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CONTENTS

THE country is to be congratulated on the final enactment, and approval by the President, of the law opening the designing of public buildings to the architects of the country. The details of the mode in which designs are to be procured are left to the discretion of the Secretary of the Treasury, but the main point — that the most important buildings in the country will be designed by architects of reputation, and not by clerks in the Government plan-factory — seems to be secured. What the result will be we prefer not to predict, lest we should be accused of an exaggeration which we wish to avoid. The New York *Commercial Advertiser* says that, "By assigning one structure to one architect, it is thought that the grandeur of European public buildings may be approached"; and it timidly adds, as if to try to justify so extravagant an assertion, that "the excellence of American architecture on private and State buildings attests the presence of genius and merit." So far as State buildings are concerned, it is an extremely rare occurrence for one of them to be intrusted to an architect of high reputation in the profession, and it would be very unfair to judge of what the best American architects can do in the way of public buildings by the achievements of the people who find favor in the eyes of State Legislatures; but of the designers of the great private buildings in American cities at the present time it is not too much to say that in originality, artistic feeling and skill in handling the masses which form the principal source of architectural effect they are not surpassed, or, as we believe, equalled, by any architects in the world; and if such men can be induced, by such treatment at the hands of the United States officials as they expect from private clients, to apply themselves in earnest to the Government architecture, not only will "the grandeur of European public buildings" be "approached," but, within the necessary limits of size, it will soon be far surpassed.

THE Boston Society of Architects takes a most unusual but very praiseworthy and public-spirited step in undertaking to conduct a public competition — the details of which will be found stated in our advertising columns — for the purpose of discovering the best way of rearranging and embellishing Copley Square in that city. Nothing more desirable could happen than to have such a solution of the problem discovered in this way as to at once prove the wisdom of the step, and so induce this society and others of similar character elsewhere to come out of their retirement and take hold of the difficult matter of municipal decoration and public convenience in such a manner as to convince the public that such matters should be intrusted to men of trained intelligence, and not to aldermen and city councillors, no matter how excellent and worthy they may be as citizens. Copley Square is at present, and is always likely to remain, the intellectual and artistic centre of Boston, so far as this can be topographically expressed, and hence should not by any chance be subjected to a treatment out of harmony with its real character. More than once this place has narrowly escaped mal-treatment, for there has been, we believe, no single movement to erect a statue or monument in Boston during the last fifteen years that has not induced a portion of the public, and often the promoters of the movement, to urge Copley Square as the only proper site for the structure. For many years these threatened disasters were averted by the willingness of Bostonians to listen to reason and good advice, and, since its formation, the Art Commission has exercised its powers on several occasions to the same effect. But the Art Commission is already a body threatened by the city politicians, because it has too faithfully performed its duties, and no one can guess how long its present powers will be left untrammelled. If one looks at the map of Boston, it will be seen that Copley Square forms with the City-hall, (on maps of the city adopted as the centre of radiation and measurement) the two foci of an ellipse within which the greater part of Boston proper lies, and this topographical fact suggests the propriety of making it a new point of departure, a place for pleasant and instructive lingering rather than a place to pass through by the shortest "cut."

ALTHOUGH the committee has sought to leave to the competitors the utmost freedom, it yet expresses a preference for a "central feature"; but this need not imply that it shall be a large feature, nor yet the only one. In fact we feel that the committee's real motive in making this one condition is that, through asking for such a feature, and getting it satisfactorily treated, they may find that they have gained an important point, in the event that the accepted solution should ever be carried into effect, in that, as the centre of the space had been suitably treated, the temptation to future promoters to place their pets in the centre of the square would be forever removed. As to whether this central feature shall be small or great, simple or elaborate, whether it shall be the sole feature or but one part of a scheme which shall embrace coördinating features on the sides or in the angles of the square, each competitor must decide for himself. We will but point out that it is not an easy or an obvious thing to find a motive purely architectural in itself, which, while according with the Public Library, shall not fight with the Museum of Fine Arts and be altogether overwhelmed by Trinity Church. If the aid of sculpture is to be summoned, then the competitor must decide whether allegory and symbolism are to form the main theme of the treatment, or whether the writers, artists, divines and statesmen of whom Boston is so justly proud are there to find in sculpture an expression of public recognition which they do not now actually lack in other forms and yet which in other countries would be accorded to them in the shape of public statues.

ALL Boston architects, and many in New York, will hear with regret of the death of Mr. George Snell, one of the oldest and best-known practising architects in the country, and the instructor, in their art, of many distinguished members of the profession. Mr. Snell was born in London, England, in 1820. He was carefully prepared for his profession. He was graduated at King's College, London, and received special instruction in mechanics, of which he had a thorough knowledge, from the celebrated Canon Moseley. He was then articled as a pupil to Harvey Lonsdale Elmes, the architect of St. George's Hall, Liverpool. In 1850 he came to Boston, and his taste and knowledge, with his charming social qualities, soon brought him into notice. Nearly all the principal Boston architects of middle age were at some time his pupils, and many in other cities owe the best part of their instruction to him. In his professional capacity, he soon found employment in both private and public work. The Boston Music Hall, one of the best concert-rooms in the country, was designed by him, and, while perhaps the earliest example in the United States

of the application of modern acoustic science to building, still remains one of the most successful. Besides this, which is perhaps his most important work, he built the Studio Building, noted in its time as a very clever example of brick architecture, the Hotel Oxford, the Concord Public Library, the South Boston Church Home for Destitute Children, and a very large number of private houses and mercantile buildings. If he had been a stirring business man, like some of the modern architects, his list of public buildings might have been longer, but his tastes were in every way quiet, and he preferred his two rooms in the Studio Building, with one or two draughtsmen to help him, to the bustle of a huge office with an army of assistants. About 1860, when he was overcrowded with commissions, he took a partner, Mr. Gregerson, in conjunction with whom a considerable portion of his work was done. Personally, Mr. Snell was the incarnation of courtesy and amiability. He was never married, and had no establishment beyond his simple bachelor-rooms, but he was always honored and popular in the many clubs to which he belonged, and in general society.

IT is pitiful to contemplate the agony of mind which a man has had, for who knows how long, to struggle against before he is brought at last to cast aside voluntarily the boon of life, which, to his fellows, seems so priceless. The gradual loss of business and the ensuing financial difficulties that seemed to Samuel J. F. Thayer, an architect of Boston, so insupportable, might to others seem trivial and endurable evils, but he thought otherwise, and on Tuesday last closed his career. Born in Boston, August 20, 1842, Mr. Thayer entered, at the age of sixteen, the office of J. D. Towle, and seemingly left it a few years later to enlist in the Fifth Massachusetts in 1862, from which he was promoted to the engineer service in the Eighteenth Army Corps, where he served, we believe, till the close of the war. On returning to Boston, he gradually built up a good and substantial practice, and in the twenty following years designed and built a large number of buildings, some of which at the time attracted considerable attention. Amongst his best-known work may be named the town-halls at Brookline and Stoughton, Mass., the City-hall at Providence, R. I., the library for Dartmouth College and the Nevins Memorial at Methuen, Mass.

A NEW device for stimulating vegetable growth by means of atmospheric electricity has been tried with success in France, and, as the apparatus is very simple, it will be easy for those interested in the subject to pursue the investigation for themselves. It seems, according to *Le Génie Civil*, that electric culture has been tried before. One experimenter, at Antibes, planted Indian-corn in a flower-pot which was connected with the lower end of a lightning-rod, but did not secure any particularly favorable results; and others have grown peas, cabbages and chicory in earth electrified by a Leclanché battery, also without remarkable success. From these attempts, it has been inferred that electricity had no favorable effect on vegetation; but Father Paulin, at Merlieu, near Montbrison, has tried a very different apparatus, with, as it seems, encouraging results. His apparatus, which he calls a "Geomagnetifère," consists of a pole of resinous wood, forty or fifty feet long, fixed in the ground, and finished with a porcelain cap, and a number of insulators. A galvanized wire, attached to the insulators, has the upper end, which extends to some distance above the top of the pole, divided into five branches, which radiate like a fan, while the lower end is connected with a sort of gridiron of wires, buried in the earth at a distance of twelve or fifteen inches from the surface. The object of this arrangement is, of course, to convey electricity from the air to the earth. As the electrification of the soil is said to be perceptible a metre from the wires, these may be placed six feet or so apart; and plants growing in the ground over them seem to be favorably affected by the influence. In Merlieu, at least, where, in a large potato-field, a circular area forty metres in diameter was furnished with the geomagnetic wires, the potatoes over the wires grew with extraordinary luxuriance. At the request of a commission of scientific investigators, two tracts, of sixteen square metres each, were marked out on the wired land, and two similar tracts on the unwired part of the field, and the product of each was weighed. The potatoes gathered from the thirty-two metres of wired land weighed ninety kilogrammes, while those from the equal area of unwired land weighed sixty-one kilogrammes. Somewhat later, two similar tracts of wired and unwired land, each containing sixty square feet, were compared, and the unwired soil was found to have yielded thirty-eight kilogrammes of potatoes, while the sixty wired feet produced sixty-three, and it was evident, from the greenness of the stalk and the thinness of the skin on the tubers, that the growth of these potatoes was not yet finished, while those on the unwired land were fully ripe. Where similar experiments were made in a vineyard, the grapes from the wired land contained about sixteen per cent more sugar than those from the unwired land.

THE Minnesota Chapter of the American Institute of Architects has hit upon an excellent idea for encouraging practice in design, and study of detail, among the draughtsmen of the State. Instead of announcing a single competition, to be held within a limited time, and on a single subject, which attracts only a limited number of competitors, it has published a little pamphlet containing the programmes for twelve competitions, to be held monthly through the year. The subjects are small, such as an entrance-doorway, or a window dressing, or a mosaic floor, but plenty of taste and study can be expended on them, and it is of immense advantage for draughtsmen in offices to have the whole set of programmes in mind, not only that they may use their leisure moments, which may not come regularly every four weeks, to advantage, but that, knowing all the subjects to be studied during the year, they can gradually pick up ideas upon all of them during the course of their ordinary work. One set is handed in every month, and voted upon by the members present at the regular monthly Chapter meeting. All the designs are under cipher, and the secretary, who alone ascertains the names concealed by the cipher, makes a record of "first mention" against the name of the competitor receiving the highest number of ballots, and "second mention" against the name of the competitor placed next. At the end of the year, the first and second mentions for the year are counted. Each first mention counts as two points, and each second mention as one point; and to the person who has gained the highest total number of points is awarded a gold medal, while a silver medal is given to the one who has the next highest number. As an ingenious and effective plan for keeping up the interest of draughtsmen throughout the entire year, at no very great expense, we commend this scheme to the attention of all Institute Chapters and similar societies.

WHAT there is such a thing as being too zealous in good works, Mr. Michael Cleary discovered the other day. The monstrous new building of the Manhattan Life Insurance Company is to stand on the site now occupied by several small structures, and these smaller buildings are in process of being removed, to make way for the giant. In the basement of one of the little houses Mr. Gossford keeps, or did keep, a restaurant, holding his room on a lease, which expires May 1 next. The Insurance Company had bought out all the other leases on the property, but Mr. Gossford, finding himself very comfortable where he was, refused to sell his lease, or to move until its expiration. As the Company is in a hurry to get its building done, it has not taken any special pains to make Mr. Gossford happy in his present location, and a few days ago, according to the daily papers, the workmen began tearing down the upper part of the building over his head. Considering, with some reason, that this manœuvre interfered with his rights as a tenant, Mr. Gossford obtained an injunction, restraining the Company from meddling with the structure; and the Company brought a counter suit to dispossess him. Mr. Gossford, fearing some nocturnal interference with his rights, employed a watchman to guard his restaurant at night; but a few nights ago the watchman mysteriously disappeared, about ten o'clock, and half an hour later a policeman who happened to be in the neighborhood heard the sound of an axe. He ran toward the sound, and arrived at the site of the new building just in time to see seven men drag Mr. Gossford's lunch-counter up the basement-stairs and throw it into the street. The officer, finding that the restaurant had been completely wrecked, arrested the foreman of the party, Michael Cleary, and carried him off to the station-house, where a charge of burglary was entered against him, and he is now awaiting trial.

THE LANGUEDOCIAN SCHOOL OF ARCHITECTURE.[1] — III.

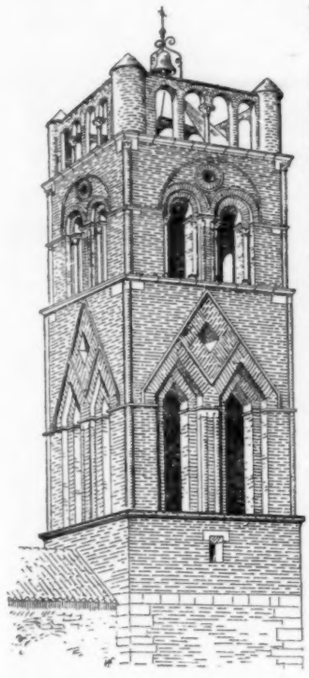


Fig. 9. Belfry of Donzac.

THE type of wholly Gothic single naves became fixed at Toulouse from about 1240, by the construction of the churches of the Jacobins and the Cordeliers. Although the former has two equal naves like the Dominican churches of the period, it possesses the external dispositions of churches with one nave, and particularly of those of the Toulouse school, with their massive buttresses connected by huge ogival machicolations surmounted by covered galleries lighted through small round or square apertures, — the latter set on the angle. This type attains its most monumental expression in Sainte-Cécile at Albi (1282–1431); here the buttresses are in the interior, with two-storied chapels between. The cathedrals of Saint-Bertrand (1304–1320), of Lodève (fourteenth century), Lavaur (fourteenth century), Mirepoix (1401–1421), Perpignan (1324–1509), Condom (1506–1521) and the churches of the lower city of Carcassonne (Saint-Michel, the new cathedral, and Saint-Vincent), of Gaillac (Saint-Michel and Saint-Pierre), the church of the Augustinians and La Dalbade, at Toulouse, the churches of Beaumont-de-Lomagne, of Montpezat and Moissac (Tarn-et-Garonne), of l'Isle-d'Albi, of Rabastens and Saint-Sulpice (Tarn), of Larroumien (Gers), of Vias (Hérault) and many others, are related by various characteristics to the family of great structures without side-aisles. To these may be added the nave of the cathedral of Béziers, the choir of that of Viviers, the abbey-church of Simorre (Gers), the Cistercian church — now in ruins — of Bellocq or Beaulieu (Tarn-et-Garonne) and Notre-Dame of Villefranche-de-Rouergue, each of which retains its own individuality. The last three have, by exception, transepts; at Villefranche the arms round into apses at the extremities. At Bellocq and at Simorre there is even a central tower.

Fig. 10. Belfry of Saint-Béat.

The breadth of the finest naves varies, in the clear, from fifty to seventy-two feet. The grandest of all is that of the Cathedral of Mirepoix. Then follow Saint-Vincent, at Carcassonne, and the cathedrals of Perpignan and Albi. The width between the side walls is seldom less than forty feet; the base was therefore too broad for a central tower. The Romanesque tradition as to the position of the tower was consequently not perpetuated — save in the two cases cited above — in any churches except those that had been begun and had to be completed, as at Saint-Savin, Tarbes and Saint-Lizier. The Languedocian belfry of the fourteenth, fifteenth and sixteenth centuries rises, as a rule, on one side of the choir. Moreover, it was the Romanesque octagonal form that was maintained, and it was the Languedocian school that held the most important place in these constructions down to the close of the seventeenth century. The Toulouse architects put a powerful, individual stamp upon their polygonal towers by substituting for the semicircular and broken arch a sort of triangular crowning which it is difficult to attach to either of these figures. Ordinarily the bays with angular crowning are disposed in pairs beneath an equally angular framework, making an opening in the tympanum in the form of a square set as a lozenge. Isolated squares of this sort are pierced, instead of oculi, above the long windows of the structure, or to admit light to the circular passages. The best examples of these productions are seen at Toulouse itself, in the central tower of St. Sernin and in the elegant tower of the church of the Jacobins; it is probably in one of these that the type originated. We do not believe that the square belfry of Donzac (Tarn-et-Garonne), in which all the signs of a transition may be observed (Fig. 9), dates further back than the latter part of the thirteenth century. It will be remarked from this example, and several others that might be cited, that the square belfry was maintained along with the octagonal; however, not much artistic talent was devoted to it. The Toulouse School bestowed more care on the so-called fan belfry; it was constructed by carrying up the western gable and piercing it with arches in which the bells were directly suspended. This type, the finest Romanesque example of which may be seen at Saint-Béat (Fig. 10), was utilized, from the end of the thirteenth century, for strategical devices, which further complicated it while at the same time it imparted a monumental aspect to it that it would not have had otherwise (Fig. 11).

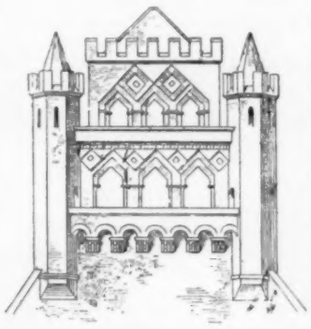


Fig. 11. Belfry of Le Taur, at Toulouse.

The attention that was given to the fortifying of the churches is apparent in a great many dispositions that we have not referred to at all. Thus it was that many of the beautiful octagonal towers were reared on a square mass with machicolations and that, in the apse of the cathedral of Narbonne, the flying-buttresses were themselves made to serve for defensive purposes. The entire façade of the cathedral of Béziers is a military work, in spite of its great rose-window and notwithstanding the richness of the portal.

Fig. 12. Portal of St. Peter's, at Toulouse.

The Renaissance set no special seal on religious edifices. The remarkable portal of La Dalbade, at Toulouse, has an originality but little affected by local influences. But these influences are more apparent in the portal of St. Peter's (Fig. 12), erected later, at the period when the School of Toulouse was in the fulness of its vigor, that is under Louis XIII. This reign also marks the date of the small cloister of the Augustinians. The artistic celebrity of Toulouse in the modern period rests mainly on the beauty of its private mansions; they are noted for their doors and windows with caryatides, their false machicolations, their low arcaded galleries forming attics, and for many other distinctive characteristics which are in great part shown in the two representative examples here presented (Figs. 13, 14).

[1] From the French of Anthyme Saint-Paul, in Planat's *Encyclopédie de l'Architecture et de la Construction.* Continued from No. 896, page 116.

The influence of Toulouse Renaissance architecture affected the construction of the château of St. Elix (Haute-Garonne);

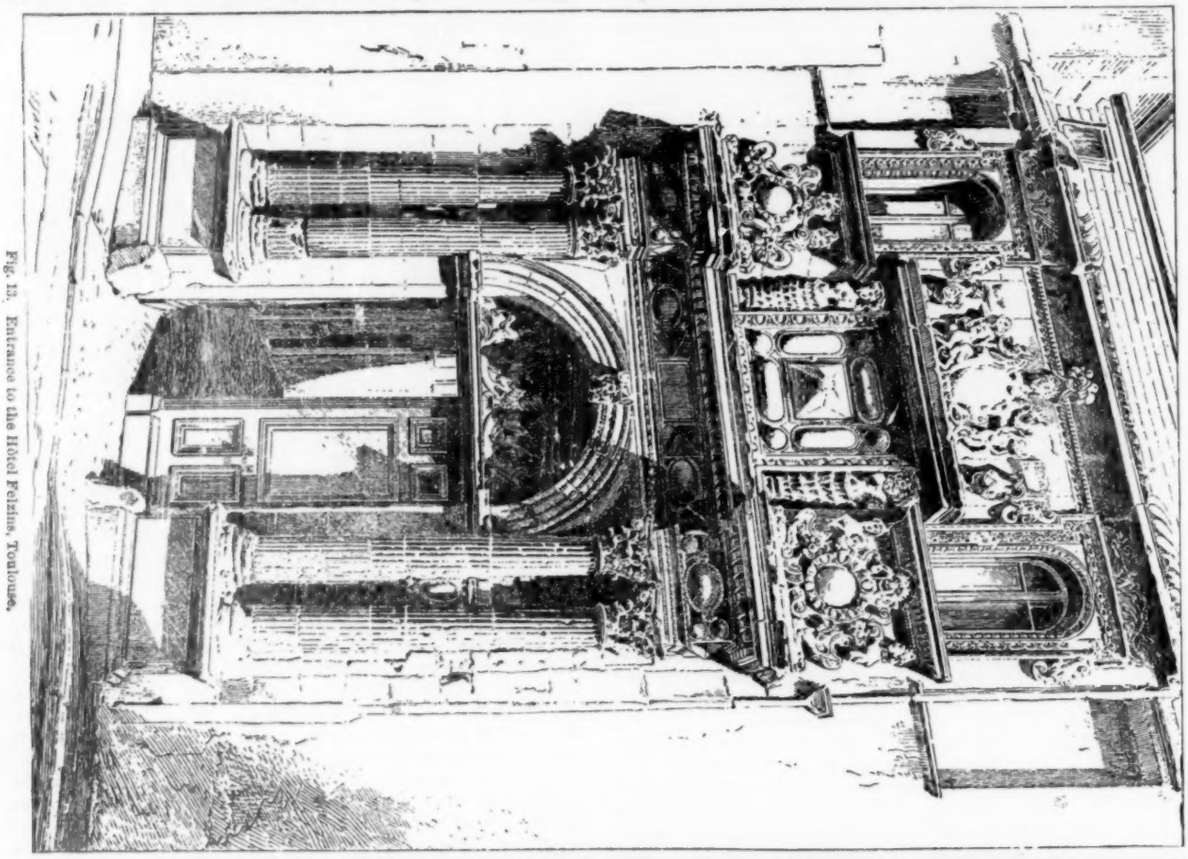


Fig. 13. Entrance to the Hôtel Felzins, Toulouse.

