue for Richard T. Crane, Jr. It will be three stories, of pressed brick, and is estimated to cost \$100,000.

Sherman T. Cooper will improve the property at the northwest corner of Lake Avenue and Thirty-ninth Street with a large apartment-house to cost \$100,000. It will be three stories, 97x102 feet, and will contain twenty-four apartments.

Alderman Joseph Badenoch, 116 North Division Street, chairman of the special committee having charge of making arrangements for the construction of the new city hall on the site of the present one, states that the contracts for steel, outside stone and the sinking of the foundation caissons will be let as soon as possible. No architect for the building has been engaged as yet. It is likely, however, that Holabird & Roche, Monadnock Block, architects for the county court-house, of which the new structure is to be a counterpart, will also be the architects for the city hall. It will be eleven-story, of similar materials as the county court-house, with exterior of granite and terra-cotta, and is estimated to cost \$4,500,000 to \$5,000,000.

The Seventh Regiment, I. N. G., Col. Daniel G. Moriarity, commanding, now using the Tattersall Building, southeast corner of Dearborn and Sixteenth Streets, for its armory, is planning the erection of a new armory in the near future. Chicago

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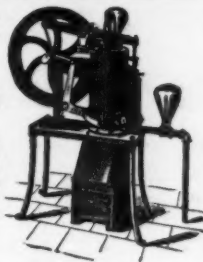
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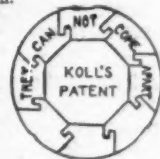
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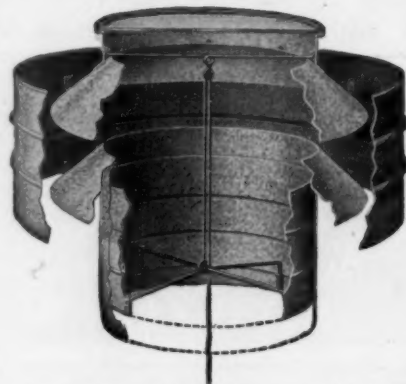
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citizens have pledged the sum of \$50,000 for a site and a bill is now before the house of the State Legislature for an appropriation of \$150,000 for a building.

It is reported that the Chicago Belting Company will construct a three-story building, 145x117 feet, on the east side of Green Street, 100 feet south of Randolph Street, to cost \$100,000.

CHICAGO HEIGHTS, ILL.—The Calumet Steel Company has purchased fifteen acres of land here, upon which they will erect buildings to cost \$200,000.

CLINTON, IA.—The Masons, it is stated, have accepted plans for a three-story, 90x95-foot temple, which is to be erected here at a cost of about \$100,000.

CORLISS, WIS.—Holy Rosary Academy has had plans prepared by Brust & Philipp, architects, Milwaukee, for a set of buildings, to cost \$125,000.

DAYTON, O.—Reports state that the Y. W. C. A. is planning the erection of a \$300,000 building.

DENVER, COL.—The Brown Palace Hotel will be sold at auction to the highest bidder in less than sixty days, and the executors of the Stratton estate will erect a huge office building on five lots at Seventeenth and Stout Streets, to cost about \$800,000.

The erection of a Temple of Mining by the people of Colorado at a cost of about \$100,000 is reported contemplated.

DETROIT, MICH.—John Kay and Wallace Franklin, of the firm of Westinghouse, Church, Kerr & Co., are reported to be interested in erecting an arcade at Bagley Avenue, Park Street and Washington Bou-

levard, which will cost about \$1,500,000, and for which plans are now being prepared.

DULUTH, MINN.—The Bethel Society is stated to be having plans prepared for a four or five-story stone and brick building to cost about \$150,000.

The Great Northern Railroad Line will erect a freight station at Michigan Street and Sixth Avenue, West, to cost \$200,000. A. H. Hoagland, St. Paul, Minn., is Chief Engineer.

ELLENDALE, N. D.—Trustees of the State Industrial School will receive bids until May 15 for the erection of a girls' dormitory, on plans by Jeffers & Henry, architects, Aberdeen, S. D.

FAIRBURY, NEB.—It is stated that the Boone Hotel Company will erect a modern hotel building. Cost, \$60,000.

FORD CITY, PA.—The citizens voted on April 14 to issue bonds to the extent of \$40,000 for the erection of a new school building.

GARDEN CITY, KAN.—J. J. Tutwiler has made the plans for a residence for Judge Thompson. The building will be of the colonial style of architecture. Large porches will be added.

GETTYSBURG, PA.—The First National Bank will erect new building, brick and terra-cotta, three stories and basement, 84x60. David Nutter is president. Cost, \$40,000. Plans have been drawn by Architect Herman Miller, Crozier Building, Philadelphia. Will contain banking room on first floor; barber shop, directors' room and toilet rooms in basement; offices on second floor and two auditoriums on third

floor for lodge purposes; steam-heating system.

GRAND FORKS, N. D.—Dinnie Bros. are reported to be contemplating the erection of a three-story brick building on Third Street, to cost \$75,000.

GREENSBURG, PA.—The First United Presbyterian congregation will build a church. Cost, \$35,000. No architect selected. Address Rev. Dr. John B. Wilson, pastor.

HARTFORD CITY, IND.—The Methodists are said to be planning the erection of a new edifice to replace the present structure on Washington Street, the cost to be about \$50,000.

HELENA, MONT.—The State Board of Education will open bids at its June meeting for the erection of additional buildings at the several State institutions. There will be an \$80,000 building at the Agricultural College, a \$50,000 library at the State University, and other buildings. Bids will be opened June 1 for the metallurgical and heating plants for the school of mines.

INDIANAPOLIS, IND.—Folz & Parker, Union Trust Building, are preparing plans for a building for the Y. M. C. A., to cost \$250,000. W. H. Godard, North Illinois Street, is secretary.

JAMESTOWN, N. Y.—The erection of a \$75,000 building for the Y. W. C. A. is reported contemplated.

KANSAS CITY, KAN.—A plan to build a new county court-house and city building, to cost about \$150,000, is being formulated.

KEARNEY, NEB.—Plans are being consid-



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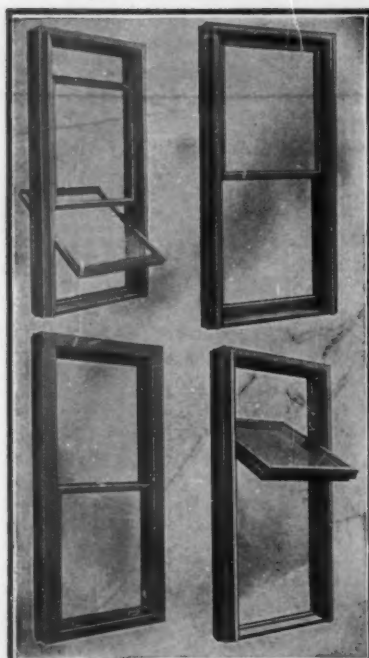
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ered for a \$34,000 church by St. Luke's Episcopal Society.

LA CROSSE, WIS.—The architect has not yet been appointed for the proposed city auditorium, which will cost about \$65,000. W. S. Woods, City Engineer.

LEWISTOWN, MONT.—J. P. Barnes and others will erect a hotel to cost \$100,000.

LINCOLN, NEB.—Reports state that the Board of Regents of the University of Nebraska, at Lincoln, recently authorized the expenditure of \$100,000 for a new mechanical laboratory building.

Plans for the Methodist Church building to be erected at University Place, it is said, have been decided on and are being prepared by Woods & Corder, who will have them ready for the contractors by May 15. The new structure, which will be erected on the northwest corner of the Wesleyan University campus, will be of Grecian architecture. The dimensions of the main structure will be 96x114 feet, with a Sunday school room 40x92 feet. Light colored brick, with stone trimmings, will be used. The total seating capacity will be approximately 2,300. The structure will be modern in every particular and cost \$75,000.

LITTLE ROCK, ARK.—Charles L. Thompson, Arkansas Building, has prepared plans for a four-story basement and attic convent, 200x100 feet, to be erected at Pulaski Heights, for the Sisters of Mercy. The structure will be built of brick and stone with galvanized iron cornices, plate glass, marble and tile work, hard plaster, tin roof, architectural and structural iron and steel

work, gas and electric fixtures, cabinet mantels and steam heat. Cost, \$250,000.

LOS ANGELES, CAL.—H. Albright is reported to be preparing plans for a ten-story office building for the Consolidated Realty Company, to be erected on Sixth and Hill Streets, to cost about \$400,000.

LOUISVILLE, KY.—Architects Mann & MacNeille, 2 East Thirty-third Street, New York, N. Y., will prepare plans for a fifteen-story office building in Louisville. Estimated cost, \$600,000.

MEMPHIS, TENN.—Reports state that the Memphis Terminal Railroad Company will proceed to arrange for building proposed union depot and terminals. Previous announcements stated the plans to call for main station, 200x200 feet, with 50-foot platform all around; yard with space for 440 coaches, etc.; amount reported to be expended, \$3,000,000 for passenger station and \$2,000,000 for terminals. John H. Watson, president.

MENOMINEE, MICH.—The bill for the new \$50,000 training school for Menominee County has been passed by the Michigan Legislature, and the matter will be taken up at once by the county board.

MILWAUKEE, WIS.—Architects H. C. Koch & Sons, 120 Wisconsin Street, have submitted tentative plans for a new county court-house, to cost about \$1,500,000. Plans were also submitted for a new wing which may be added to the present court-house at a cost of \$300,000. The plans for the new building provide for five stories, of brick and stone.

Reports state that plans by Garden & Martin, architects, Chicago, have been accepted for the new brick St. Mary's Hospital building. Cost, \$450,000.

Buemming & Dick, architects, 1107 Pabst Building, will be ready for bids on the new St. John's Cathedral building in about three weeks. The building is to be erected at Van Buren and Jackson Streets, and will cost about \$150,000. It will be one block long, with entrances at both ends. The main auditorium will seat 650 people, with room for an additional 275 in the balcony. In connection with the main auditorium there will be a complete club-room outfit, gymnasium and bowling alley.

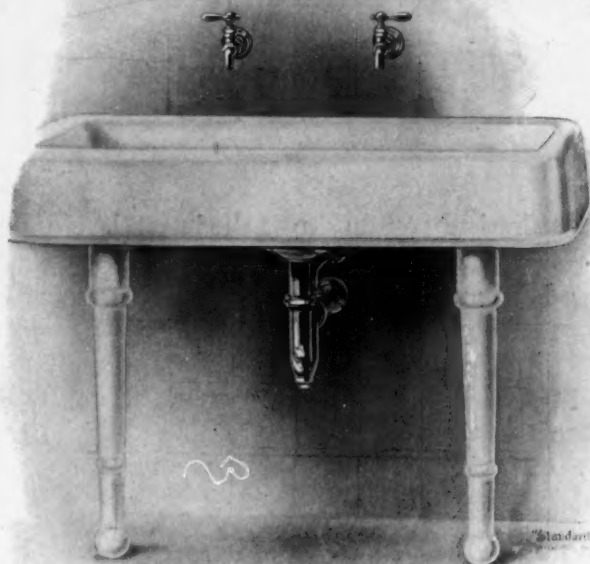
Mrs. Rudolph Tragart, Wauwatosa Avenue, has accepted plans of Gustav Stickley, the "Craftsman," New York City, for a \$50,000 residence, two-story, brick.

Plans for a \$60,000 residence for William Ott, it is said, are being prepared by Ferry & Clas, architects. The building will be of brick and steel construction, with brick or stone walls.

MINNEAPOLIS, MINN.—The labor unions of the city are said to be planning the erection of a \$100,000 building.

MONTREAL, CAN.—The authorities at McGill University, it is said, are having plans prepared for the rebuilding of the engineering building recently destroyed by fire, at a loss of \$420,000 for building and \$350,000 for equipment. W. Peterson is principal.

MORRISTOWN, N. J.—The United Electric Company is planning the erection of a new



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\$150,000 power plant here; to be completed, if possible, within a year's time.

NASHVILLE, TENN.—Draughon's Practical Business College Company has purchased site 50x120 feet on which to erect building, six stories and basement, equipped with electrical elevator service. Total cost of building about \$50,000. Prof. John F. Draughon is president.

NEWARK, N. J.—Plans are in progress, and the architects will be ready for estimates this week on a parochial school to be erected by the Church of the Sacred Heart, of Elizabeth. Specifications have not been written, but the building will be of brick and stone, three stories in height, measure 70x116 feet, and contain eighteen assembly rooms. The architect, C. Godfrey Poggie, of 2 Julian Place, has designed a modern school building with all improvements and to cost \$70,000.

NEWARK, O.—Plans have been prepared by Architect Carl E. Howell, of Philadelphia, for a first-class hotel, to be erected by the recently incorporated Warden Hotel Company. Capital stock, \$200,000.

NEWCASTLE, PA.—A brick and steel addition to the present High School building will be erected at this place. Cost, \$100,000. Plans are being drawn by Architect J. C. Fulton, Uniontown, Pa.

NEW HAVEN, CONN.—Architects have completed the plans for the proposed Catholic hospital on Chapel Street. After some minor changes have been made in the plans, estimates will be called for at once.

NEW KENSINGTON, PA.—Plans have been drawn by Architect W. S. Eckles, New-castle, Pa., for new High School, to cost

\$35,000. Brick, three stories, 70x90 feet, to contain twelve rooms. Dr. G. T. Lemon, New Kensington, is president of Board of Education.

NEW YORK, N. Y.—John E. Olson, 39 West Twenty-fifth Street, will erect a twelve-story mercantile building at the corner of Spring and Crosby Streets, lot 100x100 feet, which has been leased to a company which will use the building for its own business.

Plans have been filed with the Buildings Superintendent for an eleven-story apartment-house to be erected at the corner of Lexington Avenue and Sixty-seventh Street, for the Nine Hundred and One Lexington Avenue Corporation, of which Walter G. Merritt, 27 William Street, is president. The structure will have a frontage of 90.5 feet and a depth of 59 feet, and will have accommodation for seventeen families. It is to cost \$275,000. Rossiter & Wright are architects.

Although plans have not yet actually been settled upon for the new twenty-story office building which is to be erected on the plot at Nos. 15-17-19 Maiden Lane, running through to 18-20-22 John Street, it is stated that Messrs. Clinton & Russell, 32 Nassau Street, have been commissioned to make preliminary drawings, and in all probability will be the architects. The building will be put up chiefly by Edward Holbrook, president of the Gorham Manufacturing Company, who will organize a building company. It is expected to have the structure completed, ready for occupancy by May, 1908. With ground and building, the approximate cost is estimated at about \$2,000,-

000. There will be an arcade extending through the center of the building from street to street, making this the first arcade office building east of Broadway.