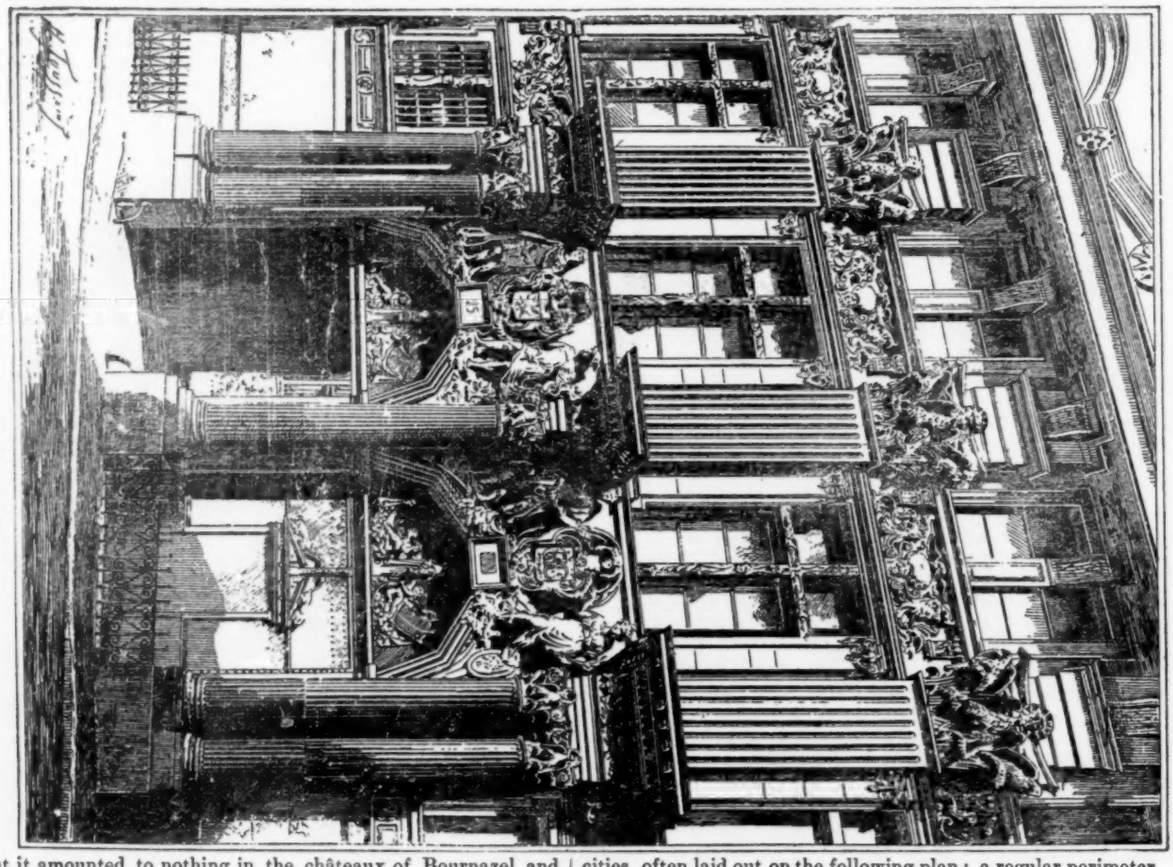


Fig. 14. Stone House, Toulouse.

but it amounted to nothing in the châteaux of Bournazel and Graves (Aveyron), whose architects were inspired by Georges Philandrier, himself imbued with Italian teachings.

The chief feature of the mediæval civil architecture of the Languedocian School was the foundation of fortresses or new cities, often laid out on the following plan: a regular perimeter, four principal streets disposed in pairs at right angles to each other, and forming at their intersection a central square which

was surrounded by arcades. Montauban, built in 1144, is the oldest of these; but the movement did not reach its height until between 1222 and 1340. Although it was not confined to Languedoc and Gascony it originated and attained its greatest force in these two provinces. The cities that have preserved

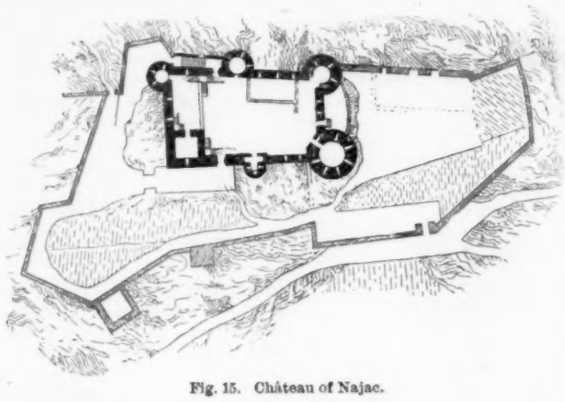


Fig. 15. Château of Najac.

the most characteristic plan of these fortresses are: Grenade, Plaisance and Villefranche, in Haute-Garonne; Mazères and especially Mirepoix, in Ariège; Pampelonne and l'Isle-d'Albi, in Tarn; Sauveterre and Villefranche-de-Rouergue (in the latter the perimeter is irregular), in Aveyron; Beaumont-de-Lomagne, in Tarn-et-Garonne; and Marciac in Gers.

Feudal architecture remained quite elementary throughout the Middle Ages. The donjons, which were always on a rectangular plan prior to the fourteenth century and usually so afterward, were sometimes of so little importance that they could be used only as observation-towers. Gaston Phœbus, count of Foix and Béarn, in the second half of the fourteenth century, originated a type of huge rectangular donjons which he himself adopted at Lourdes, at Pau, at Montaner, at Mauvezin and possibly also at Mazères. The three towers of Foix served successively as donjons; the most modern is cylindrical, a form which is less rare in Ariège than elsewhere. The flanking towers are generally wanting; quite fine ones, however, exist at Pau and at Puivert; they are square. It may be set down as a fact that the châteaux antedating the fifteenth century which possess large cylindrical towers, like those of Bellocq (Basses-Pyrénées), of Najac (Aveyron) and of the Cité of Carcassonne, are traceable to an influence proceeding directly from the royal domain. This is certainly true as to the last two examples. The fortifications of Najac (Fig. 15) are due to Alphonse of Poitiers, the brother of Saint-Louis, and those added to the Cité of Carcassonne were built in accordance with the instructions of Saint-Louis and of Philip the Bold.

ANTHYME SAINT-PAUL.

THE ARCHITECT AND HIS MATERIALS.

Miserere in Choir of Amiens Cathedral. From *L'Art pour Tous.*

DURING a season of temporary mental aberation, the somewhat pessimistic writer of the present paper once wrote a book on Structural Materials. Once written, he sought a publisher, and in endeavoring to secure from him as reasonable terms as possible held forth to some length on the great utility of such a work to architects. To his surprise, he was promptly met with the response that architects didn't buy books! As he who made the statement was a man of long experience in technical as well as strictly scientific works, besides being publisher of an architectural journal, I could but accept it, though at the time with certain mental reservations.

Subsequent observations on this very point have, however, led me to believe that, however correct his statement may have been with regard to books in general, it was certainly true with regard to works on this particular subject. I am fain to believe that the average architect of to-day is not only sublimely ignorant regarding the character of the materials he uses, or rather that are used in structures he designs, but that, further, he makes little effort to inform himself. This may seem a harsh statement, but I cannot consider myself as at all to blame in the matter, since I am merely stating the results of my experience.

To the average architect there are but four classes of stone: granites, "freestones," marbles and limestones. As to how these stones differ, what are their essential qualities, which the more durable, he has little idea. He may perhaps be able to refer to certain tables in somebody's hand-book, or pocket-companion, and give you the exact figures in pounds per square inch that carefully prepared cubes of certain stones bearing these names, at some time, somewhere, under special conditions — never to be reproduced in actual building — have been found capable of enduring. But that is all. Yet such men go on with the utmost self-complacency designing, year in and year out, structures good, bad and indifferent, from both utilitarian and architectural standpoints, and which are perhaps erected under their personal supervision. The condition is very peculiar, and quite unlike anything I ever met in other callings.

Can one imagine a sculptor carving a Greek slave or a Venus from a mud-colored, blotched and cellular limestone? or a painter who depends for his effects wholly upon perspectives and outlines regardless of light and shade or the blendings of color? I have often marvelled that Ruskin, in all his searching criticism and self-assertions, should have laid so little stress upon the subject of materials; but possibly, never having seen our "Church of the Holy Zebra"[1] and its numerous counterparts, the necessity for such was not appreciated. Still I have often wondered if something of this sort was not in his mind when he wrote: "And among the first habits that a young architect should learn is that of thinking in shadow, not looking at a design in its miserable liny skeleton, but conceiving it as it will be when the dawn lights it and the dusk leaves it, when its stones will be hot and its crannies cool, when the lizards will bask on the one and the birds in the other. Let him design with the sense of cold and heat upon him; let him cut out the shadows, as men dig wells in unwatered plains.

"His paper-lines and proportions are of no value; all that he has to do must be done by spaces of light and darkness; and his business is to see that the one is broad and bold enough not to be swallowed up by twilight, and the other deep enough not to be dried like a shallow pool by a noonday sun." — ("*Seven Lamps of Architecture.*")

I remember, not long ago, while in conversation with an architect of more than average ability and experience, of speaking concerning the quality of the materials used in one of his latest efforts. Judge my surprise at learning that he knew nothing regarding it, and stated that he did not trouble himself about such matters. He prepared the plans and left the question of materials for the owners and builders — preferred not to be bothered with such questions! This may have been an extreme case, but the man in question was one of the best in a city of upwards of 200,000 people.

I have known the late architect Richardson to devote a great deal of attention to finding just such a stone as he deemed fitted for any piece of work, but so far as I know personally, his decision was controlled always by his artistic sense; it was the matter of color, of light-and-shade, that decided the question, and one of his best efforts, what is in fact, from an architectural standpoint, one of the finest buildings in America, has the weakest stones in the position of greatest strain, simply because the contrast of color was thus best brought out. One of the most expensive Government buildings in Washington, a structure of most elaborate design, totally loses its effectiveness, owing to the fact that the stone of which it is built is quite inappropriate for that design. It is of course possible, and even very probable, that Mr. Mullett, working under Governmental supervision, was not free to use his own judgment in the matter; but the fact remains, nevertheless. The architects whom it has been my fortune to meet during the past ten years seem to have learned that there are certain kinds of stone upon the market, and which are known to them, perhaps, as Indiana or Ohio "freestone," Portland "brownstone," or Maine granite, and these are used indiscriminately, the decision being controlled only by matters of expense and, possibly, color. They do not for a moment consider the climatic conditions to which a stone is to be exposed, nor apparently realize that a stone suited for Denver, Col., may be worthless in Bangor, Me. The stone has been used in times past, is accessible, or is the cheapest, and in it goes without further question. I have more than once asked an architect his reasons for using a particular stone, and have yet to receive an answer in any way satisfactory. In most instances the stone had been used wholly without a thought as to its fitness, and I might as well have questioned him regarding the larval stages of a certain species of ichneumon-fly. Few seem to realize that a light-colored stone such as may serve well for a city like Washington or surburban dwelling is quite unfitted for smoke-laden cities like Chicago and St. Louis. A finely carved, highly ornate front of soft Indiana oölite, stained and streaked with smoke, is not merely no more effective than a plain brown front, but it is positively unsightly. The two Vanderbilt residences on Fifth Avenue, New York, the one a brown sandstone and the other a light-colored limestone, illustrate

[1] I do not now recall the exact structure in New York City to which this title was popularly applied. It was, I believe, one of the numerous agglomerates of green serpentine and gray and brown sandstone, so conspicuous for their fantastic ugliness.

this point well. The one of sandstone is uniformly dark and agreeable. The light front of the other is soiled and stained, for all the world, like a dirty garment. The same condition of affairs, but greatly exaggerated, exists in Chicago, or in any city where soft coal is consumed. In such cases, not only should stone be selected of such color as to least show the streaking but the walls should be of such finish as to afford the least lodgement for particles of dirt. Among crystalline siliceous rocks, a rock-face finish, where the natural facets of the crystals are exposed, will be found best suited: with sandstones and limestones, a sawn or smooth-ground surface. Pointed, tooth-chiselled, patent-hammered, or carved surfaces serve only as dirt catchers, and are but comparable with the costly laces on the bottom of a woman's skirts — conspicuous for the filth they carry.

Now whether the architect is or is not wholly responsible for this peculiar condition of affairs, it is not necessary to discuss here; but, obviously, such ought not longer to exist. The responsibilities of the architect are — or at least should be — enormous. "The construction of a dwelling, business-block, public building or monument is a matter in which each individual citizen has a perfect right to have an active interest, since the structure, once erected, becomes for a time a fixed feature of the landscape, and an object by which not merely the taste and abilities of the architect and builder are to be judged, but that of the community as well. The external features of the structure are constantly before the public and must exercise some influence, either beneficial or detrimental, upon public taste. It behooves the builder, therefore, quite aside from all economic considerations, to select for his purpose such material as shall be most harmonious in the finished structure, and possess as well such qualities as shall be enabled to withstand the ravages of time without serious injury.

"There are few things more conspicuously unsightly than a rich and elaborate building constructed from materials which, under the ordinary chemical and physical agencies of the atmosphere, have become discolored or disintegrated. Yet our cities and towns are replete with illustrations of such lack of forethought, or of ignorance on the part of builders.[1]"

Now, in case any architect shall have had the patience to read this article through, he will very likely contend that, like his colaborator mentioned above, the character of the material used does not concern him. But in this I must beg leave to differ, for if — to appeal to Ruskin once more — "Architecture is the art which so disposes and adorns the edifices raised by man that the sight of them may contribute to his mental health, power and pleasure," then certainly he must be more than a mere artist or compiler of specifications. He must combine to a certain extent the qualities of artist and engineer. So far as my own observations extend, the larger proportion of architects lean more toward the artistic side, and it is, I believe, very largely due to this that the erection of business structures in our large cities has become almost wholly a matter of engineering. From a practical standpoint, the engineer is the more progessive man of the two. He perhaps, in only too many cases, wholly loses sight of the artistic side, and his structures have no architectural features whatever. It is interesting to observe, in looking over the literature on the subject, how large a portion of the work of research on structural materials has been made by engineers. At the present moment I call to mind but a single instance in which an architect has turned investigator, and he, though instrumental in designing one of the most impressive buildings in the city of Washington, was not, I believe, considered much of an architect!

Even in cases where attention is given to the character of the material, I doubt if energies have been judiciously expended. Apparently, more attention is paid to the matters of ultimate strength and fire-proof qualities than to the natural weathering characteristics of a stone. This last condition is, perhaps, not strange, since the disastrous results produced in a few hours by fire are more noticeable by contrast than though brought about by gradual changes from day to day. There are few, if any, stones that can be called actually fireproof — that can pass through the fierce heat of a conflagration without serious detriment. Certain siliceous sandstones, not too compact in texture, and laid on the quarry-bed, and the basic trappean rocks, like the "black granites" of Maine, Pennsylvania and New Jersey, possess probably as good fire-resisting properties as any; but it is worse than useless to construct the walls of a building of stone of any kind, or even brick, and then fill the interiors with inflammable materials such as shall convert the entire structure into a furnace on the first favorable opportunity. More attention needs to be paid to incombustible interiors, for this is where the fires originate, and it is only when the flames acquire such fierce headway from the fuel from within as to be temporarily uncontrollable that the adjoining exteriors begin to suffer. Any properly constructed stone building should have a brick lining, and, so far as my present experience goes, the injury done is, as a rule, to the outer surface, rather than the inner. Let our architects and engineers design some practicable form of fireproof interior construction, and the problem of matter for the outer walls resolves itself into one of natural weathering. As to the matter of compressive strength, it can be said that, for all ordinary structures, the capacity of any stone to withstand more than from 6,000 to 10,000 pounds per square inch of surface is of as little moment as that of lunar attraction; and yet these figures are those of the weakest stones upon our market. The large majority go so far beyond that a mere personal inspection is worth more than all the pressure-tests that can be applied.

There are, of course, architects who can justly claim absolution from the calumny thus far heaped upon them. I would that there were more. The article has, however, not been written for the purpose of crying down the profession, but rather for the purpose of calling attention to what appears to me to be a very serious discrepancy in architectural training. In many of our technical schools steps are being taken toward instruction in this very line, and it is a move that deserves most hearty commendation.

George P. Merrill.

[1] "*Stones for Building and Decoration*," page 350.

THE WEATHER. — POSSIBLE CARPENTERS' STRIKE. — INJURIES TO THE ROOFS OF THE FAIR BUILDINGS. — THE SCULPTORS' WORK FOR THE FAIR. — THE DECORATORS' WORK. — THE COLD-STORAGE WAREHOUSE. — THE RAILROAD TRACKS. — THE AUDITORIUM ANNEX. — THE ILLINOIS CENTRAL STATION. — THE ARCHITECT TO THE BUREAU OF EDUCATION.

STILL winter in full force is with us and people who enjoy a "thorough thing" are enjoying this season to their full. First the mercury plays around the zero-point and then rises to the grade appropriate for the January thaw, only to flood the streets and walks with water, which, in its turn, quickly congeals, covering everything with ice. Such has been the weather which builders have had to contend against for the last month. It has required strenuous exertions to carry on the work on the partly finished buildings, while to undertake work on excavations has been quite impossible. Consequently this year has so far shown little activity among architects. The large amount of building undertaken last year, the cold weather and the advance in cost of material seem to be reasons enough for the present dullness. The scale of prices which was correct some months ago is approximately correct at present. Bricks are now quoted at ten dollars a thousand, which is higher than they have been for several months, while lumber is also in the ascending scale. There is a vague rumor and feeling at present that the first of April will see inaugurated a carpenters' strike, though the object of the strike seems as yet undetermined. At present eight hours constitutes a labor-day, and thirty-five cents an hour is the minimum rate of wages. Possibly because nothing else can be thought of that the oppressed laborer would be likely to demand, it is reported that a demand for the employment of union men to the exclusion of non-union men will be made. This report is decidedly vague, however, and it is to be hoped that the substance, if one really exists, which gave rise to it, will grow still more vague as the time for its appearance approaches.

Apropos of the cold snowy weather, it is appropriate to speak of the great drawback it has been to the work at the World's Fair grounds, and the trouble which has arisen from the weight of snow and ice on the roofs of the buildings. Judging from the winters of the last five or six years, such a strain to the structures was a thing little to be expected and not necessarily to be counted upon, and consequently many of the roofs, or rather portions of the coverings, of them have given way under the pressure of ice and snow. A rather exaggerated idea has obtained as to the extent of these damages and people have pictured to themselves the whole Liberal Arts Building one vast skating-rink. This is fortunately not quite the case. During this fearfully icy weather no man could be sent aloft to repair the damages, and the result has been that the rains have descended and the floods have come directly into the buildings in various isolated spots. Had any of the exhibits been in place, it would have been quite another matter. The greatest sufferer has been the huge Liberal Arts Building, while, from its ponderous proportions, its roof will be the most difficult to repair. The Transportation and Agricultural Buildings have suffered considerably, either from breakage or leakage, while the Electrical Building has stood the test much better. The interior of the dome of the Fishery Building, which had received its final coat of coloring, has become quite disfigured. However discouraging the interior may look at present, those having the affair in charge say it will be only a matter of a little time to make the repairs whenever the weather will permit their being undertaken — and most surely the weak points of the roofs have been well pointed out by this roaring winter of ninety-three. The staff statuary on the outside of the buildings seems not to have suffered at all by the boisterous treatment, upon which every one who appreciates what is really fine and good ought to congratulate himself.

Much, very much, has been said about the success and beauty of the buildings, while comparatively little notice has been taken of the great excellence of the work of the sculptors. The uninstructed and generally unappreciative public here is being aroused to the worth of

the work, by means of very charming talks given this winter on this subject of the World's Fair sculpture by Mr. Lorado Taft, one of the men who has helped to make this part of the work a success. Even if it has been one's business to keep oneself well posted in this especial branch of art, even if for years one has shuddered over the monstrosities on the National Government Building, even if silent adoration before Powers's "Greek Slave" has not been our accustomed attitude, to see these productions thrown on a screen from a stereopticon-slide, by the side of these fine and beautiful works which are to be seen at the World's Fair, makes one realize that it is "not for nothing" that so many of our young men have been spending precious years abroad in foreign schools and studios. Let us fervently pray that this fine work may lead to an appreciation of something better than the once so popular galvanized-iron ladies with jelly-mould heads and breasts.

The kindred arts of architecture and sculpture will gain much in this country if they can come to each other's aid, as in the old times in the Old World. Mr. Martiny, the chief embellisher of the Agricultural Hall, seems, of all the sculptors, to have most satisfactorily solved the problem of what one might call architectural sculpture. He has been wise enough not to look at his work simply as his work, but the question has presented itself to him, how to best make it a part of the building which it was to decorate. The result is very charming.

It seems as if there was no department of art as to which the American public possessed such dense ignorance — and that is saying a good deal — as this of sculpture; and it will be interesting to watch the awakening, an awakening which must as inevitably follow in this case as did that which aided in the appreciation of painting after the Centennial Exhibition in this country.

The decorators are hard at work either in studios on the grounds or on comparatively smaller works in their own up-town studios. Melchers is busy with a Julius Cæsar with snow-white hair and pea-green olive-wreath, which, with its accompaniments, is to be raised sixty feet in the Liberal Arts Building. It will be curious to see what will be the coloring of this work when sixty feet of atmosphere lies between it and the spectator. Owing to the well-known reputation of its artist, one feels there is a "know how" about it and not any uncertain hit-or-miss. Some of the decorations of the smaller domes and recessed arches are especially good, and it is to be hoped that the exhibits will not take all eyes away from them. There will undoubtedly be published some illustrated series of these works which will make the originals familiar both to those who are lucky enough to see them and those who have the misfortune to miss them.

Work has begun on the booths in the various buildings and before long the interiors will present quite a different appearance from what they have had heretofore. The industrial court of the Mines and Mining Building is already gay with the colors used in the booths. Building-permit for pavilion No. 1 in the Liberal Arts Building has already been granted to the Chicago firm of Lyon & Healy, manufacturers of musical instruments.

An interesting building on the grounds is the Cold-storage Warehouse, which in itself serves as an exhibition of what cold-storage can do, together with the ice-making process: it will at the same time furnish ice and ice-cream for the entire grounds, while the vegetables, meats, butter, eggs, etc., for all the restaurants will be stored within its walls. The structure will measure over one hundred by over two hundred feet, five stories high, surmounted by three towers, the highest one, in the centre, nearly two hundred feet. The roof itself will be enclosed by a balustrade, giving a chance for a promenade for those who are not able to get enough walking in other ways. Everything will be so arranged that visitors may circulate through the buildings and watch the various methods of ice-producing. Through the arched doorway one will enter a circular gallery from which one can look down on a nine-hundred horse-power steam-plant. This will furnish power for the large elevators placed in each corner of the building, as well as for the dynamos, for the electric light and the hoisting apparatus. In the rooms of the ice-machines may be seen the entire workings of an apparatus with the capacity of turning out over a hundred tons of ice a day. Across from these rooms, on the other side of the building, are to be the ice-storing rooms, where provision will be made for the storage of three thousand tons of ice. The walls separating the rooms are composed of alternate layers of heavy paper and cleated boards with double air-spaces intervening. Around each room run the coils of pipe by means of which the rooms are cooled. Practical tests will be made as to the proper temperature for storing different kinds of provisions. The ice-cream plant will be on the fifth floor, the freezers being operated by steam and cooled by ammonia vapors.

The work on the elevation of the Illinois Central tracks has been carried on with only occasional interruptions through the winter. This being the road by which the great bulk of visitors will reach the Fair, the greatest energy is necessary in the work that all may be completed by the first of May. As the stations were all on the opposite side of the tracks from the Fair Ground, of course it became essential to devise some way of getting the great crowds to the other side without being obliged to cross them. The entire six or eight tracks at the grounds have consequently been raised on a substantial bed, the crossings being made beneath them.

For a similar purpose, that is to avoid disasters on the tracks, the viaduct at the foot of Van Buren Street will be erected. It is at this point that the steamship company which will run boats to the Fair Grounds has built its large pier, and to reach this pier at present what looks to the nervous stranger like almost innumerable tracks must be crossed. The viaduct, of course only a temporary affair, is to start from the Michigan-avenue side of the lake front, and after rising gradually to an elevation sufficient to allow of the passage of trains beneath will gradually slope down again onto the spacious pier that runs out into the lake and which was completed some time last summer. This particular locality seems alive with work, which, though not all destined for the special use of visitors to the Fair next summer, is being hurried forward towards completion on account of it.

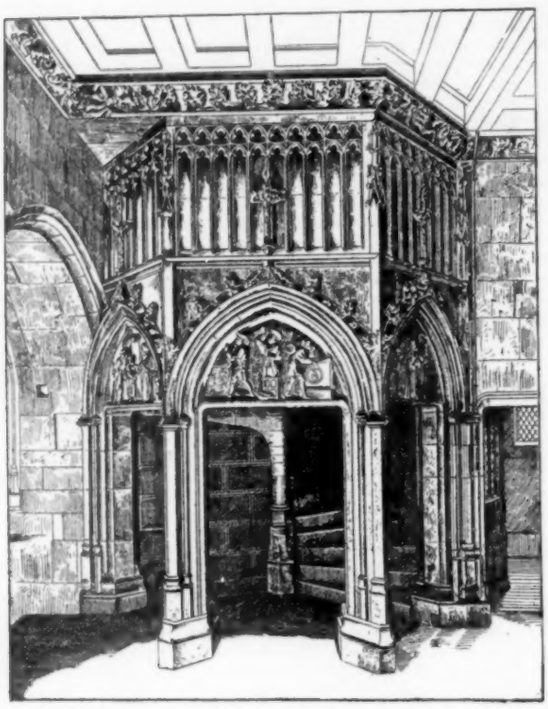
Nearly opposite the viaduct is the Auditorium Annex, a large hotel, to be carried on under the same management as that of the Auditorium itself. Apparently owing to some business scheme, a different architect from those who built the Auditorium proper has been employed on this new building. However, in spite of this fact, the two buildings have been kept in harmony with each other, as is seldom the case. The style of the new one is rather the more pleasing of the two. The material is buff Bedford stone, being the same as that used on the upper stories of the Auditorium. In that building the lower stories are of granite, but smoke, the great leveller here, has so "harmonized" the two stories that no difference is noticeable. The new building has the solid square outline so familiar to Chicago people in the Auditorium, and while the architect has kept a suggestion of the loggia and long bays, he has materially changed them. The loggia is hardly more than deeply-recessed windows, the recessed space being provided with pillars, which suggest a leaning towards the Doric style, not in keeping with the Romanesque carvings and mouldings. Should we take exceptions to this, however, there would also be a point for criticism in the balustrade of the highest of the bay-windows, where a decidedly fourteenth-century feeling is noticeable. The bays, which form a feature both in the side and front façades of the Auditorium, are, as above stated, kept in this building, but instead of the windows flush with the wall-line, as used in the older building, in the Annex bay-windows have been introduced into the bays both on the two sides as well as front and rear, which must give a delightful amount of light and sun to the rooms. The two or three upper stories of the Auditorium have their windows enclosed in a series of small bays, and to harmonize with this effect similar treatment is given to the upper stories of the Annex, the bay-windows being discontinued. In place of the flat surface of the small bays of the Auditorium, Romanesque pilasters are introduced as the dividing-line in the Annex. One feature by which light is given on all sides for the bed-rooms is the erecting of only a three-story structure on perhaps fifty feet at the southerly end of the Michigan-avenue frontage. Neither the same treatment of stories nor of the mouldings is pursued in this lower structure, and it remains yet to be seen whether it is to appear as part of the hotel or only a separate building in harmony with it.

Four or five blocks below this new structure, facing north, but still overlooking the lake front, is the new Illinois Central station. At present it is so shut-in from the general public by "no-admittance" gates that any knowledge of the details of the structure is hard to obtain. It is evidently Romanesque in feeling, and in its present state is suggestive of a good deal of picturesqueness. One most unusual feature is that, instead of being one huge pile, the station is composed of a group of three separate buildings, — four if we count the baggage-rooms, — some distance from the three others. The portion containing the main entrance is in the form of a large detached tower, while the slanting roof of the lower part of the building affords a pleasing relief from the square solidity of the corner-tower portion. The picturesque grouping is especially noticeable on the southern side, where the third detached building lies at right angles to the two principal ones. The material used is brownish Roman brick, with slate roof. The train-sheds, though very long, do not begin to equal in beauty the fine space of those of the Wisconsin Central station, recently erected here. Possibly the trusses of the World's Fair buildings have spoiled us for all else.

In last month's letter mention was made of the plan which the Board of Education was about to carry out. The matter has been definitely settled and an architect with a fixed salary of six thousand dollars has been engaged. Last year twenty-five school-buildings were erected, at a cost of fifty thousand dollars each, the architect receiving two and a half per cent for his commission. Now he draws his salary and has no expenses. The expense for the Board will undoubtedly be less than it was with the previous arrangement if all is run honestly and squarely in the bureau. All may — will — undoubtedly go right at first, but even should the head of the bureau continue to be an honest man, superior to temptation, there will doubtless be beneath him men more powerful than himself, as being the tools of prominent politicians. Such a state of things could hardly fail to bring about undesirable results, and an architectural bureau, with its contact with contractors and men of different trades, must ever be a dangerous place into which to introduce the conscience of the average politician, ever prone as it is to constitutional weakness.

BRICKS A DANGEROUS CARGO. — The captains of ships which carry brick have to be very careful. An ordinary brick is capable of absorbing a pint of water. So with a cargo of brick in the hold serious leakage may quite well go on undetected, for the water that enters is sucked up as fast as it gets in. If this should be the case the consequences are bound to be most fatal. — *The Clay Record.*

CHINESE CURIOS.[1]—I.



Spiral Stairs in the House of Jacques Cœur, Bourges. From Havard's "*Dictionnaire de l'Ameublement et de la Decoration.*

FEW collectors in the United States are aware of the wealth of China in all sorts of oddities and curios. There is an army of connoisseurs among the rich Mongolians, but they display little or no energy in accumulating art treasures. If they see something that strikes their fancy and they are satisfied with the price, they take it without a murmur. If it be ten cents beyond what they regard as a fair limit, they walk off in high dudgeon. As a consequence, the curio market has few ups and downs. Nevertheless, it does an immense business the year through. The best patrons are naturally wealthy natives. Then come European collectors and experts. Ship-captains and missionaries are also buyers of considerable importance. Last and least are the collectors of the United States.

There is hardly an artistic taste but can be gratified in the Flowery Kingdom. A full description of the art treasures to be seen in its great cities would fill many volumes. A *résumé* may be of interest to both the collector and the reading public.

ARMS AND ARMOR.

Of the former there are 1,100 types and 1,200 of the latter. The best workmanship in this line comes from Japan, and some admirable pieces are said to be of Korean origin. The Chinese work is extremely variable in quality and character, also in price, and, strange to say, the oldest and rarest weapons are sold at prices much below the charges for more modern and less curious implements of warfare.

In offensive weapons there is remarkable variety. On the coast its soldiers are armed with the latest rifles, while in the far interior they employ the same arms as were used by the vast hosts of Tamerlane and Zenghis Khan. Taking the Empire as a whole, the student or collector can find in use to-day every weapon that has been employed within its borders since the time of Confucius. In addition to this, the mandarins and high officials arm their retinues with conventional weapons representing different periods in the history of the nation. On account of the changes wrought by time, many of these martial instruments are so incongruous as to be positively funny. Thus, for example, the Mongolian Tartars did their fighting on horseback, and one of their most formidable arms was a pole to which was attached a hook edged on the inside like a reaper's sickle. With this they would pull a rider from his steed, wounding or killing him in the action, or would hamstring the horse at a single stroke. This pole-hook is no longer used by the few cavalry squadrons of China, but is found carried by footmen in nearly all the retinues of the great nobles. It looks formidable, but when used by infantry against infantry would be about as serviceable as an Indian club fastened securely to the end of a broomstick.

A glance at a collection of these arms shows that military uniformity was almost unknown to the Chinese generals of the past, and that the armies were made up of divers elements, armed usually with such implements used in peaceful pursuits as could be used in war. A common weapon is a trident, tined and barbed exactly as are those employed by fishermen in spearing eels. Similar to this is a three-pronged hay-fork. Of equally bucolic origin is a long pole to whose end is fastened the end of a scythe or sickle. The European mace is suggested by a long-handled, light-headed hammer similar to that with which Charles Martel is said to have won his quaint name. It is obvious that these four weapons are of harmless origin. The first was the favorite instrument of fishermen and the second, third, and fourth of agricultural people.

Of the five types described there are no fewer varieties. The poles are bamboo or solid wood. They are plain, carved, or decorated with mother-of-pearl, metal, or cord. The heads are copper, brass, iron, pewter or steel. Sometimes they are silvered, sometimes bronzed, lacquered or gilt. Handsome ones are the exception and not the rule. The average retainer of a high official carries an arm whose pole is of the commonest wood stained red and whose head is of the poorest kind of cast-iron or impure pewter. Many of these ominous-looking implements of war would not stand a light blow, both head and pole breaking at a very slight shock.

I have never seen any lances. The deficiency is made up by a surplus of spears and halberds. Of these the designs are varied, running from light and efficient points and edges to grotesque and hideous shapes that would frighten more than they would hurt. At times the workmanship is admirable. A spear captured by the French from the Black Flags in Tonquin is eight feet long. The shaft is of iron-wood, round, polished and varnished, and reënforced here and there by wrappings of fine copper wire, and at the upper hand is incrusted the distance of a foot with mother-of-pearl. The end is ferruled with a large copper band, in which is set the spear-head. This is made of fine steel, six inches in length and triangular in cross-section. One face is deeply grooved so as to allow a large amount of poison. These spears are used with great skill by the Chinese. Lee-Yu, a famous bandit, could throw one through a man at fifty yards. In the Franco-Tonquin war a powerful Chinese foot-soldier drove his weapon entirely through two French infantry-men. It is claimed that the finer and handsomer spears are not of Chinese workmanship, but are made by Japanese, Korean, Anamite, and Malayan ironsmiths. How true this is, I am unable to determine.

Of halberds there is great variety, ranging from the simple lochaber-axe and pole-axe to the cumbrous and complicated masses of metal that were so common at the close of the age of chivalry. The oldest specimen was one which, instead of an axe-blade on one side, had what appeared to be a hammer-head: it would make a serviceable implement for driving picture-nails in walls near the ceiling.

In archery the Chinese have long been experts, especially those of Manchooria and Se-Chuen. Their bows are of three types: the long bow, which is over five feet in length; the short bow, which is about four feet long; and the crossbow. The strings are made of silk, of gut, or of very strong home-made twine wrapped with fine silk in the middle. Bows are graded according to their pull, the standard being 100 catties (about 135 pounds). To determine the pull the bow, properly strung, is suspended from the middle and weights hung to the middle of the string until the latter is nearly an arrow's length from the bow. Famous bowmen use bows with heavier pulls, ranging from 150 to 200 pounds, and one distinguished Robin Hood is said to have drawn a 200-catty bow (about 270 pounds). The bows vary greatly in materials, construction, decoration and finish. They are made of one or several pieces of wood and are frequently inlaid or engraved until they are true works of art.

Worthy of mention are the tiger-bows. These are extra large and heavy and are generally fastened to a framework near a path or road frequented by tigers or other large animals. It requires two men to set them, and they are so arranged that the moving of a cord stretched across the road disengages the bowstring and sends the arrow on its way. The force is so great that the shaft frequently comes out of the other side of the tiger, deer or buffalo. To insure success the arrow is usually double barbed and envenomed. On the mainland, opposite the island of Amoy, these tiger-bows are in constant use and annually kill at least fifty of these big beasts.

The weapons named are much cheaper than corresponding ones in the United States or Europe. The cheapest spears and halberds bring about forty cents and bows twenty-five cents. From these figures the prices run slowly upward. A handsome pole-axe is easily had for $1.00, while weapons of the highest artistic value and finish can be secured for less than $5.00 each.

A handsome stand of arms, containing pole-axes, spears, halberds, swords and daggers—two each—can be procured for about $25. A stand equally attractive in appearance, but made in imitation materials, can be had for about half that amount.

An American resident in Amoy was requested to execute a commission for a distinguished divine of the United States, a gentleman who, though a man of peace, has the finest, if not one of the best, collection of swords and other deadly weapons in the world. This led to the examination of several hundred rare and curious weapons sent him for inspection and approval. No two were alike of the lot selected, and not one that did not display rare skill on the part of the Chinese sword-smith.

The handsomest of all is a general's sabre about four and one-half feet long, slightly Japanese in style, with an edge like a razor and a point that would extort admiration from an Italian bandit. Unlike our own, the thickest part of the blade is the centre. This gives great weight to the weapon, joined to an appearance of great lightness. The scabbard is made of hard, tough wood, lacquered to

[1] Report to the United States Department of State, by Consul Bedloe, of Amoy.

represent black iron incrusted with mother-of-pearl. The hilt is of black iron moulded in the form of a full-blown rose, the petals of which have been drilled with small holes and these filled with bright brass bars.

The most curious of the lot is the so-called warrior's two-bladed sword, from Ho-Nan. It is only about two feet long, and in the scabbard looks very like the sword bayonet of our own army. The scabbard is plain, but very neat, and covered with white shagreen (or shark skin) and trimmed with brass mountings. When you draw it the blade divides into two, each a fac-simile of the other, double-edged and spear-pointed. The twin blades have a remarkable decoration made by drilling seven holes about an inch and a half in diameter and put in a zigzag line from hilt to point. These are filled with pure copper, which is ground down to form a smooth surface flush with the steel and polished to a mirror-like brightness.

These seven stars, as they are called, are found in nearly all the martial weapons of Ho-Nan and are relics of the old astrologic faith that still prevails in many parts of China. Its hold is so strong that if the copper falls out of one of the sword holes it is accepted as a sure precursor of death, and the luckless wielder of the blade usually commits suicide to escape further trouble.

The short stabbing daggers, which find favor chiefly with pirates and revolutionists, form a strong contrast with the weapons described. They are generally so ugly that they would be ludicrous were it not for the purposes to which they are applied. I have one which looks like a queerly-made ace of spades fastened into a wire-bound handle. To increase the artistic effect of the weapon, the armorer has hollowed out a shallow, spoon-shaped concave on either side of the blade and filled-in with blood-red lacquer, the effect of which, when suddenly drawn from a black sheath, is very startling. Spades are not the only suit in the pack that is popular in the Mongolian mind. I have another weapon whose blade is a perfect ace of diamonds. All four sides are ground down to an almost concave edge, and the blade is made hideous by Chinese red-lacquer work made to represent drops of blood and gouts of gore. Still another dagger is about the clumsiest affair of the kind I ever handled. The blade is a foot long, about three inches wide, and half an inch thick. With its heavy brass hilt and gigantic guard it weighs over three pounds. If set with a long handle it can be used as an axe. It is used chiefly by the Black Flags and other celestial outlaws, who, in addition to using it in the ordinary manner, throw it with fatal precision. The ex-resident of Tonquin told me that during the late war he had known instances in which the knives were thrown with such force that they would go through a man's body and show two inches of bloody steel beyond his back. The handles of many of the instruments of death are finished with what we call "pistol grips."

The most dreadful looking weapon of all is the executioner's sword, used by the late headsman of Amoy. It is of Manchoorian type, being long, almost straight, very heavy, and keenly edged. It is used with one hand, and is shaped and wound so as to give the executioner a powerful hold upon his weapon. Upon the blade near the hilt are Chinese characters recording the tragic events in which it has taken active part. My interpreter told me that it records no less than one hundred and ninety-three human lives, which it has taken out of this world. This record enhances its value. A new sword of the same kind could be bought for $10 or $12, but for this sword, with its ghastly history, the thrifty broker wanted $200 cash. He evidently thought that, although it came high, I must have it, and accordingly raised the price. He was a very heart-broken creature when I declined it with thanks.

A word of caution as to these Oriental swords and daggers: Very many of them are poisoned, so that a mere scratch will cause death. The venom is produced by steeping the blade in decayed human blood, and is one of the deadliest known to physiological science.