OKLAHOMA, OKLA.—The Oklahoma City Railway Company, it is stated, is having plans and specifications prepared for an office building to cost about \$300,000. The contract for construction work will be let soon. Charles W. Ford is general superintendent, Oklahoma.

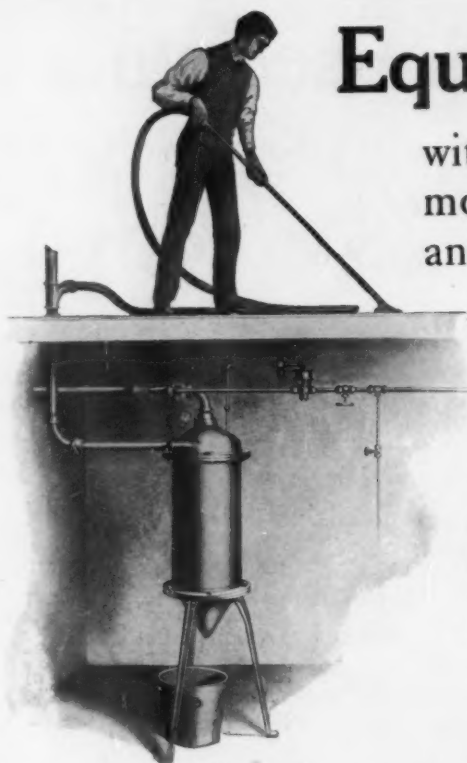
OLEAN, N. Y.—At a meeting of the Public Library Board it was decided to ask architects to submit preliminary drawings for the consideration of the Board, providing for a reading room, a children's room, stack room, reference room, historical room, public document room and such other rooms as it is thought might be desirable for a library. W. C. A. Quirin is chairman of the committee.

OMAHA, NEB.—Plans have been prepared by Frederick N. Clark, architect, for the new Christian Science Church at Twenty-fourth and St. Mary's Avenue. Cost, \$60,000.

Herman Cohn, of the Nebraska Clothing Company, has definitely decided that his new structure on Sixteenth Street, between Capital Avenue and Davenport Street, will be a four-story hotel building, and will cost \$250,000. The hotel will be modern in every respect, having over 200 large, spacious rooms.

Plans are being prepared, it is said, for a twelve-story hotel building at Sixteenth and Howard Streets, to be erected by Peter E. Iler. Cost, \$1,000,000.

It is reported that John D. Creighton, of



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with cleaning apparatus that is modern and economical to install and operate.

The illustration shows the latest development of mechanical cleaning apparatus. It consists of a vacuum producing valve and tank in basement connected to the live steam pipes of the building and then connected to risers distributed at convenient points, which by the application of tools connected to hose removes all the dust, dirt, etc., from the floors, carpets, walls, etc., and deposits them in the dust collector in the basement.

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ST. LOUIS, MO.

Omaha, will erect an eight-story fireproof hotel, to cost \$250,000.

George & Co. will erect a six-story office building on Sixteenth and Harney Streets, to cost about \$100,000.

A ten-story dry goods building of brick and stone, to cost about \$250,000, will be built by Hayden Bros. on their property at the corner of Tenth and Dodge Streets, at once. The property is 132 feet square and the building will occupy the entire space.

J. A. Swanson, it is said, will erect a reinforced-concrete building, five-story, at Sixteenth and Harney Streets. Fisher & Lawrie, architects. Cost, \$125,000.

Fairbanks, Morse & Co. will erect a six-story warehouse at Eleventh and Farnam Streets of reinforced-concrete construction.

ORANGE, N. J.—Papers have been filed with the County Clerk incorporating the Essex Inn Company with a capital stock of \$100,000. The company intends building a hotel on the Orange Mountain at the top of the old cable road.

PARSONS, KAN.—The building committee of Topeka (S. C. Elliott, secretary) is reported to be planning improvements to the State Hospital. Cost, \$85,000.

PHILADELPHIA, PA.—Plans are being prepared by Cope & Stewardson, architects, 320 Walnut Street, for a building at Sixteenth and Arch Streets, for the Franklin Institute. The building will be of brick and terra-cotta construction, five stories high, and will cost \$300,000.

The Maison Estate will erect an eight-story manufacturing plant at the corner of Eleventh and Market Streets. It will be of

brick and fireproof construction, 52x180 feet, and cost \$400,000.

It is stated that a committee has been appointed, of which William Reilly is chairman, to have plans prepared for a parish building to be erected for the Church of the Immaculate Conception on East Cheltenham Avenue, at a cost of \$50,000.

PITTSBURGH, PA.—Architect J. Lewis Beatty, Jackson Building, Pittsburgh, Pa., it is stated, has prepared plans for a \$50,000 residence for Captain Alfred Hicks, Fifth Avenue, Pittsburgh.

Reports state that Architect Henry Hornbostel, of Palmer & Hornbostel, Empire Building, Pittsburgh, Pa., has selected Architect R. Maurice Trimble, Ferguson Building, Pittsburgh, Pa., to be his assistant in building the Soldiers' and Sailors' Memorial of Allegheny County on the Schenley farm. This is according with the rulings of the County Commissioners, which provided that a local architect should be employed to assist in and supervise the work.

It is reported that the members of the South Avenue M. E. Church contemplate erecting an edifice to cost \$100,000.

Rutan & Russell, architects, 255 Fifth Avenue, have prepared plans and will take bids at once for a bank building, to be erected at Fifth Avenue and Wood Street, for the First National Bank. The structure is to be 75 to 80 feet high, of granite, with marble and tile work, structural iron and steel, terra-cotta, electric-light fixtures. Cost, \$500,000.

O. Z. Brunner, it is stated, will build a four-story fireproof apartment-house at

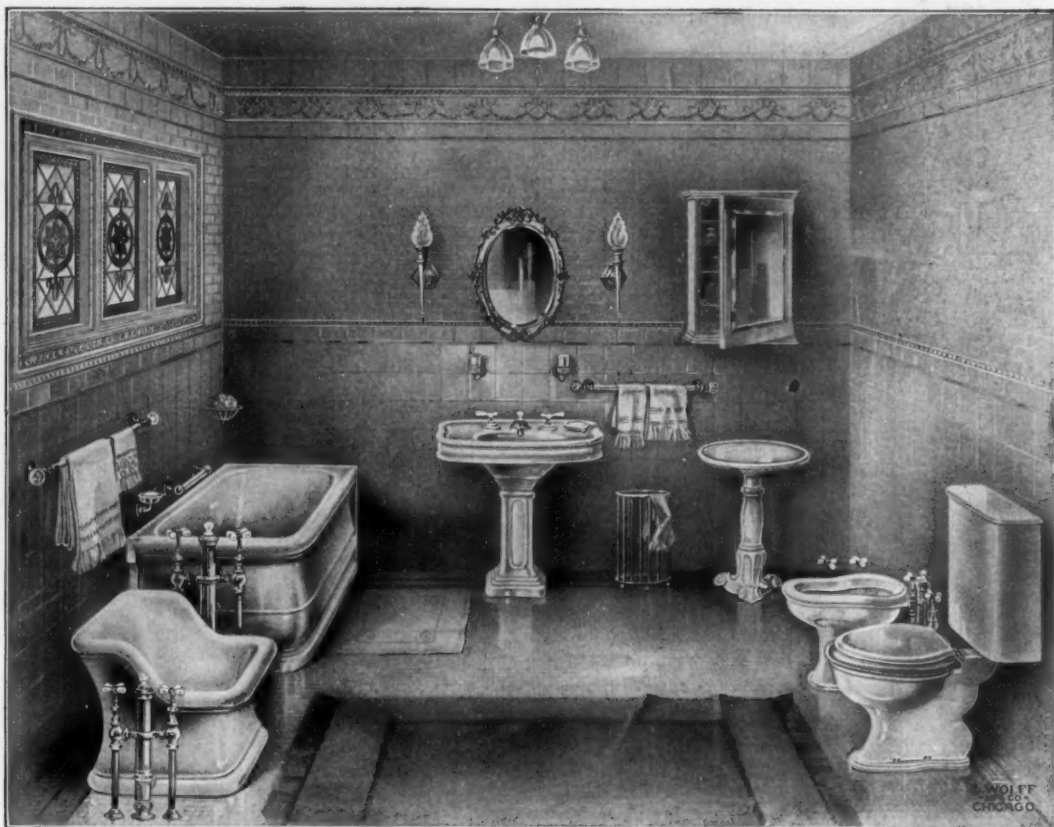
North Highland Avenue. Cost, \$80,000. No architect selected.