From now on for the next five years will be the golden opportunity for the collector to secure the finest specimens of swords. The market has never before contained, and never will again, such an assortment as regards either beauty, economy, historic value, variety or workmanship. The reasons are simple enough. The opening of China and Japan to the outside world and the introduction of firearms was a fatal blow to the sword-smiths' industry. Before that event the makers of swords formed the wealthiest and most powerful guild in the East. The mediæval rivalry between Milan, Toledo and Damascus was insignificant alongside of that of the great armorers of the Orient. Competition caused experiments in metallurgy, alloying, forging and tempering that produced results of high value and disclosed mechanical secrets to the workers in steel that are unknown to the best cutlers of Europe and America to-day. They produced blades with perceptible tints in violet, blue, green, red, silver and gold. Saladin's sword, that would cut a veil or a cushion, and Richard Cœur de Lion's, which would sever a steel mace, could have been duplicated in a hundred shops in the days of the Shogunate and the eighteenth-century mandarins. Upon the sword, art ran mad. The smith learned to arrange the fibres of the metals so as to form geometrical patterns, the figures of flowers, fruits and leaves, and even the Chinese characters composing quotations from the great poets and philosophers. Their skill in this field bordered on the marvellous. You can obtain superb weapons even now which in the brightest light seem made from metal mirrors. Put them in the sunlight so as to cast a reflection on a dark surface, and in the illumination you will see in faint lines every pattern I have described. The effect is the same as that produced by the magic mirrors of Japan, but how it is done no one knows. The appearance of this flood of weapons upon the market is due to an additional cause. Under the ancient régime every noble, high and low, in Japan was attended by two-sworded men-at-arms, just as the robber barons of the Middle Ages were accompanied by steel-clad swash-bucklers. In 1860 there were, it is estimated, at least 400,000 "two-sworders" in Japan. The revolution of 1868 changed all this in a twinkling. Sword-wearing, except by the police and the soldiery, who had the ordinary European weapon, was made a crime. The two-sworder lost his occupation, and his tools of trade were locked up as mementos of the golden past. But twenty years have come and gone since then, the Mikadate is an established fact, and all hopes and desires of a return to the old feudal system have become mere echoes. A new generation has arisen which cares for money and not for the "hero's weapon," and the old one, which loved the blade for its past, is rapidly dying out. The consequence is that young Japan, with admirable thrift, is putting the weapons of his sires and grandsires in the curio-shops to exchange them for *yen* and *sen*, the dollars and cents of their mint. In China the mandarin has sold his grandsire's blade and carries an umbrella instead. So many have taken this course that the market is more than glutted. Two-thirds of these weapons have tasted blood. All are interesting, a majority are very handsome, while a few hundred are simply superb works of art. The prices at times are so low as to be laughable; $3.00, $2.00, $1.50, $1.00 and even 75 and 50 cents will procure a weapon such as Broadway and Strand dealers have frequently sold for $50 and upwards. The low prices have put many noble weapons to ignominous uses. Here and there in rich farming-lands the Oriental goes beyond the Biblical prediction and turns the sword into a plowshare, a reaping-hook, a pruning-knife, a carver, a poker and even a skewer. One day I saw two fishes roasting on a blade which may have swung in the great wars between China and Japan.

There is no more handsome ornament to a drawing-room or library than a trophy of arms, and of these the most attractive is a set of old Eastern swords, with their exquisitely carved hilts, their noble blades, and their fantastic yet ever beautiful scabbards.

While China cannot compare with Europe in the beauty, richness or variety of the defensive armor, it nevertheless can show many ingenious and interesting types.

The original armor of the north (Manchooria and Mongolia) seems to have been leather, and in shape was more like a blouse than a jerkin. In the course of years the skin was doubled, trebled and quadrupled, and a Chinese lower garment that might be called leather greaves and cuirasses combined was added to the upper one. The Mongolian nomads learned at an early age that a coat or cuirass made of sheepskin in several thicknesses made a very warm garment and would turn a spear, arrow or sword. Apparel of this class is in use to-day and may be bought very cheaply in Shan-Toong. Parallel to this alternating of leather and wool in the north was that of paper and cotton cloth in the south of China. It seems ridiculous to call such combinations armor, and yet they make an armor superior in many instances to steel. Thirty thicknesses of alternate calico and paper will resist a pistol bullet or one from a rifle at a distance of one hundred yards. A spearman who thrusts his weapon into a man clad in this kind of garment can neither wound his enemy nor extract his weapon, and, if the enemy is an archer or is armed with a long sword or javelin, he is likely to lose his life for his mischance. The suit of a famous Yun-Nan bandit consisted of sixty thicknesses of cotton cloth and paper and made him practically invulnerable. These suits are comparatively light, are very durable, and, of course, extremely cheap. Between these extreme types lie many kinds of plate, scale and chain armor. Plate-mail never reached a high development in the far East. I cannot find that it ever passed beyond the combination of breast-plate, back-plate and shoulder-pieces. Scale-mail, on the other hand, at an early period was carried to a high perfection. The scales were applied to cloth or leather at first as spangles are to gauze and later as tiles or slates are to the boards of a roof. They were composed of iron, pewter, silver, gold or of various Oriental alloys. In making a suit scales of one kind were usually employed, but combinations were frequent in which metals of contrasting colors were used. A good suit of armor can be bought at prices ranging from $10 to $150.

Of the different pieces of armor the helmet alone deserves attention. The Chinese artist worked along a different channel from his European colleague, and tried to make the headpiece monstrous and terrifying rather than protective. Designs representing the jaws of serpents, griffins and dragons are very common, but such affairs as the barred and vizored helmet which Doré loved to draw are entirely unknown. Morions and skull-caps were also in general use and are to-day. The queerest type of all is the executioner's helmet. It resembles a high mouse-trap or fly-trap in wire and painted the conventional vermilion. Centuries ago the wires were flat and so arranged as to defy sword and axe, and, owing to their great height, disconcerted the archers of the opposing army. In the north, where wood is scarce, the helmet is made from woollen cloth, leather and metal; in the west, where there are forests, wood was frequently employed; while in the south, in addition to these materials, cotton cloth and paper were also used. Helmets vary in cost according to workmanship and materials, and range from fifty cents to $50.

Shields and bucklers have been in vogue from time immemorial. The favorite type is a bossed circle from two to three feet in diameter

similar to those employed by the Highlanders. Its composition is leather, metal or woven split bamboo. Bamboo shields are very strong and durable. They are made of a certain variety of that vegetable, which must have attained a certain size and hardness of fibre before it was fit for this particular purpose. The bamboo is split into pieces an inch in width and four feet in length, softened and braided in basket-work over a frame the size of the desired shield. It is dried in the sun and then in a kiln, and afterwards polished and varnished. Its great strength and elasticity and lightness render it an admirable weapon of defence. A double thickness of bamboo with metal rim makes a buckler unlike any to be found elsewhere, and costs fifty cents. Unlike at home, the new weapons cost more than the old. Antiques can be had for a third or a fourth of the cost of new reproductions. Rich men in China prefer cheap imitation to originals, whether new or old, and the curio market scarcely knows armor as an *objet de vertu*.

[To be continued.]

SKETCHES OF ITALIAN ARCHITECTS.[1]

PALLADIO.

Hunting Trophy: by Stefano della Bella. From *Der Formenschatz.*

ANDREA PALLADIO, of Vicenza, in the course of his long career, probably erected more public and private buildings than have ever yet owed their design to any one architect.

Mr. Gwilt has given the sanction of his high authority to the assertion that Palladio's works were models for all the countries of modern Europe, and that in them the style which bears his name has had no rival. "So true is it," he observes, "that there is always to be found room for a man on whom nature has bestowed the faculty of seeing, feeling and thinking for himself." The extraordinary success which attended the career of Palladio, and the great extent to which he was able to control and modify the taste of his time may, perhaps, be better understood by a brief reference to the condition of society at the time when he appeared on the stage; for the observation is certainly entitled to credit that, "in the case of the architect something more than genius is necessary." It is requisite that circumstances should exist by which his art may be developed, or, in other words, that what he is capable of producing should be suitable to the wants of society at the time in which he may live. There is no doubt that many fine and sensible conceptions have been lost to the world for the want of taste to appreciate them or of opportunities in which to put them in practice. But circumstances of the kind most favorable to architecture had existed for a long period in Italy up to Palladio's time. The rich and the great had, in fact, been contending with the governments which should be the greatest patrons of the art; hence sprang the multitude and variety of works which still point out the greatness of the Italian States (now United Italy). But on account of the political condition of Venice, as well as on account of the particular period when Palladio rose to fame (which was about the middle of the sixteenth century), he cannot be said to have enjoyed those extended opportunities for signalizing himself which had proved so great an advantage to many former masters. Still, Venice had risen into power and wealth by her arms and commerce, and, although the works she required were not on a scale of the most grand and regal dimensions, yet those which her citizens required were likely to keep pace in luxury with the increasing wealth of the families who erected them. This was the peculiar nature of the career which remained open to the genius of Palladio. It will readily be conceived that his art was not called upon to furnish churches of colossal dimensions, nor palaces for sovereigns, nor immense public monuments left for posterity to finish and, perhaps, to pervert. Fortunately for the talents of Palladio, the political state of the country furnished a numerous class of wealthy citizens, who contended for the aid of this great man in rearing a villa or a palace — which might serve the double purpose of a present dwelling for the family, and a future memorial of their consequence. This was the feeling that found full scope in Venice, that covered the banks of the Brenta with edifices, which, of their class, form a complete school of civil architecture. They sprang up on all sides, under the same controlling hand, and thus the industry of Palladio was obliged to keep pace with the wonderful fertility of his invention.

The architectural taste of this great artist has been observed to be tempered and modified in no small degree by the care which he bestowed on the convenient arrangement of his structures. No one has exceeded him in the pains he took to accommodate external beauty to interior convenience; in suiting the art to the wants of persons with moderate means, through the medium of greatness of manner without extended dimensions; and richness of effect without a profusion of outlay. In the imitation, or, rather, appropriation, of the architectural system of the ancients Palladio truly excelled in that manner which selects from the skill of past ages the ideas best suited to the wants of his own time; he felt it was his calling to adapt his art to the wants and uses of the age in which he lived. No model, however perfect, was held up by him as an invariable copy or propounded as an infallible test. With him architecture was not a blindly imitative, but an inventive and an intellectual, art. Thus he acquired that just medium of exactness without pedantry, of severity without harshness, and of freedom of manner without abuse, which has made the architecture of the ancients so popular, and so modified it as to be practicable and convenient in all countries. We, too, have now learned to understand that it is the elements, and not the precise and rigid combinations, of Grecian architecture — changed, as they have been, by a passage through an intermediate existence in the schools of Italy — that can give us a natural, vigorous, unaffected and beautiful style. "No architect," says Mr. Gwilt, — and I know not where we are to look for a higher authority than this elegant scholar, — "can consider himself thoroughly educated who has not studied the works of Palladio.

The admirers of Palladio are sometimes charged with lacking an appreciation of the beauty of the Grecian outline. But this is not the case, — nothing could in reality be farther from the truth. Had one been born an Athenian the glorious temple of Pericles would have been the chief idol of one's imagination; but living in another country, a different climate and a distant age, one can only view it in the light of an example, not as a model for a flimsy dwelling-house, or a pattern for a brewery. Its unity, expression, harmony, fitness and extreme simplicity teach that the Greeks adapted their architecture to the demands of propriety and of common-sense, and the lesson thus derived is that we should endeavor to do likewise. The materials of classic taste are all supplied to the architect from the exhaustless storehouse of antiquity; the rules which guide, but not fetter, the artist, are before him, but the combinations which are to meet his own uses must be *his own*.

Thus, doubtless, reasoned Palladio, and thus it is that his name attained the proud eminence which it has always continued to occupy. It must have been by the observance of such principles that his peculiar properties of taste and style resulted. The utmost naturalness and propriety pervade all his works, in their adaptation to the uses of their erection. Suited, as most of his examples were, to the means of moderate fortunes, they found in England — if such an expression may be pardoned — a second native country, where those great masters, Jones, Wren and many others, have naturalized the plans, façades, distribution and details which were originally planted in the provinces of the Venetian republic. Indeed, the fascinating style of Palladio could not be prevented from spreading throughout Europe as a true happy medium between the severe use of ancient forms and the irregular license of those who reject all rules whatever. It only needs for the public to acquire architectural information to perceive that the architecture of the Venetian school is ancient architecture practised upon principles of common-sense, and since the outline and disposition of the works of the ancients must necessarily be changed, to fit them at all to our purposes, changing also the component parts of which they are made up so as to accommodate them to their new situation. Thus Palladio did not scruple to vary the proportions of an order according to the nature of the building to which it was applied or the peculiar position in which he might be obliged to place it. For example, the fine Corinthian portico of the Pantheon, at Rome, lost much of its effect by being necessarily placed on the north side of the rotunda, so as to be constantly *in the shadow* of the larger mass. This variation of situation was a departure from the usual practice of the classic architects, who generally placed their porticos in such a position as to receive the full benefit of the strongest light upon which their effects, so far as light and shade are concerned, will be found mainly to depend. Now Palladio, when obliged, from a difficulty in the site, to submit to such an inconvenient arrangement, would have taken care to exaggerate somewhat all the profiles of the component parts which would have the effect to deepen the shadows in that situation, and thus restore, by simple artificial means, the advantage which he would otherwise have been compelled to lose. A parallel expedient is found in the practice of our sculptors, who deepen their lines and

[1] From the papers of the late Arthur Gilman.

cuttings on a bust in marble, to avoid the weakness of shadow that would result if these were not more boldly developed than in the original models in clay. Palladio's practice exhibits the result of an artist's venturing to *think* for himself, instead of blindly copying the mere detail which he may happen to find in the example before him. So in the law, too, the advocate takes the broad and general principles of his argument from the precedents which he finds laid down in the books, but they must be varied in their application to suit the new circumstances, or to apply to the novel combinations of his case. "Thus the buildings designed by Palladio," says Mr. Gwilt, "exhibit great good sense, simple means of accomplishing the end, a satisfactory agreement between the demands of necessity and those of pleasure, and such a harmony between them that it is hard to determine which has submitted to the other." I do not think that the characteristics of his style could be better described than in this perspicuous quotation. That Palladio had faults it would be useless to deny, for no architect can ever be expected to reach absolute perfection. These faults, often resulting, too, from circumstances over which the artist could have had no control, have been magnified by modern critics into evidences of his ignorance and incorrigibly bad taste. But it is beyond dispute, that everything must find its own level at last, and the system which is based upon convenience, reason and common-sense will, in the end, prevail. The style in question has already almost entirely superseded the use of Grecian details in France and England, where the attention paid to architectural science is so much greater and the means of patronage so much more ample than among ourselves. This, I think, every one will be willing to confess, without sacrificing that national pride which is so highly natural and commendable a feeling; and it is not too much to say that we should be wanting to some degree in self-respect, as well as in a due regard for the advancement of the arts, if we were willing to remain in the same state of supine inaction.

We annually, as a nation, expend a great amount of money too, — both on our public and private edifices, — and is it not time that those who are called upon to pay for these undertakings should qualify themselves to understand, in some small degree at least, the real value of the return which they receive for their outlay? So well based upon the practice of the ancients does the style of Palladio appear to be, that it is, with but few modifications, suited to all nations, and just such as the ancients themselves would have adopted. There can be no doubt that had Ictinus, the designer of the Parthenon, been called upon to furnish a residence for a gentleman of Venice, — if such a thing could have happened, — he would have followed precisely the manner of Palladio: both were guided by reason and fitness in their works; and the character of these accordingly varies only according to the difference in the circumstances to which they were severally adapted. It has been said that if Plato were alive at this day there is no class of men for whom he would entertain so hearty a contempt as the professed Platonists of modern times. Instead of following out their great master in his search for truth, they are content to stop short exactly where Plato, in his day, was obliged to leave them. Just so is it with our modern Grecian architects, — instead of applying the principles of the classic style, they only reconstruct copies of its examples, and think that by multiplying Doric porticos they are really reviving Grecian art. But in thus transcribing specimens they violate first principles; and it may safely be declared that Ictinus would faint at beholding the productions of his modern admirers. In modern Grecian designs architectural features are continually tacked onto buildings with which they have no possible concern, merely to make up a show. Thus it is not an altogether unheard-of thing for two estimates to be made of the cost of such a building, — one estimate of the house without the architecture, and the other of the architecture with the house. Instances have occurred where one man has taken a contract to build the house, and another one contracted to build the architecture; and when both were finished the architecture was found to be too large for the house, and had to be considerably cut down and modified before it could be fitted to its place. One would not advocate a literal adherence to one of Palladio's plans in all its parts, any more than to that of an hypæthral temple of antiquity. Convenience changes as the modes of life vary. It is in the manner in which Palladio and his school used the system — the way in which they disregarded the letter, in order to adhere to the spirit of it — that they afford us an example, but their invention in details is at least of direct use, and these can be well applied without any variation among ourselves. The number of palaces and villas with which Palladio enriched the Venetian and Vicentine territories is almost incredible; the variety of plan and elevation in them seems as inexhaustible as their number. In these, it is not pretended that there is not much that does not conform to the manners and customs of our own day. The architect made his arrangements with relation to the age in which he lived; he could not foresee the taste of posterity, nor, could he have done so, is it likely that he would have been permitted to make it a consideration by his immediate employers. But his rising to such high eminence, together with the number and great variety of his engagements, is a sufficient proof that *they* at least obtained from him all that they required. One of the most noted of his villas was the Villa Capra, designed on a scale of great dignity. It was a square house with a basement, a very high principal story, and an attic story above, communicating with the lower apartments by stairs placed in the angles which were cut off by a great central rotunda. This rotunda terminated inside in a hemispherical dome. There were four principal rooms on each floor and four smaller intermediate ones attached to them. There were also four fine porticos on the exterior, — one attached to each façade of the structure, — displaying in each six columns of the Roman Ionic order. The entablature which these supported was continued round the whole of the building, indicating the line of separation between the principal story and the attic above it. Elegant statues were placed at each angle and on the apex of each pediment, and the ornate character of the whole was kept up by the richness of the dressings round each aperture in the principal story. An imposing flight of marble steps led to each portico; and here, also, statues terminated the advanced portions of the balustrade. In this design Palladio appears to have had the noble style of the ancients always before him, and thus to have preserved that simplicity and majesty in his structure which, in spite of its admitted blemishes, it possessed in a high degree. Palladio's best church was that of Del Redentore, at Venice; there was also a theatre at Vicenza, built upon the ancient model for the Olympic Academy, which added much to his reputation. He was never employed upon any stupendous structures; for these opportunities were rare; but, had an opportunity been afforded him on a grand scale, there is no doubt that his simple and majestic taste would have achieved a triumphant result. The unity and dignity of design in the Villa Capra show that Palladio would never have tolerated many of the littlenesses that mar the beauty of St. Peter's. Many of the designs of Palladio were left, at his death, to the Senator Contavini, his friend and patron; but the Senator himself dying soon after, his designs were variously dispersed. Many of them subsequently became the property of the celebrated architectural amateur, Richard, third Earl of Burlington, who was a great admirer of Palladio, and who built a villa at Chiswick, in imitation, though not an exact copy, of the Villa Capra. This charming residence passed into the possession of the Duke of Devonshire; and the Emperor of Russia was entertained there by his Grace, in a style of unusual magnificence. This house was one proof, among many, that the public and posterity — the true judges of human merit — have awarded that position to the genius of Palladio which his various noble works so justly deserve. The death of this great artist occurred in 1580.

THE TOWER BRIDGE, LONDON.

Abo Cathedral, Finland.

A CORRESPONDENT of the *Glasgow Herald*, in describing the Tower Bridge over the Thames, says that although it might be dwarfed by comparison with the immense cantilevers which span the Forth, it is in some respects almost unique, embracing three of the principal types of bridges — suspension, cantilever and bascule. Bascule bridges, under which category it comes, are very common wooden structures in Holland, especially in connection with the Amsterdam Canal, and the wooden spans over the Forth and Clyde Canal suggest the same type, but nothing of the size of the structure at the tower has ever been attempted. The length of the bridge and abutments is 940 feet; with the approaches

the length is half a mile (2,640 feet). The approaches are 70 feet wide, being gradually reduced to 60 feet, and finally to 50 feet over the central span. There are three spans, the two side lengths, each 270 feet clear, being on the suspension system, and the central span of 200 feet between piers is on the bascule principle, with two high-level footpaths. That is to say, the main span is in two equal halves, each pivoted in the piers so that they can be raised by hydraulic machinery, assisted by balanced weights, to a vertical position against each pier, and thus allow vessels of any height to pass. When in the horizontal position, and forming the bridge, the height from water-level is 29½ feet, so that the great majority of craft can pass under. Indeed it is expected that the bascules will not require to be opened more than from thirty to forty times in each twenty-four hours. When the bascules, or draw-bridges, as they may be popularly called, are up, passengers have the option of climbing a stair or being raised by hydraulic hoists to the two foot-bridges which stretch from tower to tower at a height of 140 feet from high-water level, and this alone prescribes the height of ships' masts. There is little chance of this ever being exceeded. The view from the foot-bridge, it may be said in passing, will compensate for any inconvenience.