Palmer & Hornbostel, New York and Pittsburgh, and R. Maurice Trimble, Pittsburgh, have designed and submitted to the County Commissioners plan for large addition to the Allegheny County court-house. Design consists of a mammoth tower 90x90 feet by 700 feet high, to cost about \$2,000,000, to be constructed of skeleton steel frame and granite, the structure to be erected in the areaway of the court-house. Commissioners are considering design. The tower is designed to carry out the present architectural scheme of the court-house, which was designed by the late H. H. Richardson, of Boston.

H. C. Frick has offered to contribute \$200,000 to the Central Young Women's Christian Association for a building fund if the Association will raise \$300,000, making a fund of \$500,000 with which to erect a large, new home. The Association will start at once a campaign to raise the amount necessary.

Alden & Harlow, Farmer's Bank Building, Pittsburgh, have drawn plans for South Side branch of the Carnegie Library, and will secure bids on same at once. W. N. Frew, Pittsburgh, is president of the Board of Trustees.

The Building Committee of the Central Board of Education has invited architects to submit competitive plans for the new High School to be erected in this city. Fourteen architects have signified their intention to enter the competition as follows: S. R. Beman, Berger Building, Pittsburgh; the E. M. Butz Co., Bessemer Building,



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Pittsburgh; J. B. Elliott, Publication Building, Pittsburgh; Wm. Kaufman, Lewis Block, Pittsburgh; H. E. Mills, House Building, Pittsburgh; McCollum & Dowler, 327 Fourth Avenue, Pittsburgh; F. J. Osterling, Times Building, Pittsburgh; U. J. L. Peoples, Times Building, Pittsburgh; F. C. Sauer, 804 Penn Avenue, Pittsburgh; E. J. Schellentrager, 431 Fifth Avenue, Pittsburgh; Thomas H. Scott, Machesney Building, Pittsburgh; Lloyd Titus and Charles Oelschlager, Philadelphia, and Ullom & Frost, East Liverpool, O. Cost of structure, \$1,200,000. Architects have until May 27 to prepare and submit plans.

Charles Bickel, 524 Penn Avenue, has drawn plans for six-story brick and stone warehouse, 80x128, to be erected by Boggs & Buhl, Allegheny, Pa., on West Parkway. Structure will cost \$100,000. Henry Boggs, 501 Federal Street, Allegheny, is president of company.

PORTLAND, ORE.—Dr. C. W. Cornelius, it is reported, intends erecting a six-story brick hotel and store building at Alder and Park Streets, to cost \$75,000.

ROCK ISLAND, ILL.—The Rock Island Safety Deposit Vault Company, it is said, has awarded the contracts for a six-story fireproof reinforced-concrete office building to E. E. Brown & Co., Chamber of Commerce Building. Estimated cost, \$150,000. O. Z. Cervin, Hessel Building, Moline, is architect.

ST. JOSEPH, MO.—The Buchanan Hotel Company, it is said, are preparing to erect a fireproof nine-story hotel building.

Eames & Young, Lincoln Trust Building,

St. Louis, and E. J. Eckel, Commercial Building, St. Joseph, have prepared plans for an eight-story hotel building to cost \$300,000.

ST. LOUIS, MO.—Mauran, Russell & Garden, Chemical Building, are preparing plans for building to be erected on property owned by the J. G. Chapman estate. The site is 50x150 feet, and the building will be eight-story reinforced-concrete, with steam heat, sprinkler system, electric passenger and freight elevators. Cost, \$150,000.

James H. McTagus is reported to be arranging plans for a hotel at Pine and Ninth Streets. Cost, \$300,000.

Reports state that the Lean-Gould Advertising Company has selected a site at Washington Avenue and Charles Street, on which it is proposed to erect an eight-story building to cost about \$150,000.

The proposed Central Presbyterian Church, to be erected at Delmar and Clara Avenues, will cost \$150,000.

The Mercantile Trust Company, during the last week, concluded a sale of a large tract of land in St. Louis County, at the intersection of the Price and Laude roads. The tract comprises 162 acres. The purchaser was the St. Louis Roman Catholic Theological Seminary, better known as the Kenrick Seminary. The building at Nineteenth and Cass Avenue has been found inadequate for its purposes, and new buildings are planned. The Rev. Patrick W. Tallon, pastor of the Holy Name Church, and Rev. E. J. Shea, pastor of St. Kevin's Church, president and secretary, respectively, of the seminary, conducted the negotiations for that institution.

ST. PAUL, MINN.—Plans have been prepared by Architects Thori, Alban & Fisher, 508 Chamber of Commerce Building, for the Norwegian Lutheran Deaconess Institute Hospital, 120x90 feet, to be erected on Twenty-third Street and Fifteenth Avenue. Cost, \$50,000.

SALEM, MASS.—Bids are asked until May 9 by the County Commissioners for constructing a two-story fireproof granite building for the Registry of Deeds. Cost of building, \$300,000; equipment, \$100,000. Clarence Blackall, 20 Beacon Street, Boston, is architect.

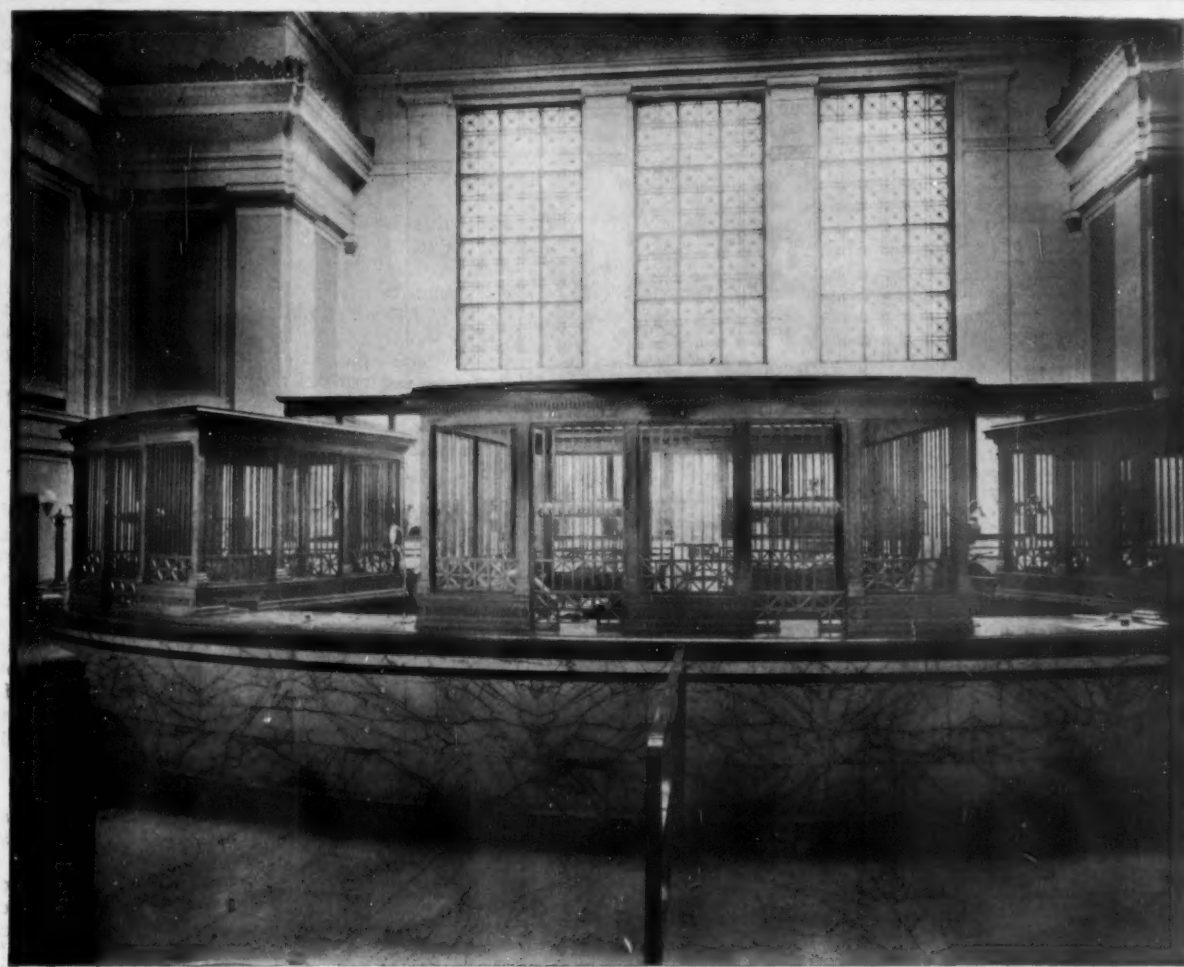
SAN ANTONIO, TEX.—George Danks, 324 Mermod & Jackard Building, St. Louis, Mo., is preparing plans for an eight-story hotel to be erected at San Antonio at a cost of \$500,000.

SAN FRANCISCO, CAL.—An application for a permit to erect a five-story hotel on Larkin and McAllister Streets, has been filed by Edward Rolkin, architect. Estimated cost of the building, \$300,000.

L. B. Dutton, Chronicle Building, it is stated, has prepared plans for the Metropolitan Trust and Savings Bank Building, to be erected at the corner of Market and New Montgomery Streets. Estimated cost, \$600,000.

Reports state that the Alaska Commercial Company, Kohl Building, will erect a twelve-story Class A structure at the corner of California and Sansome Streets, to cost \$500,000.

SCRANTON, PA.—Plans for a new passenger station at Scranton, to cost \$600,000, have been approved by the Lackawanna management. It is to be built of Indiana



SUFFOLK SAVINGS BANK FOR SEAMEN AND OTHERS, BOSTON, MASS.

CASS GILBERT, Architect

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limestone, with marble columns as the central feature, and is intended to be one of the finest structures of its kind. Estimates are being received. The station building will be 250 feet long, 83 feet wide, and five stories high. It will be built fireproof, of brick and steel construction, with concrete walls and partitions. The main waiting room will be 110 feet long and 40 feet wide, and will be covered at the third story by a large skylight of art glass, affording space for one balcony. The interior will be finished in marble and faience.

SEATTLE, WASH.—The Trustees of the Children's Home are stated to be contemplating the erection of a building to cost \$50,000.

Graham & Myers, architects, have plans for a \$300,000 building for C. J. Smith, of steel and pressed brick.

Plans are being prepared for a hospital to be erected by the Sisters of Providence. Cost, \$300,000. Sommervell & Cote, Walker Building, architects.

SPOKANE, WASH.—The Spokane Club will erect a club building to cost about \$150,000.

The Union Trust Company is reported to have secured a site at Riverside Avenue and Stevens Street, on which it is proposed erecting a building ten or twelve stories high, costing about \$400,000. J. C. Cunningham is secretary.

SPRINGFIELD, MASS.—The Phelps Publishing Company is reported to have had tentative plans prepared for a six or eight-story reinforced-concrete building to be erected on Worthington and Water Streets.

TACOMA, WASH.—It is reported that plans are being prepared for a hotel on C Street, to contain 1,000 rooms, for John C. Donnelly and Edmund Croft. Cost, \$750,000.

TOLEDO, O.—E. O. Fallis, The Nasby, it is said, is preparing plans for a bank building for the Peoples' Banking and Loan Company. Estimated cost, \$100,000.

TORONTO, ONT.—The Manufacturers' Life Insurance Company, according to reports, has secured a site on Bay and Melada Streets, and intends erecting a twelve-story building, costing about \$600,000.

WALLA WALLA, WASH.—Sidney Menkis, secretary of the Fifty Thousand Club, is reported to be organizing a company for the purpose of erecting a seven-story hotel on Main Street. Cost, \$200,000.

WASHINGTON, D. C.—Thompson-Starrett Co., 49-51 Wall Street, New York, and Commercial Bank Building, Washington, D. C., has the general contract to erect the six-story Masonic Temple at Washington, to cost about \$350,000. Messrs. Wood, Donn & Deming, 808 Seventeenth Street, N. W., Washington, D. C., are the architects.

Bids will be received until May 27 for constructing, including plumbing, heating apparatus, electric work and lift, of an extension to the United States Custom House, Washington County. James Knox Taylor, Supervising Architect, Washington, D. C.

It is said that Fissell & Wagner, Home Life Building, have secured the contract for constructing a brick and stone college building for the Paulist Fathers. Estimated cost, \$400,000.

WATERTOWN, N. Y.—Directors of the New York Central and Hudson River Railroad Company propose erecting a depot here to cost about \$250,000. A. Forsyth

is Supervisor Bridges and Buildings, Watertown.

WEST ORANGE, N. J.—Plans have been prepared for a hotel on the Orange Mountain in West Orange. Cost, \$100,000. Address Orylle E. Freeman, West Orange.

WHEELING, W. VA.—Architect Sidney F. Heckert, 341 Sixth Avenue, Pittsburgh, has drawn plans for brick and stone three-story laundry building, 50x120, to be erected by the Sisters of the Good Shepherd. Cost, \$40,000.

WICHITA, KAN.—Reports state that a building permit was issued to F. G. Smyth & Son for the construction of a six-story steel and concrete construction building, to cost between \$100,000 and \$110,000, and to be located at the northeast corner of Douglas and Lawrence Avenues.

NOTES AND CLIPPINGS.

A NEW CABINET-WOOD.—One of the latest things in the way of a fancy wood for interior decorating and cabinet work is the Tasmanian myrtle. It is rich pink in color, very close-grained and moderately hard.

CREMATION IN ENGLAND.—Cremation is increasing in Great Britain, the number of bodies cremated being 742 in 1906, against 604 in 1905. Consul Mahin, at Nottingham, writes: "There are crematories at Leicester, Hull, Leeds, Ilford, Bradford and Sheffield, owned by the respective municipalities, besides several conducted by companies in other cities. The operation of cremation requires about an hour and a half, the ashes are perfectly white and weigh four pounds, and the cost is about \$25. Cremation is now fully recognized by law in Great Britain, though strictly guarded."—*Chicago News*.