In describing generally the method of construction, attention is naturally turned first to the foundations. Besides the two abutments on the shore there are two piers, 270 feet distant from each abutment and 200 feet apart. Owing to the requirements of the river traffic, only one pier could be constructed at a time, and that on the Middlesex side was started in 1886, when the foundation-stone was laid by the Prince of Wales. The high-pressure closed-chamber system of driving underground being so common, it is interesting to note the different methods adopted by the contractor, Mr. Jackson, in sinking the foundations. Eight rectangular wrought-iron caissons, 28 feet square, and four triangular-shaped caissons were constructed on staging in the river and lowered into position on the bed of the river. The excavation of the material inside the caissons then proceeded by means of grabs or buckets on cranes, while divers shovelled out the material from the sides. The caissons had a cutting edge, and, being weighted at the top, sank as the excavating proceeded. New temporary sections were added to keep the top above water-level. At 19 feet below the river-bed the London clay was found, and when 4 feet of it had been penetrated it was thought safe to pump out the water, so that further operations inside the caissons were pursued in dry ground. The foundations are carried 7 feet into the London clay-bed, so that the depth from river-bed is 26 feet and from high-water level 112 feet 6 inches. Around the outer edge at the foot, too, the clay was excavated and concrete substituted from the interior through high-pressure jet. The interior of the caissons was filled with cement concrete to within 2 feet of the level of the bed of the river, when gault bricks were substituted. The caissons were separated the one from the other to the extent of 2 feet 6 inches, but piling was driven to enable the work to be done in these intervening spaces. After the inside of the caissons had been filled with concrete the intervening spaces were similarly filled, the whole site of the foundation being thus of concrete and the top of permanent caissons Cornish granite, outer walls and inner packing of gault brick, carried up from the level of the bed of the river to 4 feet above Trinity high-water mark, or 116 feet 6 inches above the bottom of the foundation. Spaces were left in the interior of the pier for accumulators for the working of the hydraulic-hoists, for a recess into which the short balance-weighted arm of the lifting bridges will fall as the bascules are raised, and chambers were, of course, provided for machinery, which is in every respect in duplicate. The completed piers are, at the bottom, 204 feet 6 inches long in the central line of the river and 100 feet wide, while at high-water level they are 154 feet 8 inches long — there being immense breakwaters — and the width is 70 feet. The sectional area of waterway is 20,040 square feet, whereas at the London Bridge it is 19,300 square feet.

Coming now to the superstructure, it may be stated that it was all made and temporarily erected at Sir William Arrol's Dalmarnock Road works before being sent to London, Sir William being the contractor for the superstructure. On the piers we have just described there were erected a series of octagonal built-up steel columns, each firmly secured on immense granite beam-blocks. These columns, which are 119 feet high and 5 feet 9 inches in diameter, are well braced together. At three heights there are landings of steel plates carried on girders, and connecting these landings are flights of stairs and two large hydraulic-hoists in each tower. Londoners have had opportunities of seeing, and therefore appreciating, the great strength of these steel towers; but even the affording of this guaranty would not atone for the unsightly effect of the steel skeletons, as gaunt-looking as those on the Forth Bridge which so offend the artistic eye, and one can appreciate the great advantage of having the steelwork cased in rock-faced granite. The main architectural features of the design of the Tower of London, close by the bridge, have been adopted in these immense masonry towers, which rise, with their little turrets of Portland stone, to a height of over 200 feet above water-level. With the subdued tone which time quickly gives they will assimilate with the venerable and historic tower.

The draw-bridges which project from the bottom of these towers, meeting in mid-stream, may be easily mistaken for an ordinary iron span of 200 feet. Each is made up of four longitudinal girders, the depth being greatest close to the tower to give the bottom a curve, with cross girders between, carrying the roadway. But the two parts are not jointed at the centre, and instead of terminating at the towers, each is pivoted to an immense "pin" on the respective towers, which alone weighs something like 26 tons, and the steelwork is continued into the interior of the pier for a distance of 49 feet. The inner arm is fitted with a ballast-box containing about 300 tons of lead, to counterbalance the outer arm, which carries the roadway. The weight of each leaf, including the counterpoise, is 950 tons. It is an easy matter for the hydraulic machinery to raise from a horizontal to a vertical position this great girder, counterpoised on a pivot. This is done by means of an enormous quarter-circle rack fitted on the inner arm, the general operation being pretty much that which may be seen any day at the wooden bridges on the Forth and Clyde Canal, but the rack is of necessity worked through gearing by hydraulic-engines instead of by hand. The projecting arm rising to a vertical position lies close against the tower, and thus admits vessels passing, affording them a headway of 140 feet above water-level. Vehicular traffic is stopped for the time, but passengers, by going by hoists or stairs, reach either of the two high-level footways, 12 feet wide.

The footways are on the cantilever principle, and the building of them excited no little interest, for, as in the case of the Forth Bridge, the work was started from each tower, the girder being thoroughly anchored down to each steel tower. The bridge was built outwards into space, — the two ends advancing to meet each other having no visible support, — and the spectacle of men working with heavy cranes at a height of 140 feet above the river under these conditions was new to Londoners. The cantilever arms are 60 feet long, with a central span of 120 feet, carried by steel rods from the ends of the cantilevers. The girders were so carefully measured and constructed that when the joint came to be made in the centre the two halves were only an eighth of an inch apart at a temperature of 60° F.; and of course on a slightly warmer day the expansion of the metal proved sufficient to enable a thoroughly close joint to be made. The expansion-joint is not in the centre, but, as in the Forth Bridge, is where the central span is suspended.

The two side spans connecting the shore abutments with the river piers are on the suspension principle, and for this purpose towers have been erected on the shore abutments, which, although not so large, are of similar design to those in the river and already described. The roadway is carried on cross girders, 18 feet apart, suspended by steel rods to the "chain," which, as in all suspension bridges, extends from tower to tower. The "chain" is built-up of upper and lower booms, with strong bracing, and is practically of two links, the one 106 feet 6 inches and the other 190 feet 6 inches long, the former link being that connected to the shore tower and anchored in a huge bed of concrete in the ground beyond, and the latter reaches up to the tower in the river. Horizontal tie-rods are provided for each chain to counteract the pull of the chains on the towers. These rods are 301 feet long and built-up of eight thicknesses of plates 1 inch thick by 2 feet. On the girders, which are suspended by rods to these chains, a corrugated floor is laid with the usual roadway, which is 60 feet wide. The suspension bridges on each side of the river are alike, and are at the towers 27 feet above high-water level and at the abutments 20 feet, so that the rise in the 270 feet is very gradual. Indeed, the steepest gradient is only 1 in 40, which is very much better than at London Bridge.

BOOKS AND PAPERS

JUST as in former years, I have recently made a visit to those publishers who ordinarily lay before the eyes of amateurs a choice of many fine books, amongst which those dealing with art most particularly concern us. Unfortunately, this year there is in France a real crisis in the publishing business, and New Year's has seen disclosed few novelties, especially in the way of costly books. Included in the Bibliothèque de l'Enseignement des Beaux-Arts, which now numbers more than forty volumes, I will mention two new works: "*L'Archéologie Chrétienne*," by André Peraté, and "*Les Styles Français*," by Lechevallier-Chevignard. The first of these books is a study of the origin of Christian art, and is limited to the consideration of Occidental art, of which Rome was the centre, and hardly covers more than the Carolingian epoch. Nearly half of this work deals with paintings in the Catacombs, which for so long a time have been the objects of the liveliest religious polemics. The author considers the art of the basilicas, architecture and decoration of Christian buildings; then, taking up the composition of Christian mosaics, he traces the development of triumphal symbolism and the persistence of antique modes in the mosaics of the fourth and fifth centuries. Finally, he reviews the mosaic-work of the fifth and sixth centuries — Rome, Naples, Milan, etc. — down to the epoch of the decadence in the seventh, eighth and ninth centuries. The last portion of the book is consecrated to miniature-painting and Christian sculpture, based on studies of statues, sarcophagi, carved ivories, engraved glass, painted and decorated glass, lamps, jewelry, medals, etc.

Under the title of "*Styles Français*," M. Lechevallier-Chevignard lays bare the principal transformations of artistic sentiment which have occurred in our country. For this purpose he has asked his

questions of all the arts relating to design, without excepting the most modest ones, for the simplicity of the means or the humbleness of the material does not detract from the beauty of the resulting work and the evidence of its origin. A fragment of thirteenth-century woodwork or a Renaissance pewter pot will as surely show to what period they belong as the most imposing of our cathedrals or the Louvre of the Valois. This work might be criticised for being rather concise. The author himself foresees this criticism, and demands whether, in an essay of this kind, conciseness is not indispensable, and whether it is not at times a good thing to disembarrass oneself of special analyses, so as to take in at a single look the progress of art under those circumstances which have hampered or helped it. Such as it is, this book must awaken in the mind of the reader a desire to have access to more complete studies, and this, in truth, is the real object and purpose of the Bibliothéque de l'Enseignement des Beaux-Arts.

A city like Paris interests us because of its general aspect, and because of its monuments. It must also interest us because of its worst side; and just as at the theatre what takes place behind the curtain and in the green-room always excites curiosity, so the organization of Paris, its by-paths and processes of administration, can give rise to many interesting studies, which may also be instructive and philosophical. This is what M. Paul Strauss, municipal councillor of the city of Paris, has undertaken, and his work has earned for his fine book, "*Paris Ignoré*," an enormous success. If I speak of this work, it is because it is not altogether without value to the architect, as might at first sight appear. When one is called on to build markets, offices for the tax-collector, town-houses, prisons, etc.,— in short, everything which comes under the classification of public buildings,— is it not indispensable to know the practical needs which the building is to satisfy, the services which it is to house, and even the manner in which those services are discharged? Many little details are neglected in drawing up an official programme, often neglected as of too little moment; yet if the architect does not take upon himself to make the necessary investigations, he runs the risk of committing those blunders which are never discovered until the time has come to make use of the building. M. Strauss's book, then, has this special value, independent of the general interest which it presents. Everybody will read with interest the account of those services which he is called upon to prepare for.

How many things are found to be unknown! When the public to-day complain of the bad condition of the sidewalks, what must one have said in the times of Philip Augustus? This good king, having placed himself at the window of his palace, to see pass the chariots which were crossing the city, could not endure the fetid odor which disengaged itself from the mud stirred up by the wheels. This gave him the idea of lining the principal streets with strong stone. From that starting-point, street-paving has made considerable progress. To-day the streets of Paris are paved in four different manners: with stone over a surface of 6,384,000 square metres; they are macadamized over an area of 1,484,500 square metres; asphalt covers about 315,470 square metres, and wood-paving covers about 568,300 square metres. The process of quarrying the stone, the yards, the necessary equipage, tools, materials, everything, are described in M. Strauss's book. One can, after having read it, easily understand the works which too often encumber our streets, and amongst which the wood-paving particularly excites the interest of the loafer — a fact which is most curious and amusing. Then come the sewers, the water-works, the gas and electricity, the central markets, etc. All these studies are preceded by little historical introductions, which are very interesting when it comes to the Bourse du Commerce, the Hôtel de Ville, the prisons and hospitals.

How great a progress has been accomplished! What a long road has been passed over in the administration of the public services! Take hospitals, for instance. These are no longer the times when four, five and six patients were required to sleep in the same bed, pell-mell and side by side, without any one ever thinking of isolating or separating them one from the other; when the poor convalescents, the sick and the mad were hived together, and when the most frightful mortality decimated the patients in the hospitals, particularly at the Hôtel Dieu. A description of this state of things is frightful to a degree, and it dates back hardly more than a century. To-day the hospitals are admirably kept, and very numerous. In taking stock of the most recent ameliorations, it is discovered that twelve thousand beds are to-day in daily use by the sick poor in the Paris hospitals It is not true that at all times the number of beds exactly fixes the population of the hospitals. Usually the hospitals contain more sick than the normal number of beds. Yet the supplementary beds used have the double disadvantage of increasing the expense of maintenance and of being injurious to the health of the patients, who are deprived of their necessary allowance of air, which should be forty or fifty cubic metres. Each of the establishments is administered by a director, generally assisted by a steward. The provisions are supplied by the Department d'Assistance Publique, which supplies meat, bread, wine, vegetables and medicine. The greater number of hospitals are provided with laundries, and so do their own washing. Those establishments which have no laundries are assisted by those neighboring hospitals which have them. Thus the number of laundries is but nineteen, several of which are badly installed, badly equipped, and cannot be enlarged, while the quantity of linen which must be washed constantly increases, and to-day exceeds twelve million kilogrammes per year; that is to say, thirty-five to forty thousand kilogrammes daily. The cost of this laundry-work is about ten francs per hundred kilogrammes, and the administration is now studying how to reorganize the work, either by establishing a central laundry at Salpêtrière, or by making alterations in the present laundries.

Another very important service in the hospitals is the kitchen, with its dependences,— the ice-room, pantry, butler's pantry, butchers' shop, vegetable-room, etc.; but this is not all. The invalids often complain of having to eat cold meals. The distance between the kitchen and the wards is often great, and the roast meat has thus time to become cold — and this is a very serious annoyance to invalids and old persons. So the new hospitals, like the Hôpital Tenon, are supplied with an underground railway and lifts for the transportation of provisions: one on the Decauville system has recently been introduced at the Salpêtrière. A fine laundry, well arranged, a vast kitchen well lighted and of immaculate cleanliness, are, as it were, cheerful notes to find at the side of the operating amphitheatres, the dead-house, and the dissecting-rooms. As a rule, the dead-house is relegated to the farther limit of a well-aired court, as far removed from the other buildings as conditions allow.

Hospitals are very numerous in Paris and its suburbs. The most celebrated is that of Bicêtre, whose lofty walls dominate Paris. The old Bicêtre partook more of the nature of a prison than a hospital. "It is impossible," wrote Michelet, "to know what the prisoners, invalids and paupers suffered at Bicêtre: compelled to sleep as many as seven in a bed, eaten by vermin, nourished on mouldy bread, housed in damp rooms, often in cellars, fearing, on the slightest pretext, the whip-lash, they looked enviously toward the galley as if it were paradise." While looking through the immense establishment at Bicêtre, quite rejuvenated and metamorphosed about fifty years ago, these old memories involuntarily come to mind. It is the custom to show visitors the cell occupied by Latude, that legendary prisoner of the ancient bastiles, who sojourned at Bicêtre from August 2, 1777, to March 23, 1784. It was at Bicêtre that the first experiments with a guillotine were made, at seven o'clock in the morning, April 17,1792, in the presence of Drs. Phillippe, Pinel, Cabanis, Louis, Cullerier and Guillotin, corpses being used for subjects. The prisoners hoisted themselves up to the gratings of their windows, and in this way were present at the sinister experiment. The old Bicêtre was at the same time a prison, an almshouse, an asylum for old people, a special hospital, a lunatic asylum, a political bastile, and an infirmary for infants. The present Bicêtre consists of only two grand administrative divisions, namely, a hospital for old people and an insane asylum. In reality it shelters three distinct groups — old people, mad people, and idiotic and epileptic children. The buildings of the hospital properly so called extend around four rectangular courts, planted with trees and ornamented with gardens, where the old people warm themselves in the sun upon benches arranged at intervals. In case it rains, they take shelter under the arcades. All occupants of the hospital who are strong enough are expected to work. The four hundred working-people at Bicêtre are scattered amongst clothing-shops, tapestry workrooms, locksmith shops, painting and glazing shops, and shops where coopering and plumbing are done. The articles manufactured in these workrooms are sold for the benefit of the establishment.

It can be seen by this brief epitome of the chapter on hospitals and asylums collated while skimming over the pages that Mr. Strauss' s book very well shows, as I have said, the organization of Paris, its administration and the working of its services. One finds in it, apropos of prisons and poor-houses, many details concerning the criminal world, of which most people are ignorant. These facts are not useless, and can only bring about an amelioration or greater degree of completeness in the construction of these public edifices, and it is that architects may surround themselves with all possible sources of illumination that I draw the attention of the readers of the *American Architect* to "*Paris Ignoré*," since they will find in it, at all events, studies that are very interesting from a philosophical and social point of view.

In another column will be found a reproachful communication from Mr. George P. Merrill, who evidently feels that he deserves better of his generation than that generation has yet admitted — and, to save misconception, we will say at once that the generation is distinctly in the wrong. But admitting that Mr. Merrill is right in his conclusion, he is distinctly wrong in his premises.

In so far as his reproaches have justification, we freely admit that they should in larger part be levelled against ourselves than against the members of the profession at large, whom he charges with being lax of interest in acquiring knowledge of the materials they use and disregardful of their clients' interest. He intimates that no one of them, or very few at least, has ever carried out investigations into the structural qualities of building-materials, and, strangest charge of all, accuses them of not being buyers of books! We fancy Mr. Merrill can have little real acquaintance with architects, for our own knowledge of them leads us to believe that there are few men who spend a greater proportion of their income on purchasing books than do American architects. But this must be qualified by declaring that, inasmuch as this is a new country, and as therefore most architectural information relates to the Old World, the greater part of an architect's library of necessity relates to foreign architecture, foreign materials and foreign methods of construction.

The nub of Mr. Merrill's claim lies in the fact that he has written a book, an excellent book, an admirable one, which in spite of its merits has apparently fallen flat on the market and deceived the expectations of both author and publisher, and for this untoward result we believe that in a considerable degree we are responsible, responsible in this way: The publishers of the book duly sent us a copy for notice and review, but unfortunately it arrived but a short time before our office was invaded by fire and in the confusion and litter that was consequent on repairs the book was so far lost to sight that its character and very existence were forgotten, to such a degree even that some months later we took occasion to express regret that no one competent for the task had ever undertaken to make a thorough, reliable and comprehensive investigation as to the existence, characteristics and qualities of the building-stones, known and unknown, in all the several parts of this country — the very work Mr. Merrill had already accomplished.

The fact that Mr. Merrill is curator of geology in the National Museum at Washington, even if nothing else were known about him, would earn for his work the attention that is usually accorded to a scientist, even if he had not already achieved note as a man of practical ideas.

As we have said, this book, "*Stones for Building and Decoration*,"[1] is an excellent, an admirable book, but, best of all, it is a practical one, clear in statement, commonsensical in its arrangement, and usable for the needs of every-day life, and if what we say here shall bring about a greater immediate return from the author's copyright account it will give us great pleasure, as surely he deserves this much at the hands of the profession, in spite of the stigma he casts upon them through arguing from improper premises.

As for the book itself, it begins with a brief historical and geological chapter, in which the geological formations are concisely described, their composition given, and the general manner in which the several deposits are distributed in the several States. In further explanation of this a table is given which shows for the several States what deposits exist therein and which of them are now worked and which are as yet practically neglected by the purveyors of building-stone.

Distribution is the key-note of the method which the author has followed, and the Second Part is devoted to the consideration of the manner and degree in which the several classes of building-stone are distributed through the different States. Here, under the headings Steatite, Serpentine, Gypsum, Limestone, Granite, Schistose Fragmental Rocks, and so on, will be found a more full and complete consideration of their geological properties than was given in the First Part, followed, under each class, with one or more paragraphs showing where and how the particular stone is found in each State — alphabetically arranged — and in what way the deposit varies from or conforms to the generic peculiarities of the stone under consideration.

In this Part builders and architects will probably be surprised at finding enumerated a number of good building-stones common to their own place of nativity or domicile of which they have been in total ignorance — a discovery which may lead to the opening of new quarries and the building-up of new industries.

The Third Part is even more practical than the others, and it is the one which will probably be read with most thoroughness, since it describes with clearness and sufficient fulness the ordinary manner and method of quarrying building-stone. In this Part also are considered the important matter of the weathering of building-stone, their comparative durability, and some of the methods that have been or may be employed for their preservation when built in the wall.

A full table of contents and a complete and careful index would be enough to make the book a complete and adequate hand-book of the subject; but there is also given an Appendix, which contains a table which gives the weight, specific gravity, crushing-strength and ratio of absorption of some two hundred and fifty varieties of building-stone. Further value is added by a short glossary of terms, in which we detect not one of those extraordinary terms which are never used, nor yet met with in books, except in glossaries which seem to be compiled only to establish the scholarship of the compiler. To this is added, furthermore, a bibliography which we give below in full. All taken together, this book is one of too real a practical value to be neglected by architects, and we hope our words will be heeded to such a degree that the author may no longer have reason to believe that architects "do not buy books."

We might find some things to criticise, but it will be enough in the way of detraction if we point out that a greater number and better quality of illustrations might easily have been introduced, colored plates, for example, as in Burnham's book on Limestones and Marbles, and that the index would have been improved if it had contained the local and colloquial names of stones as well as the formal scientific ones.

"The following list includes all the principal works on the subject of building-stone which have come under the writer's notice. It does not include isolated and special papers which have appeared from time to time in various journals and periodicals, or State geological reports. Such, when containing matter of sufficient importance, have been mentioned in the text and reference given in the foot-notes. The list is arranged alphabetically by authors:

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Burnham, S. M. History and Uses of Limestone and Marbles. Illustrated, with colored plates. Boston: S. E. Cassino & Co., 1883.

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Köllsch, Carl. Die Baumaterialienkunde für ausführende Bautechniker und für Studirende der Bauwissenschaft. Schwetschke & Sohn. Bruhn, 1861.

Kunz, George F. Gems and Precious Stones of North America. Scientific Publishing Company. New York, 1890.

Malécot, Léon. Matériaux de Construction employés en Belgique. Bruxelles & Liége, 1866.

Newberry, J. S. Building and Ornamental Stones. Report of Judges, Group 1, U. S. International Exposition, 1876, Vol. III. Washington, 1880.

Notes on Building Construction. Part III. Materials. (South Kensington Educational Series.) London, Oxford and Cambridge, 1879.

Schlegel, Carl Friedrich. Die Lehre von den Baumaterialien und den Arbeiten der Maurer. Leipzig: Verlag von Heinrich Matthes, 1857.

Schmidt, Otto. Die Baumaterialien. Berlin, 1881. Verlag von Theodor Hofmann.

Smock, John C. Building-stone in the State of New York. Bulletin No. 3, New York State Museum of Natural History, March 1888, 8 vo. 152 pp.

Report on the Building-stones of the United States and Statistics of the Quarry Industry for 1880. Vol. X. Report of the Tenth Census of the United States. Washington: Government Printing-office, 1884.

Thurston, R. H. Materials of Construction. New York: Wiley & Sons, 1885.

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Visser, J. E. Die Baumaterialien. Handbuch für Architecten, etc. Emden, 1861.

Webber, Martin. Das Schleifen, Poliren, Färben und künstlerische Verzieren des Marmors. Weimar, 1878. Bernhard Friedrich Voigt.

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In connection with the foregoing bibliography we will give the following one[2] which Professor Chandler of the Massachusetts Institute of Technology has affixed to the little treatise on Limes, Cements, Mortars and Concretes, which he has prepared for the use of his class. Whether this little pamphlet of forty pages can be procured by outsiders, we do not know; but it contains a digest of some of the latest investigations of experiments, as well as of those of older and standard authorities, it brings nearly to date and in very compact form those conclusions which now form the basis of the best modern practice:

Vitruvius.
Pliny.
Higgins. Calcareous Cements.
C. W. Pasley. Limes and Cements. London, 1838–47.
Rondelet. L'Art de Bâtir.
Vicat. Recherches sur la Chaux, 1819. Trans. by Capt. J. T. Smith, F. R. S., 1837.
Treussart. Mémoires sur les Chaux et Ciments. Trans. by J. G. Totten. New York, 1842.
Lipowitz. Manufacture of Portland Cement.

[1] "*Stones for Building and Decoration*," by George P. Merrill, Curator of Geology in the United States National Museum. New York: John Wiley & Sons, 1891.

[2] "*Notes on Limes, Cements, Mortars and Concretes.*" Prepared for the Students in the Architectural Department of the Massachusetts Institute of Technology. By F. W. Chandler. Boston: Collins Press and Bindery, 1892.

Reid and Lipowitz. Practical Treatise on the Manufacture of Portland Cement.
Reid and Lipowitz. On Concrete.
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Notes on Building Construction. 2d Edition. Part III. London, 1889.
G. R. Burnell. Limes, Cements, Mortars, etc. London, 1887.
Proceedings of the British Institution of Civil Engineers:
John Grant. Articles in Vols. XXV, XXXII and XLI.
Charles Colson. Experiments on the Portland Cement used in the Portsmouth Dockyard Extension. Vol. XLI.
Isaac J. Mann. The Testing of Portland Cement. Vol. XLVII.
Q. A. Gillmore. A Practical Treatise on Limes, Hydraulic Cements and Mortars. New York, 1874.
Q. A. Gillmore. Notes on the Compressive Resistance of Freestone, Brick Piers, Hydraulic Cements, Mortars and Concretes. New York, 1890.
H. Faija. Portland Cement for Users. London, 1884.
Transactions of the American Society of Civil Engineers:
W. V. Maclay. Notes and Experiments on the Use and Testing of Portland Cement. December, 1877.
Preliminary Report of the Committee on a Uniform System for Tests of Cements. January, 1884.
Report of the Committee on a Uniform System for Tests of Cements. November, 1885.
Eliot C. Clarke. Record of the Tests of Cements made for the Boston Main Drainage Works, 1878–84. April, 1885.
F. Collingwood. Behavior of Cement Mortars under Various Contingencies of Use. November, 1885.
Alfred Noble. The Effect of Freezing on Cement Mortar. March, 1887.
Hints on Cement Testing. September, 1891.
J. Sondericker. How to Test the Strength of Cements. Am. Soc. Mech. Engrs. for 1888.

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE LINCOLN MONUMENT, LINCOLN PARK, CHICAGO, ILL. MR. AUGUSTUS ST. GAUDENS, SCULPTOR. MR. STANFORD WHITE, ARCHITECT, NEW YORK, N. Y.

[Gelatine Print, issued with the International and Imperial Editions only.]

BIRD'S-EYE-VIEW OF COPLEY SQUARE, BOSTON, MASS.

IN connection with the announcement of a competition for the remodelling and decoration of Copley Square we publish this view, and will repeat that any person desiring to avail himself of such aid can procure a larger print of it on drawing-paper by forwarding twenty-five cents to the Secretary of the Boston Society of Architects, Mr. H. Langford Warren, 9 Park St., Boston.

LABORATORY BUILDING FOR MT. HOLYOKE COLLEGE, SOUTH HADLEY, MASS. MESSRS. EARLE & FISHER, ARCHITECTS, WORCESTER, MASS.

GYMNASIUM FOR THE UNIVERSITY OF VIRGINIA, CHARLOTTESVILLE, VA. MESSRS. CARPENTER & PEEBLES, ARCHITECTS, NORFOLK, VA.

LUNATIC ASYLUM, WEST ROXBURY, MASS. MR. EDMUND M. WHEELWRIGHT, CITY ARCHITECT, BOSTON, MASS.

HOUSE AT GUADELOUPE, MEXICO. DESIGNED BY MR. C. ALOIS HERMAN, ST. LOUIS, MO.

[Additional Illustrations in the International Edition.]

THE SARATOGA BATHING-ESTABLISHMENT, SARATOGA, N. Y. MESSRS. FULLER & WHEELER, ARCHITECTS, NEW YORK, N. Y.

THIS building, which is owned by Mr. H. M. Levengston, Jr., was erected recently, at a cost of about $80,000.

PLAN OF THE SAME.

52 CADOGAN SQUARE, LONDON, ENG. MESSRS. ERNEST GEORGE & PETO, ARCHITECTS.[1]

THE improvement of Lord Cadogan's estate has given opportunities to several architects to depart from the established type of West End house. Cadogan Square is one portion of the estate where a comparison between many designs can be made.

CHÂTEAU DE PIERREFONDS: CHAPEL AND GRAND PERRON.[1]

THIS illustration shows another part of the court, including the chapel, which is situated nearly at right angles to the part lately given.

[1] NOTE. — As we go to press we find it is still uncertain whether this plate will arrive in time to be included in this issue. In case of actual omission it will be furnished with the next issue. — EDS.

PREMIATED DESIGN FOR AN OXFORD UNIVERSITY-EXTENSION COLLEGE. MR. C. R. ASHBEE, M. A., ARCHITECT.[1]

THIS design was prepared as a pattern plan upon which, subject to the modifications suggested and the requirements needed by any flourishing university-extension centre, further and more specific plans might be based. The following data were assumed: That (1) an average flourishing centre would need accommodation for 200 students in one large hall, irrespective of the other class-rooms. That (2) the centre, even if flourishing, would be impecunious, and all architectonic effect would have to be got inexpensively. That (3) the centre might reasonably be situated in a well-to-do country-town; and that therefore (4) the land procurable would have to be economized, and would probably be of the nature of ordinary street frontage, with a depth of say fifty or sixty feet. That (5) all planning should admit of the possibility of later expansion. The building as shown could be provided for a sum of £2,000, subject to the possibilities of the district as regards building-material — stone, brick, etc., — and exclusive of the internal fittings, for which another £500 might be reckoned. It provides the following: a hall, a vestibule, a secretary's office, men's and ladies' cloak-room and lavatory accommodation, a small lecture-room, a students' library, a large lecture-room, a laboratory and care-taker's apartments. In the style chosen it was the endeavor to express three things: (1) strict utility, as, for instance, in the square forms of the windows and the large light of the lecture-hall, etc.; (2) the idea of continuity from the universities, the architectural treatment being such as to carry out the idea of expansion expressed in actual stone in the buildings of Oxford and Cambridge, even as the extension movement is the social and literary expansion of the universities over the country; and (3) in the style indicated, namely, that fusion between the late Gothic and the Renaissance, though liberally treated for modern purposes and though the most strictly utilitarian, a reference to that earlier and greater extension of the universities when Colet lectured at Oxford and Erasmus led the new learning of Europe from his little cell at Queen's. The design was exhibited in the last exhibition of the Royal Academy.

NOTES AND CLIPPINGS

THE COMINO-TREE OF COLOMBIA. — This tree, called "comino," produces an excellent wood for the use of cabinet-makers, and contains some exceptional properties, not only for high-class furniture but for building purposes. The common kind of comino is very much appreciated for house-building, its merit being that it is perfectly proof against all wood-destroying insects so prevalent in this part of Colombia. It is a well-known fact that all kinds of timber used for building purposes in this country are assailed and destroyed within a short space of time by insects called "comejen," a winged insect; and a house built of common timber is fought shy of by all purchasers of property, whereas property built of comino-timber will stand strong and unchanged for ages, and is unaffected by either insects, water, soil or climate. There is another kind of comino-wood having the same properties as above described, but commanding a very high price and used mostly for veneering purposes. It is of a beautiful dark and light undulating color of a yellowish tortoise-shell appearance, as will be seen by the small box I send with the seed. High-class furniture veneered with this kind of comino, called here "comino crespo," presents a magnificent appearance, always bringing a high price if well worked and properly finished. This tree is especially grown in the department of Antioquia, and also serves as a handsome ornament to a country place. You will likewise find inside the box of seed some leaves which I have picked from some plants in my country home. The comino above described can be successfully cultivated at a temperature of between 18° and 20° C. I have no doubt but that if it can be cultivated and acclimated in the United States this beautiful and wonderful tree will be a great and an important acquisition to the American wood-workers. One fully-developed tree of comino can yield four hundred pieces, as follows: Two hundred boards 9 feet long, 10 inches wide, by 1 inch thick, and each of them can be sold for $1.20; two hundred girders, 9 feet long, 4 inches wide, by 2 inches thick, and each is sold for $1. Besides, the branches of the tree are utilized for small columns for windows and for other purposes, and the very thin or exiguous ones for fuel, although it burns very badly, yielding a great deal of smoke. The comino-tree is not the *Sandalo citrino* of Ceylon, Brazil and China, as is believed by some. — *Luciano Santa Maria, U. S. Vice-Consul, Medellin.*

LIEUTENANT PEARY'S ARCTIC HOME. — The general theory of its construction was to make it a series of light tight shells, inclosing several air-spaces between the innermost and outermost coverings. The frames were made of six boards, 10 inches wide by 1 and 1-4 inches thick. They rested upon three plank sills, and were spaced three feet apart lengthwise of the house. Boards similar to the bottom board of the frames were placed upon the plank sills, half-way between each two frames, and these with the bottom boards of the frames formed the floor-joists, spaced 18 inches apart. Then the floor was laid of one and one-quarter-inch yellow-pine boards 3 inches wide, tongued and grooved, and solidly blind-nailed to every floor-joist. Next came the roof and sides. First, heavy two-ply tarred paper was laid in horizontal courses entirely around the house, against the outside of the studs, from the ground to the ridge, each course overlapping the one below, like weather-boarding, and nailed to each stud. Then over this was laid

the outside boarding, of one-inch boards, tongued and grooved. When this boarding was finished, all the horizontal laps of the tarred paper were tacked to it (from the inside, of course) to make wind-tight joints. Then three-ply paper was put on outside of the boarding, in vertical strips running from the ground up the wall, over the roof, and down the other side to the ground again. On the ends the strips ran from the ground to the edge of the roof. Each of these strips lapped the others about two inches, and the laths nailed continuously from ground to ground over these laps made wind and rain tight joints. This completed the outer shell of the little house. Then came the lining of the interior. First, thick sheets of pasteboard known as trunk-boards, 3 feet wide by 4 feet long, and a quarter of an inch thick, were nailed against the inside of the studs, on the sides, and overhead, until the entire house was cased-in Now, if you have followed me closely you will see that the house consisted of two shells, the outer composed of two thicknesses of tarred paper and an inch of closely-fitted boards, and the inner composed of thick trunk-boards. Between these two shells was an air-space varying in thickness from 10 inches at the sides to over 3 feet in the centre of the triangular place just under the ridge. Now, as air is known to be a good non-conductor, if the air in this space could be prisoned effectively it would form the most simple, cheap and effective blanket. So all the joints in the cardboard were carefully pasted over with wide strips of heavy brown paper and made perfectly air-tight. — *Harper's Young People.*

What a Pound of Coal can do. — "The day is not far off when we will get heat and power without the intervention and assistance of fire," said Civil Engineer Marston McGrath to a St. Louis *Globe-Democrat* reporter. "The solution will come when we get electricity direct from coal without the loss of any part of the wonderful energy that there is in the fuel. I never knew fully the value of coal as a power-producer until I saw it exemplified on a recent trip across the Atlantic in the steamer '*Majestic*.' The vessel carried 2,400 tons of coal, — almost enough to give a half-bushel to every family in St. Louis, — and it used up 200 tons a day to maintain a speed of about twenty-three miles an hour. This seems like an awful lot of coal, doesn't it? But the '*Majestic*' is a big boat, 582 feet long, and it requires an expenditure of 18,000 horse-power to drive it at top speed through the water. Figure the thing out, though, and you will see that 1 and 1-2 pounds of coal, which is less than a good handful, furnishes one horse-power for one hour, and one horse-power represents the lifting to a height of one foot of 300 pounds, so that your 1 and 1-2 pounds of coal lifts 300 pounds one foot, and sustains it for one hour. Or take this illustration: It would require 100,000 galley-slaves rowing night and day to carry the '*Majestic*' at a speed of twenty-three miles an hour. Dividing 18,000 horse-power into 100,000 galley-slaves, we find that over 1 and 1-2 pounds of coal represents the work for one hour of about six rowers. Of course there wouldn't be room for the placing of more than 400 oars on the '*Majestic*,' and ten bushels of coal would do an equal amount of work, while the 100,000 galley-slaves, if they averaged 150 pounds each, would weigh five times as much as the 1,740 tons of coal required by the '*Majestic*' for a six-days' trip."

A Garbage-Crematory Test. — The garbage crematory erected in the city offal-yard at the foot of East Brookline Street, on Albany Street, by the Brown Developing Company, was tested to-day in the presence of members of the City Government, and the results were apparently quite satisfactory. The crematory is about twenty-three feet long, ten feet wide, and ten feet high, and has fire-brick walls a foot thick, covered with boiler steel, braced with great iron rods to keep them from being forced apart by the heat. The receptacle for the garbage has a capacity of several tons, and is fed through openings in the top with iron covers. The furnace in which the fire is started is a part of the structure, and is fed with crude petroleum conducted by means of pipes from a large tank a considerable distance away. A wood fire is first started and then the oil is turned on, and, with other devices for generating inflammable gases, an intense heat is soon produced. A blower, run by a six-power steam-engine, forces this fiery mass into the receptacle for the garbage, which is slowly fed-in until it becomes a burning mass. After that the combustion is very rapid, the garbage disappearing almost as rapidly as it can be shovelled in. There are two chambers for its reception and there is a system of draughts by which all the smoke and gases go from one to the other, making a complete circuit of the crematory, and then what is left escaping to the air through a high chimney. In the test to-day all kinds of stuff were fed into the furnace just as they came from the places where they were collected, tin cans, bottles, bones, and similar matter being disposed of. From twenty-five to thirty gallons of oil, costing about three cents a gallon, were used each hour, consuming from four to five tons of offal an hour. Scarcely any ashes are made. The amount of garbage collected by the city each day is two hundred tons, and it is estimated that this can all be consumed by four furnaces at a cost of about twenty-five cents a ton The whole operation is remarkably free from odor, and scarcely an offensive smell is noticeable as coming from the furnace. — *Boston Transcript, February* 10.

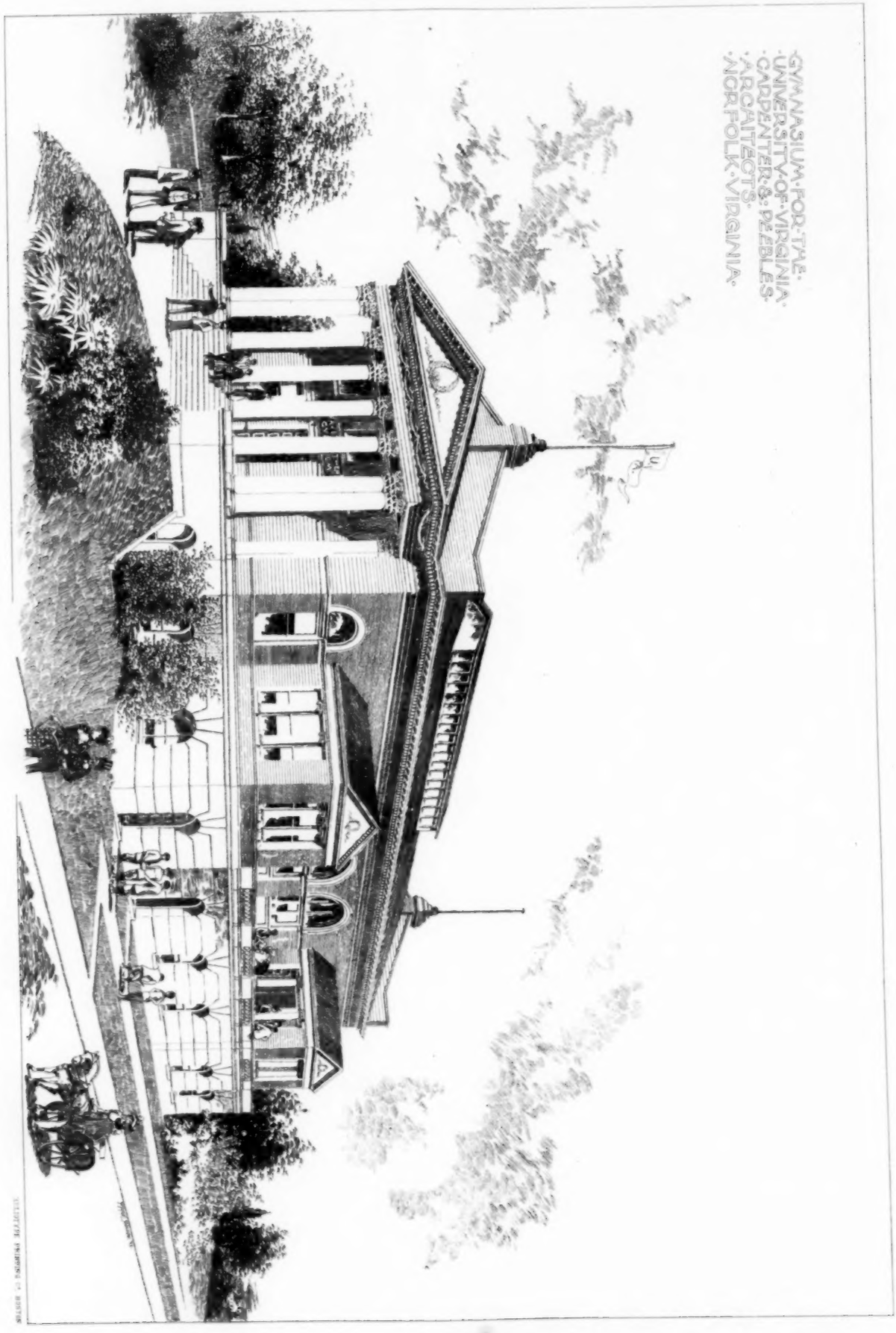
A Pacific-coast Bathing-establishment. — A bath-house that Mr. Adolph Sutro is having built on the harbor shore near San Francisco gives promise of being one of the wonders of the Pacific Coast, so vast is the scale of construction. It is situated in a natural cove into which sweeps the line of surf. To break its onset and protect the building a massive sea-wall has been built. On the inner side of it is an enclosure with a capacity of 1,000,000 gallons of water, and adjacent to this are six apartments, or bathing-tanks, which are to be filled from the large reservoir with water at various temperatures, to suit the bathers. No pumping will be necessary, the flow from the ocean being continuous by reason of the conformation of the cove, which is that of a horse-shoe. In the calmest weather all the tanks can be filled in fifty minutes. The waste water is carried by pipes far out to sea. Back of the baths tiers of seats are to be raised for the accommodation of thousands of spectators. The dressing-rooms, four hundred in number, will be placed under the seats and on five different floors. They are to be finished handsomely with natural woods and provided with the best appointments. On each floor there will also be a club-room. Elevators will carry patrons from story to story. Over all there will be a roof of glass 350 by 250 feet. At night the building will be lighted by electricity. A stage for dramatic performances and a promenade on the roof for use in summer are also features of the scheme. The work of construction will take a year and a half, from which alone the magnitude of the enterprise may be inferred.