KEYHOLD TENURE.—The curious custom of keyhold tenure still prevails at Crowland, the famous abbey town in the Lincolnshire fens, where there are a number of cottages which are neither copyhold, freehold nor leasehold. They were originally built on waste land, and in each case the possessor of the key holds an undisputed tenancy. Although some of the occupiers have replaced the mud and thatched dwellings of antiquity with brick and slated buildings, they have no power to sell or will them away, for they have no deeds. On a tenant dying the first person to cross the threshold takes his place, if he so desires. Many devices have been resorted to to obtain the keys. The properties carry a county vote, but the Poor Law guardians always refuse to grant relief to the tenants. —*London Globe*.

WHY RED CEDAR IS SCARCE.—The lead pencil is one of the most common articles in everyday use, and nearly 320,000,000 pencils are manufactured in this country every year. To manufacture these millions of pencils there are required 110,000 tons, or 7,300,000 cubic feet, of wood, so that each day in the year 300 tons or 20,000 cubic feet of wood are used for pencils. Since practically all of the wood is red cedar, and since the pencil industry is steadily growing, the supply of red cedar is greatly depleted; yet no substitute has been found for it. Leaving out of consideration the imported pencils, says *The Boston Transcript*, the average educated American over ten years

of age uses six pencils of home manufacture each year. Ten years ago he used less than five. Red cedar has a soft, straight grain, and when grown under the best conditions is very free from defects. Because of its peculiar qualities no equally good substitute for it has ever been found, and it is doubtful if any other wood-using industry is so dependent upon a single species as the pencil industry is dependent upon red cedar. In fact, red cedar suitable for pencil manufacture is the only wood the price of which is always quoted by the pound. Strange as it may seem, no steps have heretofore been taken to provide for a future supply of red cedar. This has been largely due to a lack of information on the rate of growth and the habits of the tree, and to the widespread belief that second-growth red cedar never reaches merchantable size. In accordance with its policy toward the conservation and economic use of commercial woods, the Government Forest Service has made a careful study of red cedar, and has come to the conclusion that it can profitably be grown in the regions of its development. Several changes are recommended in present forest management in order to secure the desired growth. In the Southern forests the cedar will have to be given a better chance instead of being considered, as now, a negligible quantity in its younger stages, and many of the forest-grown trees which are now cut for fence posts can profitably be left to attain their full development and thus become available for pencil wood.

WHAT IRRIGATION IS ACCOMPLISHING.—Accord to official figures, says *The Chicago News*, since the reclamation law was enacted by Congress in 1902 eight towns have been built and ten thousand people have settled on what were desert lands. One hundred miles of branch railways have been built, 1,267 miles of canals have been dug, many of which carry whole rivers, and forty-seven tunnels have been excavated. It is estimated that the territory embraced in what is known as the arid regions of the United States covers 600,000,000 acres, of which about 60,000,000 acres are subject to irrigation and can be converted into farms fully as productive as lands in the most favored sections.—*N. Y. Tribune*.

THE MILAN-PAVIA CANAL AN OLD ONE.—There is now a canal connection between Milan and Pavia, about twenty-five miles long, through an ancient channel, which has been in use for more than six hundred years. Thousands of canal-boats from the Po go to Milan every year, pass through the city's canal system, which is founded on the old defensive moats of the Middle Ages, and proceed northward to the Italian lakes, or vice versa.—*New York Tribune*.

CHURCH BUILT BY PRISONERS-OF-WAR.—An appeal is being made for help in the restoration of the Church of St. Michael and All Angels, in the parish of Lydford, England. Standing on the heights of Dartmoor, this church of the highest inhabited village and of the largest parish in England, was built in the early days of the nineteenth century by the French and American prisoners-of-war, and is doubtless

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the only church in the United Kingdom built under such circumstances.—*Exchange*.

CEREAL RUBBER.—The cereal rubber of William Threlfall Carr, an English inventor, was suggested by the observation—familiar to country boys—that the chewing of wheat grains produces a sticky, gummy mass. Experiment shows that the *ptyalin* of the saliva acts as a ferment and combines with starch to form dextrose, which special treatment converts into rubber. The *ptyalin* of saliva is found to be essential, but this has been obtained in remarkable quantity from hogs. Different kinds of rubber result from arresting the fermentation, and the six grades so far produced are designed for waterproofing, tubes and other flexible material, tires, floor coverings, paving and golf balls. Unlike other rubber substitutes, this can be vulcanized or hardened by sulphur.—*Boston Transcript*.

EMIGRATION FROM ITALY.—U. S. Consul J. E. Dunning, of Milan, reports as follows concerning Italian emigration: During the year 1906, 417,573 emigrants departed from Italy, and 132,190 former emigrants returned to the old country. In 1905 the ebb was 350,381, and the inflow 102,889, so that the emigration for 1906 was greater than that for 1905 by about 67,000 persons. The greater number of emigrants went to the United States, the Italian records showing 287,090 persons so departing. A total of 114,818 went to Argentina, 13,143 to

Brazil, 1,097 to Central America, 1,148 to points east of Suez, and 277 to other countries. The United States also contributed the largest number of returning fortune seekers, the total for 1906 being 94,445; from Argentina, 24,602; from Brazil, 11,861, and from Central America, 571.

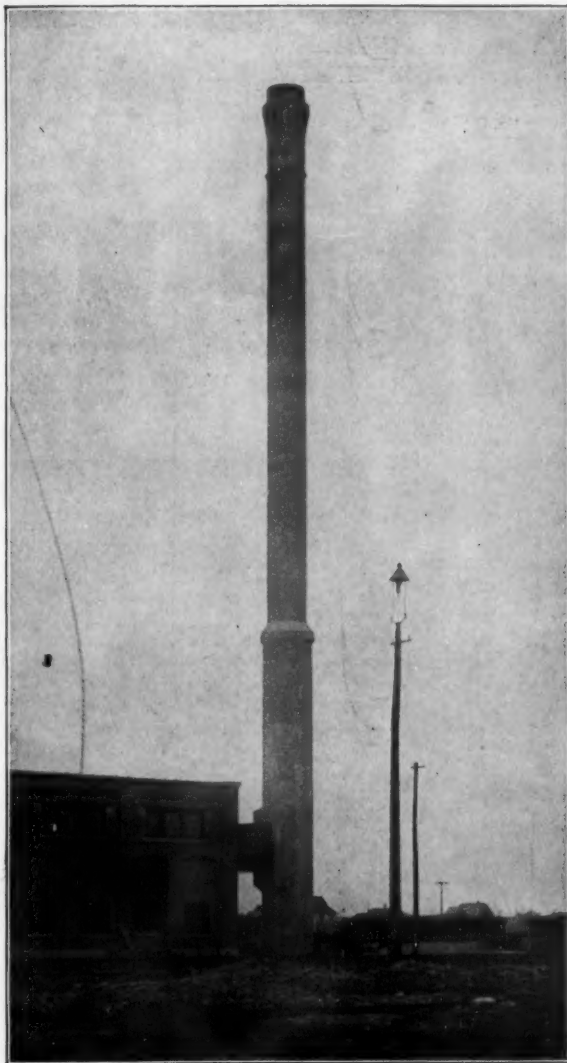
USED AN AUTO TO OPERATE A TACKLE.—Lewis A. Dow, a Boston architect and builder, used a 10-horsepower automobile in building a church. Mr. Dow was awarded the contract for erecting a Methodist Episcopal church in Medford. When the foundation for the structure was completed the contractor was on the point of hiring a hoisting engine, when he thought of his automobile as a substitute. He first rigged up a tackle and experimented with a small load, which proved no work at all for the car. When the success of the experiment was assured, the machine was called on to hoist heavier loads, and it did everything asked of it in a most satisfactory manner. He found it perfectly easy for the machine to hoist a loaded shale box weighing 1,500 pounds. For two months the machine worked steadily, raising this load from 7 A.M. to 6 P.M., lifting the weights from forty to seventy feet. The large stone ornaments at the base of the tower of the church weigh 1,850 pounds each, and they were raised and lowered into position at a height of sixty-five feet, and were deposited in their final resting place with the assistance of three men.—*Exchange*.