The Quais at Marseilles. — The quays which have been constructed since 1857 are built on the following plan: A bed of stones is laid as a foundation, and on this a series of huge artificial blocks is placed, without any mortar between them. This series is continued up to the water-level; but, before the wall that is to form the front of the quay is built upon it, the system of blocks is subjected to great pressure, by means of two rows of similar blocks which are placed upon it, in order to make the subsoil and foundations settle quickly into the shape they will definitively assume. The two rows of blocks are then removed, and the wall is built in the usual way. This method of construction has given the most excellent results, and the quays so formed are second to none either in appearance or in durability. — *From Report of C. B. Trail, U. S. Consul.*

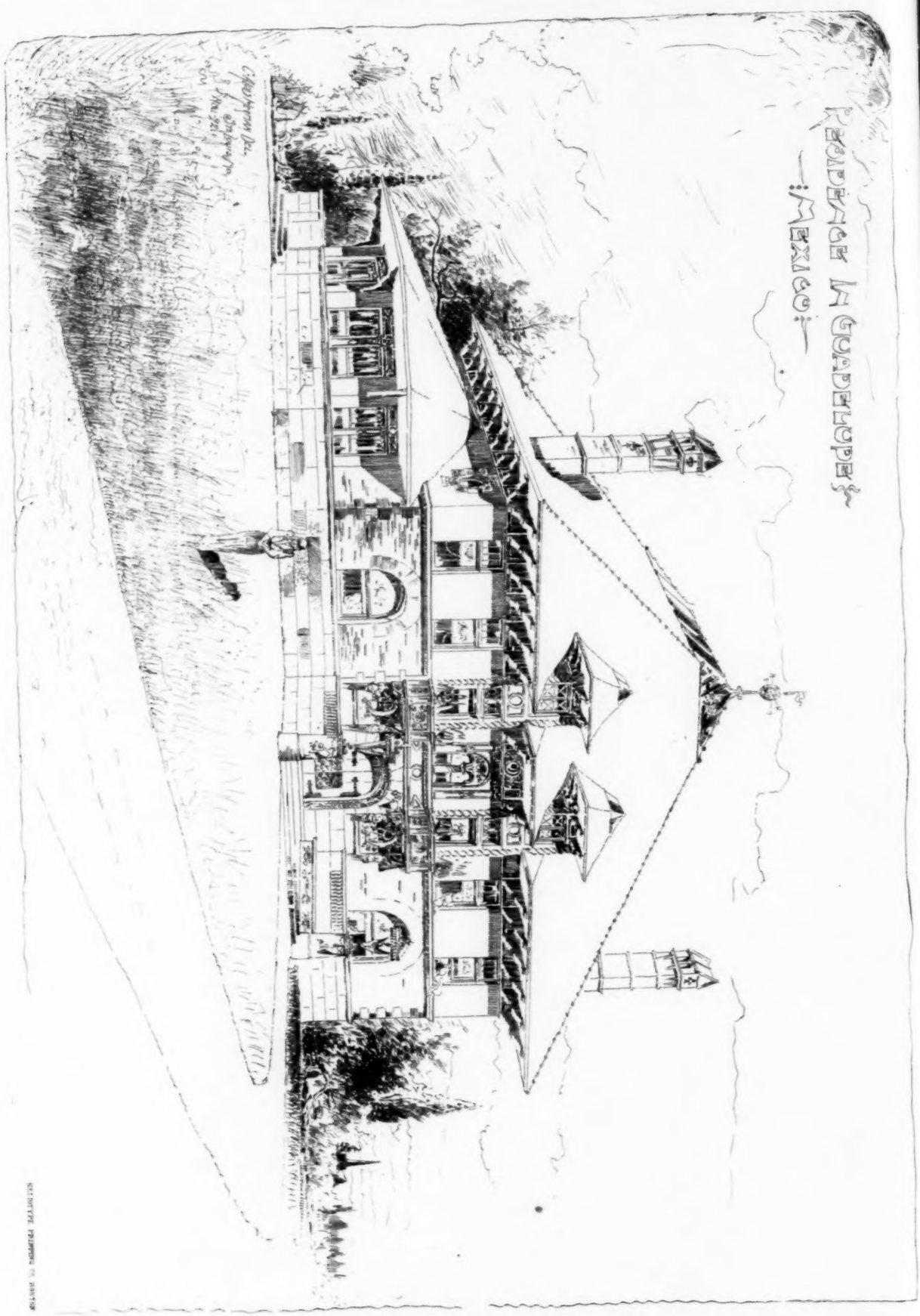
TRADE SURVEYS

That which is surprising and disappointing to most of the large business interests of the country — financial, railroad, manufacturing and commercial — is that the general liquidation of values that has been effected, on one hand, and the equalization between production and demand, on the other, have not been attended with the usual beneficial and stimulating results. The prescribed hygienic treatment has been, so to speak, gone through with, all the healthful requirements have been subserved, and yet there is not that degree of energy nor that degree of commercial and industrial activity that was anticipated. Yet when we look at the fact that the gross returns on 131,000 miles of railroad last year was 7 1-2 per cent greater than for 1891, and that the net earnings were a little over 2 1-4 per cent greater, it would seem, so far as railroads were concerned, that the complaints were without good grounds. It is true also that bank-clearings are larger, in short, that more business was done last year, but, owing to greater producing-capacity and more intense competition, prices for the greater part of the year were somewhat lower than for the previous year. But the chief source of dissatisfaction, we are told, lies in the fact above mentioned, that, after having suffered from previous misdeeds or neglect in economical matters, we are not recuperating in the direction of a heavier volume of business and better prices. The stock-markets are disappointing. Reading depreciated some thirty-four million dollars on paper. Some other systems suffered. Foreign investors "want to know" several things. There is an abundance of new stocks for testing purposes, but they are not wanted; in fact, the Stock-Exchange people wish they were rid of a good many calls they have to make. The trouble is, too many people are looking backward rather than forward, or trying to spy out new possible markets for merchandise and manufactures. The grinding-down agencies are still at work, though there is but little fluctuation in values or prices. Small lots of American securities are wanted abroad, and if foreigners understood the situation here better there would be a greater demand. There are, just at present, several unobserved agencies at work having our interests as a people in their keeping. One is the growing dependence of the outside world on this country for cereals and meats; another is the unobserved formation of new opinions and conclusions among the masses of the people on two or three vital questions of public policy. A more immediate cause at work is the changing policy of wheat, corn and cotton producers. Throughout the civilized world a new influence of this nature is at work, viz, to depend less on remote communities and create more of what is needed within each community. This is a natural reaction against the extremes which all peoples have been running into with the object of accumulating wealth through exchange of commodities. Production will increase, international exchange will also increase, but the percentage of purchases per head of population from foreign countries and from remote localities of each country must of necessity diminish. In other words, the Home-rule idea will soon begin to extend itself to industrial conditions. The apparent overproduction of cotton and wheat points in this direction. Farmers are losing money on seventy to eighty cent wheat, and cotton-planters see the risk they ran this season on cotton. In short, recent developments have given an impetus to that decentralization of industries which set in in 1861 in this country. As that condition is reached other conditions will improve permanently. To upset one financial theory with another as a remedy for this is not quite the right way. To make a low tariff succeed a high tariff is hardly the proper method either, as these are secondary causes, and do not strike at the root. Still, the game of politics must have material to play with. In current affairs there is nothing new to note. Two or three unimportant failures in the iron trade gave rise to rumors of more to come, but these failures were due to the fear of two or three five-cent country bankers. In quite a number of industries production is on at full pressure. The year of 1893 will, in all probability, be a year of low prices, because of the fact that three to six months' requirements in so many channels of trade are now being covered. For coal, stocks are everywhere moderate, and mines are producing nearly to maximum. In the world of machinery there is great activity; orders are multiplying, and raw material therefor is being promptly purchased. In building, the latest news is that builders are generally making preparations for a more active year than 1892. Jobbers are meeting with no obstacles in the distribution of goods, and the rank and file of traders are acting cautiously. The farmers are anxious to sell one hundred million bushels of wheat, and, so far as can be seen, they will find opening markets for their accumulations in due time. In manufacturing circles generally a nervous feeling exists over the possible harm that may come from the practically complete transfer of the administration from one party to the other, and it is quite frequently said in offices and counting-rooms that a conservative Presidential inaugural to-day may produce a marked improvement in trade.

S. J. Parkhill & Co., Printers, Boston, U. S. A.

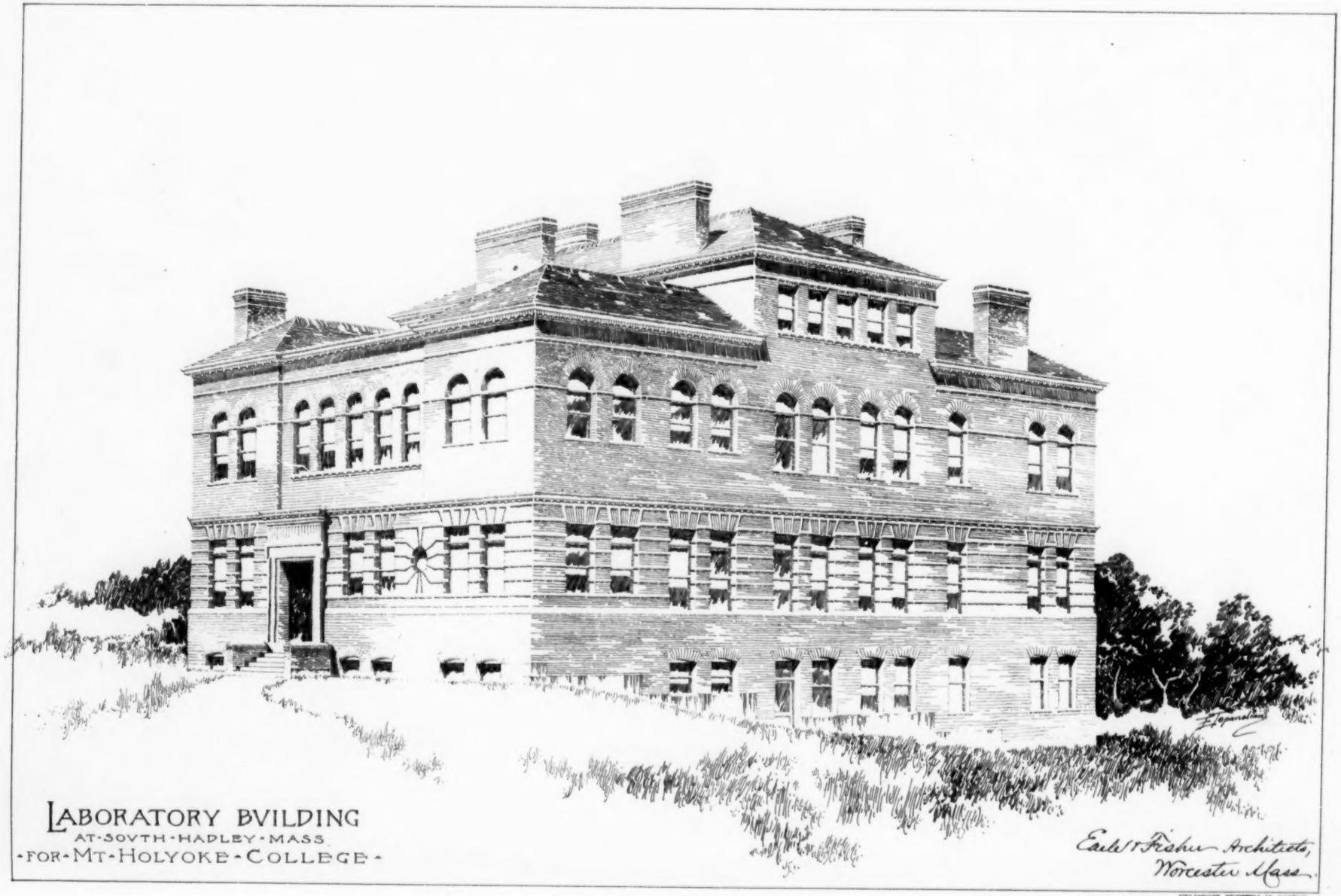


GYMNASIUM FOR THE UNIVERSITY OF VIRGINIA. CARPENTER & PEEBLES. ARCHITECTS. NORFOLK, VIRGINIA.



RESIDENCE IN GUADELOUPE
—:MEXICO:—

American Architect and Building News, Mar. 4, 1893. No. 597.

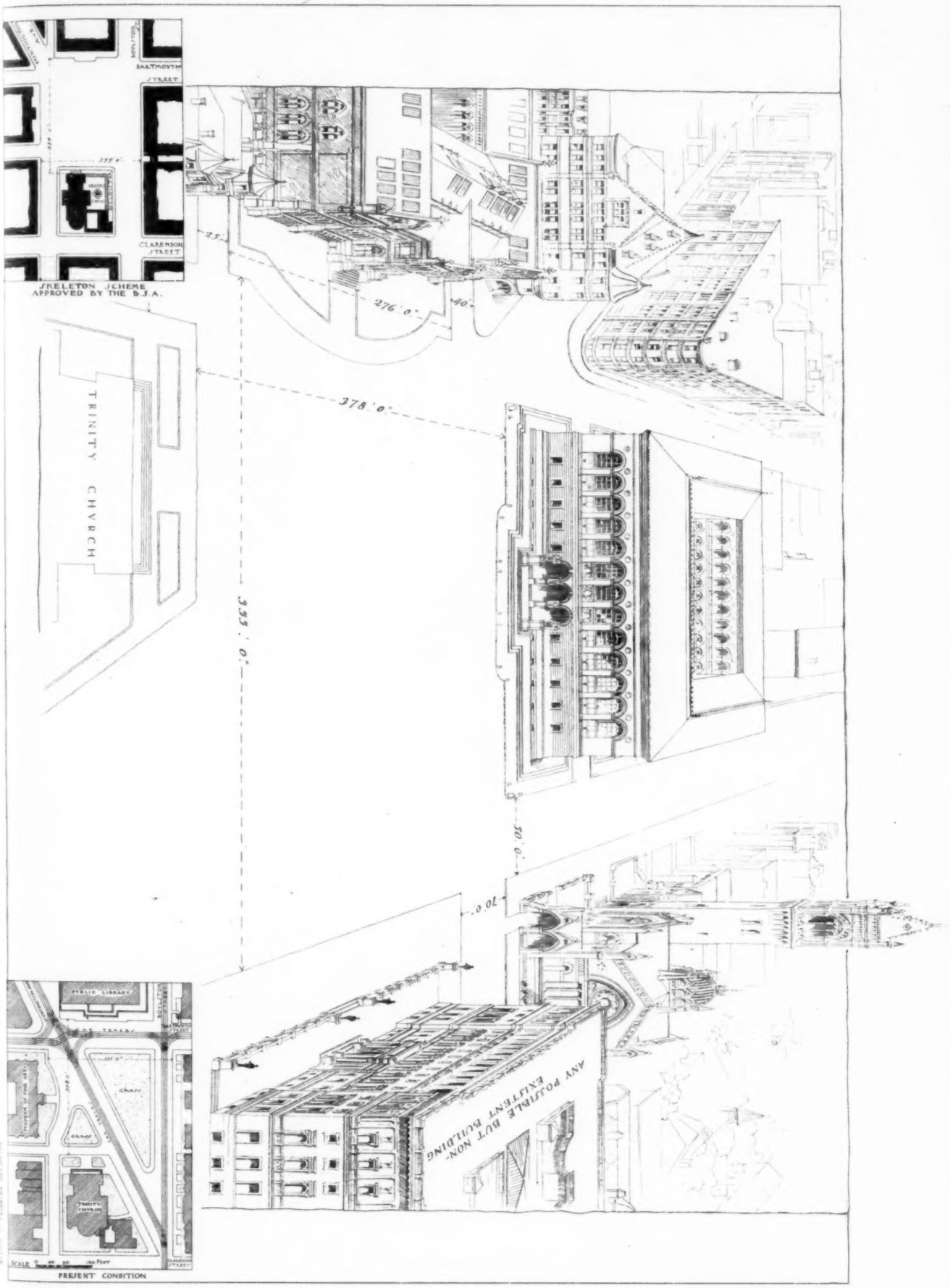


LABORATORY BVILDING
AT SOVTH HADLEY MASS
FOR MT HOLYOKE COLLEGE

Earle & Fisher Architects,
Worcester Mass.

HELIOTYPE PRINTING CO. BOSTON

PROGRAMME FOR THE DECORATIVE TREATMENT OF COPLEY SQUARE

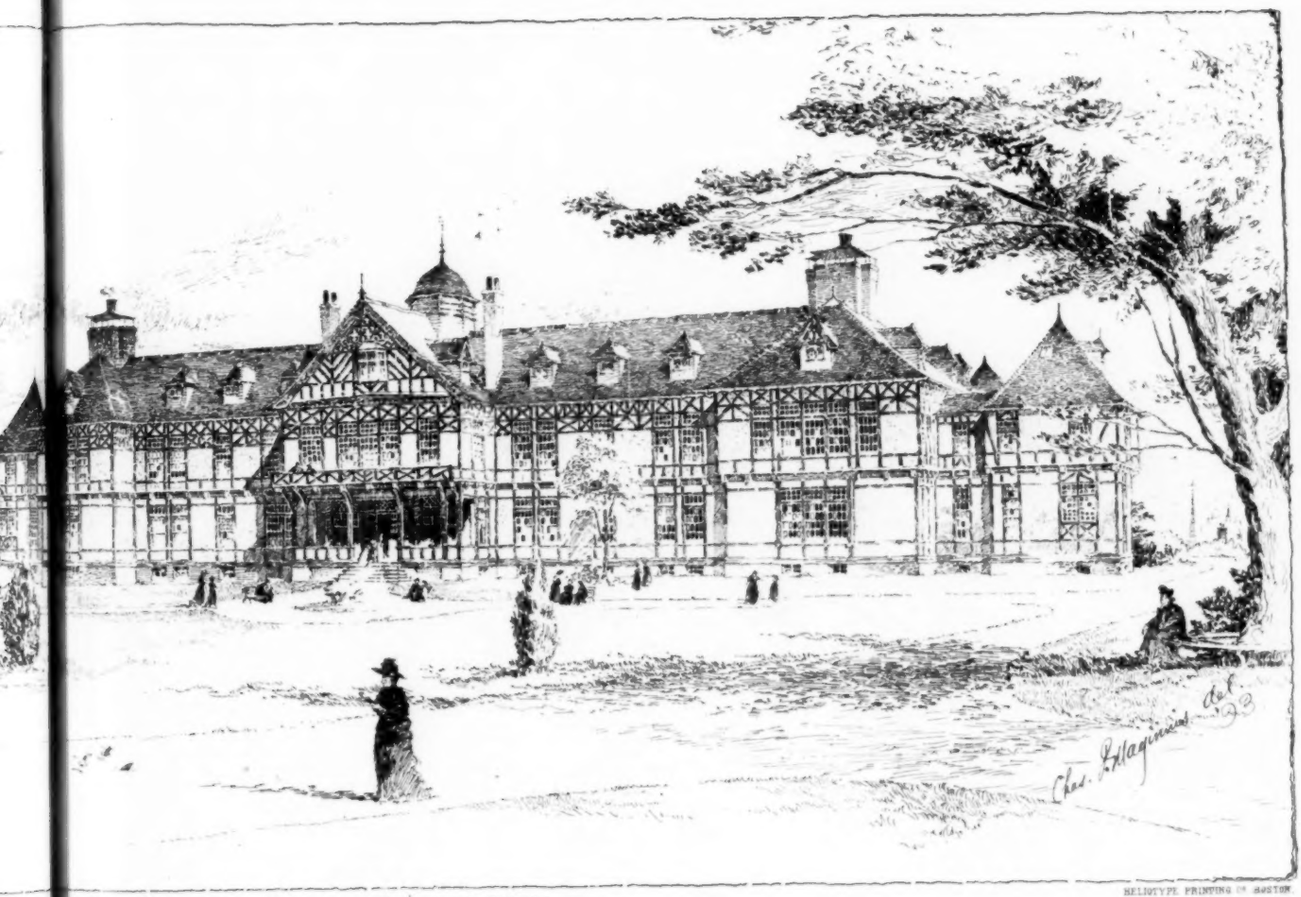


CITY OF BOSTON ~ PUBLIC INSTITUTIONS DEPT.