A FLOODABLE COAL-PIT.—Storing coal in pits capable of being flooded has been adopted at the new plant of an American electric-power company at Hawthorne, Ill. A plot about 320 feet by 75 feet has been excavated to a depth of about 12 feet, and lined and sub-divided by concrete walls into twelve 80 foot by 25 foot pits. Their bottom is the clay subsoil, and the walls are carried about 4 feet above ground. The pits can be flooded by means of a 12-inch water main. The longitudinal division walls are wide enough to carry the tracks on which the coal is delivered.—*Scientific American*.

CHURCH BUILT FROM ONE TREE.—A large Baptist church that stands in the city of Santa Rosa, Cal., enjoys the distinction of having been constructed entirely from a single tree. Of course, that includes the woodwork of the structure. The tree from which the timbers, lumber and shingles were cut was a giant California redwood. A considerable quantity of the lumber was left over after the church building was completed. This building has a spire seventy feet high; an audience room capable of seating 300; a parlor capable of seating eighty; a pastor's study fourteen by twenty feet; a vestibule and toilet room. The building is thirty-five by eighty feet. There are not many buildings in the country all the timber of which came from a single tree.—*The Technical World*.

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For CLASSIFIED LIST, See Page xlv.

A Aberthaw Construction Co.xvi Aisen Cement.lxvii American Concrete Steel Co.x American School of Correspondence.xlv American Luxfer Prism Co.liv, lv American Mason Safety Tread Co.lxviii American Sheet & Tin Plate Co.xxviii Associated Expanded Metal Co.xxix Atlas Engine Works.lii Atlas Portland Cement Co.lxvii	Engineering News Pub. Co.lix Expanded Metal and Corrugated Bar Co.vii F Fisher Co., Robert C.lxviii French & Co., Samuel H.xxix Frink, I. P.xxix G Genasco Roofing Co.xxvii General Compressed Air and Vacuum Co.viii, ix General Fireproofing Co.lxvii Globe Ventilator Co.lxvii Gorham Mfg. Co.xxxvii Gurney Heater Mfg. Co.lxviii	L Lane, John.xliv Loomis-Manning Filter Co.xxiv Lufkin Rule Co.xxix	Society of Beaux-Arts Architects.xxiv Soltman, E. G.xliv Standard Sanitary Mfg. Co.xxxiii Stanley Works.xxix Sun Dial Co.xlv
B Barber Asphalt Paving Co.e-o-w, xiv Batterson & Eisele.xxxi Benger Mfg. Co.lxviii Bird & Sons, P. W.xxxix Burt Mfg. Co.xxxix	H Hartmann Bros. Mfg. Co.xxix Hartford Faience Co.xlv Harvard University.xlv Hayes, Geo.xxix Hennebique Construction Co.xi Holophane Glass Co.xxix Horn, A. C., Co.lii	M Mass. Institute of Technology.xxiv Miller & Bro., James A.viii Monarch Water Heater Co.xxxvi	T Tacony Iron Co.lvii Taylor, J. W.xxiv Technical Supply Co.xlv Thorn Co., J. S.e-o-w, xviii Thorp Fireproof Door Co.xliii Troy Laundry Machinery Co.lxviii Trussed Concrete Steel Co.xii, xiii Turner Construction Co.xvii
C Campbell, Walter M.xxiv Cardinell-Vincent Co.lxvi Cement Age Co.lxviii Chappell Furnace Co.lxviii Chicago Portland Cement Co.xlviii Clark, M. C., Pub. Co.lxvi Clinton Wire Cloth Co.xiv, xv, xxxi Contractors' Supply & Equipment Co.lvi Corrugated Concrete Pile Co.xxvii Cutler Mfg. Co.xxvii	I Information Bureau of Tile Industry.xxiii J Jackson Co., Wm. H.lxviii Jenkins Bros.xxii Johns-Manville Co.lxii Jones, T. W.xxii	N National Fireproofing Co.lxiii, lxiv, lxv, lxvi National Lead Co.xxii Neuchatel Asphalt Co.xxiii New York Belting & Packing Co.xxiii New York Blower Co.xxii Northwestern Terra Cotta Co.xxxvii	U U. S. Mail Chute Equipment Co.xxxvi U. S. Mineral Wool Co.xxvii Universal Portland Cement Co.i, lxvii University of Illinois.xxiv University of Michigan.xxiv University of Pennsylvania.xxiv
D Deane, E. Eldon.xxiv Dixon Crucible Co., Jos.xxix E Elevator Supply and Repair Co.xxvii Emmel, Charles.xxxix	K Kewanee Water Supply Co.xxv Keystone Varnish Co.xxii Knoche & Steves.xxix	O Okonite Co. (Ltd.)xxii Otis Elevator Co.xlvi	V Vaile & Young.lxviii Van Nostrand Co., D.ix
	W Washington University.xxiv Weber Steel Chimney Co.xli Winslow Bros. Co., The.xxxix Winslow Co., E. J.li Wirt, F. B.xxiv Wolff Mfg. Co.xxxv	P Peerless Rubber Mfg. Co.iii, iv, v, vi Pennsylvania Rubber Co.xxi	Y Yale & Town Mfg. Co.xxvii

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(FOR ALPHABETICAL LIST SEE PAGE 42)

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BOOKS AND PUBLICATIONS. American School of Correspondence, Chicago, Ill.; Cement Age Co., New York, N. Y.; Myron C. Clark Publishing Co., Chicago, Ill.; Engineering News Publishing Co., New York, N. Y.; D. Van Nostrand Co., New York, N. Y.	CONCRETE PILING. Raymond Concrete Pile Co., Chicago and New York; Simplex Concrete Piling Co., Tacony, Philadelphia.		TERRA COTTA HOLLOW TILE National Fireproofing Co., Chicago.
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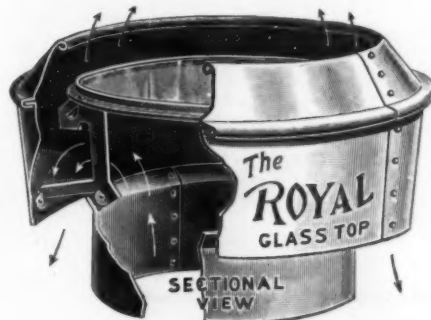


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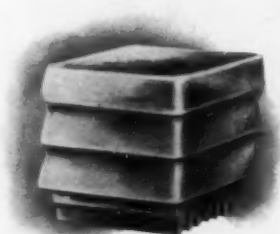
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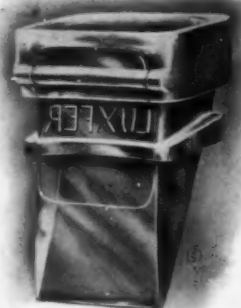
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LUXFER PRISM SIDEWALK LIGHTS

should always be specified where a diffusion of light is desired over basement area.

¶ By their use it is possible to *flood every foot of basement space* with bright daylight.

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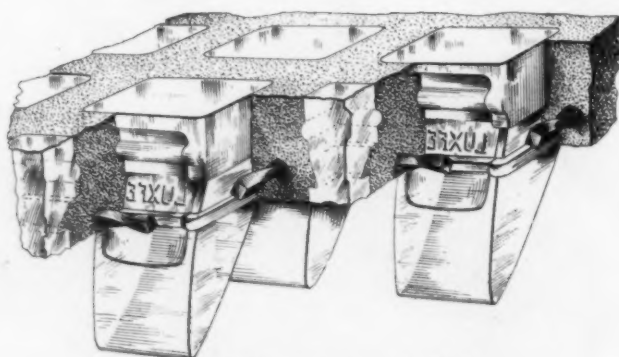


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LUXFER BLANK SIDEWALK LIGHTS

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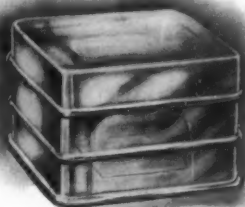


No. 65, Round Blank Light.

Points of Supremacy:

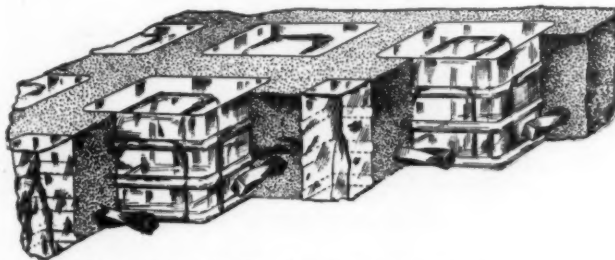
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Results: *No Rusting,*
Sound Proof,
Absolutely Water Proof,
Extremely Durable.



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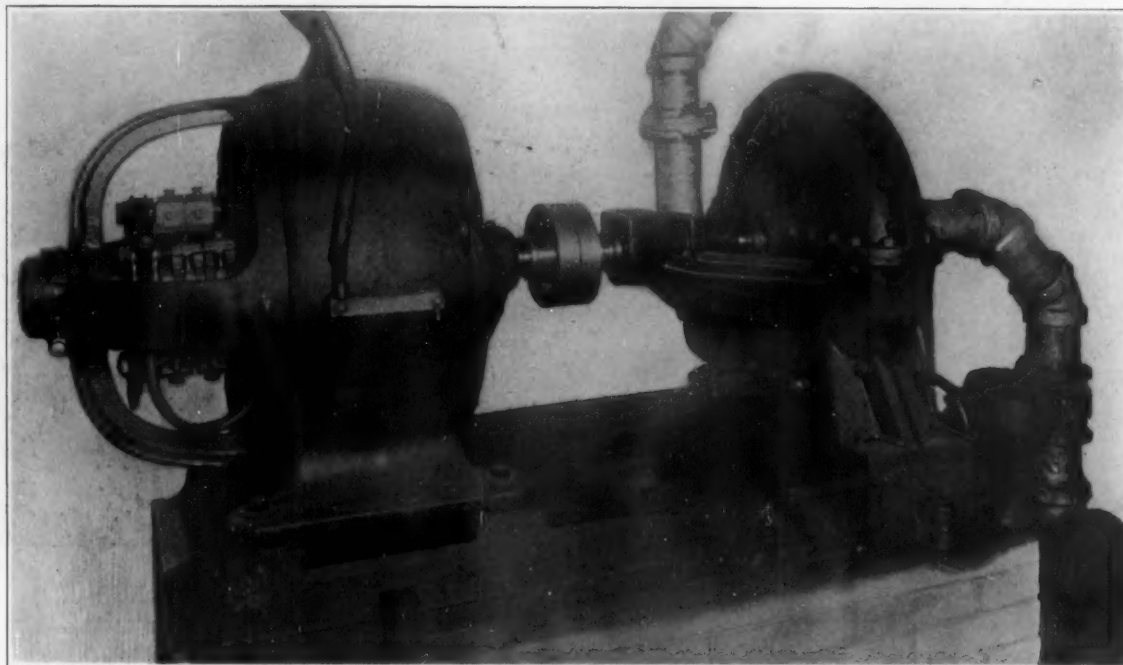
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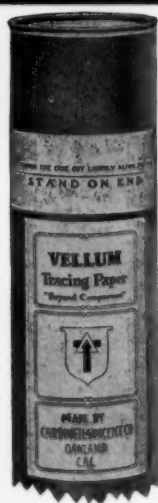
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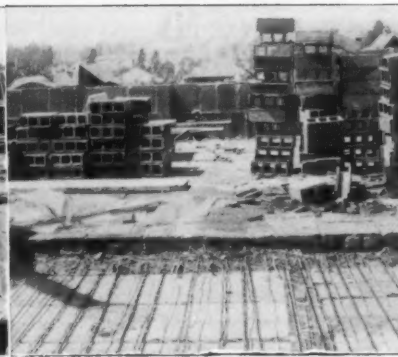
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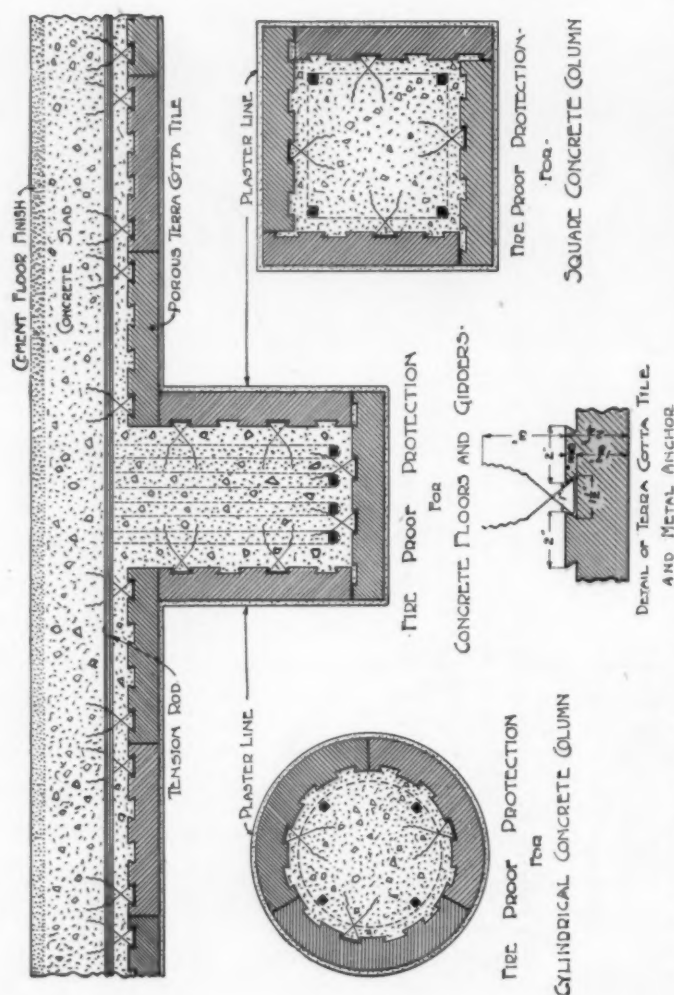
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