LUNATIC ASYLUM AT PIERCE FARM, WEST ROXBURY.

EDMUND M. WHEELWRIGHT CITY ARCHITECT.

"B" MEN'S DORMITORY. "A" ADMINISTRATION BLDG.. "D" DOMESTIC BUILDING.



HELIOTYPE PRINTING CO. BOSTON.

"C" WOMEN'S DORMITORY

The American Architect and Building News

ADVERTISERS' TRADE SUPPLEMENT.

No. 129. SATURDAY, MARCH 4, 1893. Volume XXIX. No. 897.

REMOVAL OF STUMBLING-BLOCKS.

The removal of a stumbling-block marks a positive step in the line of nineteenth-century progress, and inventors have been so busy during the last decade in making existence for mankind not only tolerable but pleasurable as well that literal stumbling-blocks appear to have been practically annihilated; so that it is somewhat in the nature of a surprise that we learn of a recent invention having for its object so simple a matter as a level floor or walkway into a bank or safe-deposit vault. We smile at the story of our forefathers, when they loaded their horses for mill with the bag of grain slung on one side and a large stone for counterbalance on the other, while it is quite probable that the shades of these same worthy men may be in possession of a more than equal amount of enjoyment at witnessing the efforts of our capitalists as they laboriously climb in and out of their burglar-proof strong-rooms, frequently stumbling and often falling prostrate with their arms full of securities.

It is, indeed, singular that this state of affairs should have been allowed to exist in the banking-rooms up to the present time, when at all other points, both in office-buildings and residences, the one idea of the architect has been to secure plain, level floors, even to the extent of frequently tabooing the thinnest kind of thresholds.

Who will not recall more than one unpleasant experience in attempting to cross the portal of some magnificent specimen of modern burglar-proof vault-work, upon the construction of which perhaps more than a hundred thousand dollars have been spent, and whose massive doors and impregnable walls afford security for millions of capital?

At all other points in the lines of strength and convenience wonderful progress has been made during the last ten years, but the original stumbling-blocks, the door-sills, have always remained a constant source of annoyance and danger, growing worse rather than better with the ever-increasing thickness of the doors, until at present it is necessary to climb two steps to gain access to some of the most stupendous vault-work ever built.

It is difficult to conceive why the vault-engineers and vault-builders of this country, some of whom worked at the problem twenty years, have, apparently, been blind to this glaring defect in the construction of modern work, but such is the case, and it has been left for one in no wise connected with this line of business to point out not only the defect but the remedy.

Capt. George S. Clark, who for many years has had in charge the extensive vaults of the Fidelity Trust Company of Philadelphia, which contain, probably, $300,000,000, and have 100,000 visitors annually, long since realized the necessity of a radical reform in this direction, and, aided by past experience as a practical mechanic, solved the problem by the invention of the Clark patented fixed and movable sill and level vault-floor devices which accomplish the object of a level floor in several ways, the two chief methods being known as the "Dropped Vestibule" and "Movable Sill." These methods are precisely what their names indicate, and the slightly increased cost is insignificant when compared to their comfort, convenience and safety.

In *all cases* the finished *floor-line of the vault* is directly on a level with the *finished floor-line of the office* or banking-room adjoining, the "dropped vestibule" being of ordinary construction, but dropped until both the outside and inside fixed door-sills are below the line of the finished floor. A recess or pit is made in the office-floor sufficiently deep to allow of the outside door opening and closing back against the front of the vault, this recess being covered with a foot-plate or movable floor, as is also the space in the vestibule between the outside and inside doors during such time as the vault may be in use, and forming an absolutely level and unbroken passageway into the vault (see Patent, December 24, 1889).

The "Movable-sill Devices" (see Patent, November 18, 1890), however, are usually preferable, as in this case the office-floor is left intact up to the vault, and the outside vault-door swings out with just a clearance. The sill to this door is made movable by a mechanical arrangement of heavy clamps and locking-bars, and is made to revolve downward below the floor-line with a single motion of one lever. So massive and strong are the arrangements for moving and locking this sill that a pressure of many hundreds of tons would not dislodge it; and yet it is constructed upon such nice mechanical principles that it can be operated easily with one hand.

This sill is arranged with rebated steps, packed tongues and sharply-serrated grooves around its entire edges, and constructed in precisely the same manner as the doors, and, when securely seated and locked, actually forms a much *stronger feature* of the work than the door proper. After the doors have been opened and the sill revolved downward, a movable floor or foot-plate completes the level through the vestibule.

One of the most eminent mechanical and consulting engineers in the United States writes as follows: "To advise my clients regarding this invention, I have made careful examination into the merits of it, both as to its utility and its safety, satisfying myself on one point, and that is, that, all other things being equal, safe-renters are attracted to the safe-deposit companies who pay most attention to their personal comfort.

"I have many times been called upon as an expert in a suit for damages (damage to person), and in one case the cause of complaint was ascribed to a roughness of the floor, one board projecting above the other not more than three-eighths of an inch, but indicated as causing the fall that resulted in the plaintiff losing a limb crushed in a machine into which he was thrown in falling. A person tripping while carrying a heavy tin box may be injured and may have cause for action of damage if an unusual step, forgotten for the moment, causes him to fall. Low steps and inclined planes are each objectionable.

"The very simple device perfected by Captain Clark cannot be objected to on the score of cost, in consideration of the comfort and security effected by its use.

"In all my specifications for vaults I make the level entrance obligatory, not being willing to give advice if the person seeking my opinion objects to the use of some method of doing away with a rise in floor at the entrance to the vault — in other words, objects to a level-floor entrance. My reason for taking this stand is that, in event of being called on in a damage-suit, I would not be able to defend the interest of my client, and would have to acknowledge that, having advised him of 'the state of the art' at the time of his vault-erection, he had objected to the most improved construction recommended by me.

"The introduction of Captain Clark's invention involves no difficulty in construction that cannot be met by any vault-builder who has *machinery fit* for doing good work of the kind. On the other hand, objection is only likely to be raised by those who have not the facilities for such work as is now called for.

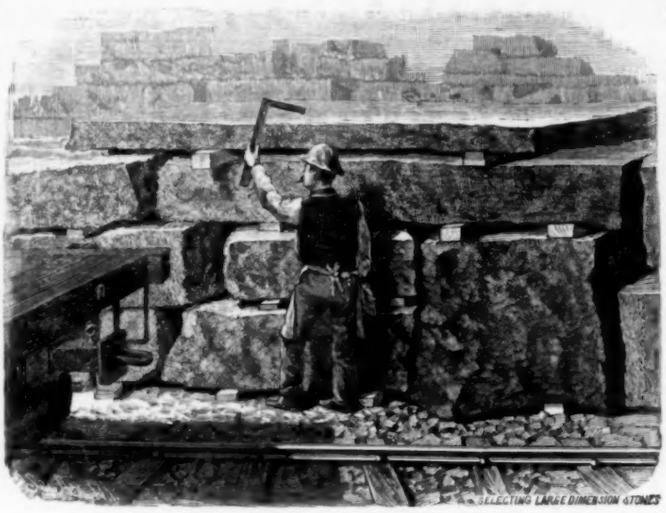
"No element of weakness is introduced into the construction by the introduction of the movable sill."

The United States Government Commission on Safe and Vault Construction, the Director of the Mint, the Treasurer and Assistant Treasurer of the United States, the Supervising and ex-Supervising Architects of the Treasury Department commend these devices and recommend their use.

The Franklin Institute of Philadelphia, in recognition of the merits of these level-passage devices, through its Committee on Science and the Arts, awarded to the inventor the John Scott Legacy Premium and Medal.

No expense has been spared to perfect these devices, and civil, mechanical and vault engineers and architects throughout the country unanimously approve them, and vault manufacturers have advocated their use in a manner which indicates perfect confidence not only in the correctness of their mechanical construction but in the probable demand for their universal adoption.

G. S. CLARK,
325 Chestnut Street,
Philadelphia, Pa.



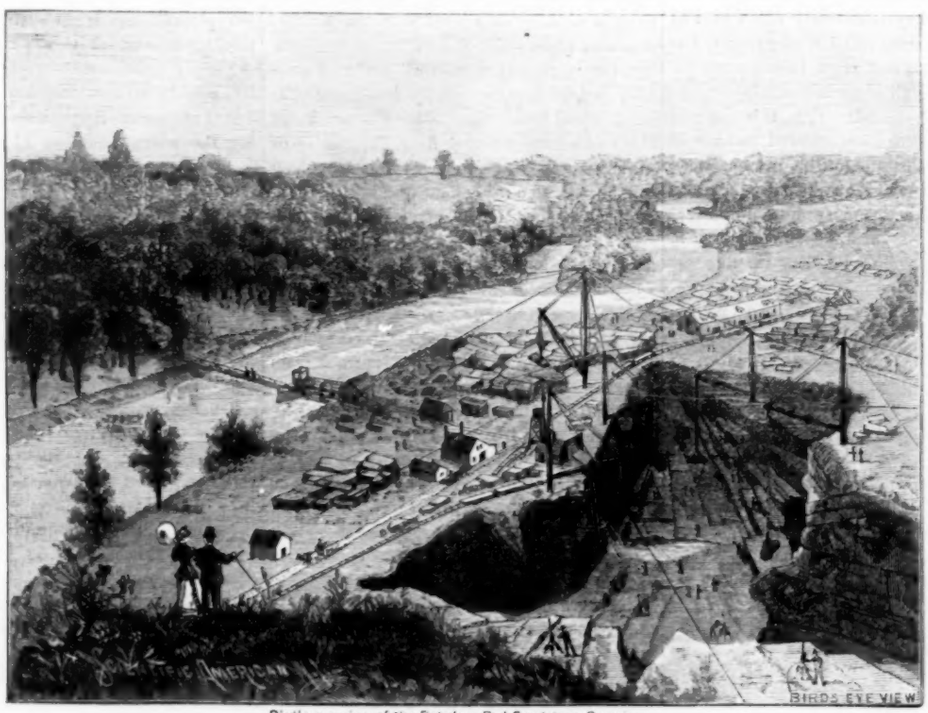
Selecting Large Blocks of Stone.

THE POTSDAM RED SANDSTONE.

The selection of a building-stone to-day, says Mr. Wehle in the *Manufacturer and Builder*, is a subject of far more weighty and anxious consideration with American architects than with their predecessors of the preceding generation. To-day both the profession and the public have a much better knowledge of the vital importance of making this selection with care and good judgment. The present state of opinion on this subject has been of slow growth. It has been brought about in part by the elevation of the profession of the architect, and the growth of public sentiment in the direction of an adequate appreciation of his duties and responsibilities, and in no small degree by the object-lessons forced upon the notice of the most unobservant by the condition of premature decay exhibited in the appearance of public and private buildings everywhere throughout the northern section of the United States. The older architects and builders were not perhaps so much to blame for the want of durability so frequently manifested in the specimens of their handiwork, for the reason that they were compelled to depend entirely upon their own unaided judgment in the absence of experience to guide them. Fortunately for the permanency of our modern structures, the present generation of architects is no longer dependent upon a reliance so uncertain and misleading.

The great development of the quarrying industry in the United States, to meet the rapidly-growing demand for structural material, the observation of the great inferiority of much of the stone that has found its way into the structure of many of our buildings, public and private, and the coincident demand for more careful and scientific methods in the selection of building-stones, have placed at the service of the architects of to-day a great fund of information on the subject of the properties of our domestic building-stones which their predecessors lacked. At the present time the architect cannot plead want of information as an excuse for the choice of an inferior material. The pages of the architectural and building journals teem with facts and figures on the subject, and not to be familiar with them is evidence that he is conspicuously unfit to exercise the responsibilities of his profession.

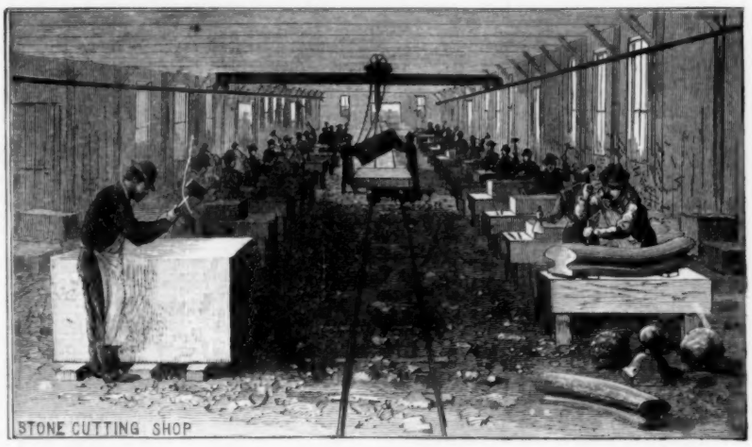
The inference might be drawn from the reading of what has preceded that the evidences of extensive and premature decay exhibited in American structures indicated a very general inferiority of American building-stone. This inference is true only in a limited sense. Many of the stones that have shown their weakness after twenty-five or fifty years of service in such cities, for instance, as Boston or New York, would survive the lapse of centuries of exposure in New Orleans or Savannah. And in that statement we begin to get a glimmering of a fact which is of the highest import in relation to the value of a building-stone, namely, that the suitability of a given stone for a given purpose, other things being equal, must depend largely upon the climatic conditions to which it will be exposed. No more striking illustration of the truth of this declaration could be desired than is afforded by the case of the Egyptian obelisk erected several years ago in Central Park, New York. This monolith, originally erected about fifteen hundred years before Christ, had stood for centuries on the shores of the Nile untouched, practically, by the hand of Time; but, after exposure to the frosts of two New York winters, the granite shaft exhibited such manifest symptoms of extensive decay that the expedient of protecting its surface by some weather-proof and fungus-proof composition was found to be imperative to save



Bird's-eye view of the Potsdam Red Sandstone Quarries.

its hieroglyphics from speedy obliteration.

The fact is — and this will go far to explain the practical failure of many of our building-stones to exhibit durability — that the severity of the climate of the northern portions of the United States is very hard upon the permanence of a building-stone, and demands that only those shall be chosen for the construction of external walls that are known to be capable of resisting the extremes of heat and frost without suffering injury. We leave here entirely out of consideration the errors of builders, the most conspicuous of which is the frequent practice of setting blocks of facing-stone (such as brown-stone) on edge. There is but one of our native sandstones (to be mentioned later), so far as we are aware, with which this method of setting can be practised without risk of rapid deterioration.



Stone-cutting Shop.

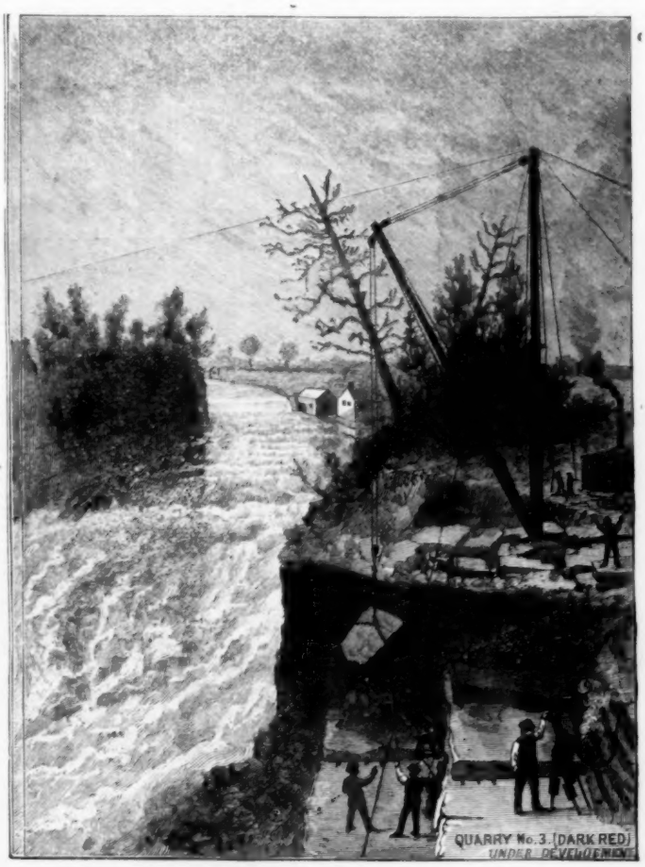
It is obvious, from what has preceded, that in our Northern climate building-stones are exposed to much more severe service than in the more evenly-tempered sections, and from this fact the inference is obvious that only the very highest qualifications will suffice to render a building-stone suitable to stand our severe weather.

We have named the most important quality of a permanent building-stone for our climate first, namely, the ability to withstand the weather unimpaired. This means that the stone shall be so dense as practically to resist the penetration of moisture, which, by subsequent freezing, will cause it to flake or weaken it. Other things being equal, great durability in a building-stone is associated with great strength to resist crushing beneath a weight placed upon it; and this quality also is of prime importance. Next in rank among the qualifications of such a stone, we would place its ability to withstand the action of fire. There are many stones classed among the granites and gneisses that are sufficiently close-grained to be only slightly absorbent of moisture, and which are possessed of strength in excess of all ordinary requirements, but which exhibit a fatal weakness when exposed to the heat of a fierce fire. The limestones (and marbles), of course, are not to be considered in this connection at all. They would be calcined by the fire, and the walls would fall; but many of the sandstones, and even the granites, exhibit their deficiency in this respect, as has been demonstrated in several notable cases, where the stream from the firemen's hose, directed upon such walls, has caused the red-hot stones to split and fly to pieces with almost explosive violence. Such extreme conditions, it is true, are hardly fair to set up as tests of the general fitness of a building-stone; but if there be building-stones capable of withstanding them successfully, it is proper that their superiority should be known and acknowledged.

Last of all, from the technical point of view, though first from the artistic standpoint, the building-stone should be pleasing in appearance and color, and should possess the quality of weathering, after exposure in the wall, to a neutral tint, and should not afford a foothold for the growth of fungi and other low forms of vegetation, which hasten its superficial decay, while rendering it dingy in appearance.

There is found in the United States an exceedingly dense sandstone, which, in the judgment of qualified experts, answers the foregoing bill of particulars so completely in almost every respect that they have unanimously chosen it as the typical example of a building-stone that most closely approximates to what the perfect stone should be. This unique production of Nature is known as the Potsdam Sandstone. It is one of the oldest of the fragmentary rocks, being the lowest member of the Silurian group, where it is found resting on the primitive, or azoic, rocks. As it has been observed at various places, its condition varies from that of a typical quartzite — a dense and apparently homogeneous mass of quartz — to a friable sand-rock. At other points it is found in great beds, evenly stratified, forming a material of high value for constructive purposes.

We exhibit a number of views of the quarries of this stone in the neighborhood of Potsdam, N. Y., where it has been found in great abundance and of the highest average quality. The examination of a microscopic section of the rock discloses the following characters: It is found to consist of angular grains of clear quartz, quite unmixed with other granular material. There is no feldspar or mica intermingled with it. The interstices between the grains contain a cementing material. This is found to be a clear, colorless, silicious cement, so that the rock is virtually silica. On this point Prof. Thomas Egleston, of the Columbia College School of Mines, and an authority on building-stones in the United States, in a paper read before the American Society of Civil Engineers on the decay of building-stones, says: "Of the sandstones having a silicious binding material, Potsdam sandstone, which has been used in the recently-constructed Columbia College (an engraving of which is published herewith), and the silicious, triassic sandstone, which was the material used in the lower part of the cathedral at Rodez, are the best examples, and in these no decomposition takes place. Of these sandstones, it will be noticed that there are two general varieties, one in which the quartz-grains are more or less large, and are rounded, but are cemented together by silica. . . . In the Potsdam sandstone, on the contrary, the grain of the quartz is quite small; its shape, when it can be distinguished at all by a magnifying-glass, is always angular. . . . This is the best of all building-materials though mouldings made of the other variety (large grains) will last for many years without suffering any appreciable amount of deterioration."



Quarry No. 3 (Dark Red).

Not all the sandstones, it should be noticed, conform to this general character. In many of them the cementing substance is argillaceous, the clay binding the grains together

occasionally appearing in places segregated in lumps, that can readily be picked out of the rock with the knife. In others the cement may be carbonate of lime, a much softer material than silica, and much inferior to the latter in point of weathering and fire-resisting qualities. The best cement, by far, of all is silica, the material of the sandstone itself. The result is a strong, hard, dense rock, approaching the constitution of the unchangeable quartzite itself, but departing far enough from this in physical texture to be still workable.

We have in a previous article set forth in such detail our views of the excellent characteristics of the Potsdam sandstone, that to save needless repetition we shall draw upon the statements and opinions of noted experts for confirmation of our own. First in order we append a table giving the crushing-strengths of a number of the most noted building-stones employed in the United States. The names of the authorities we give in each case.

Columbia College, New York.

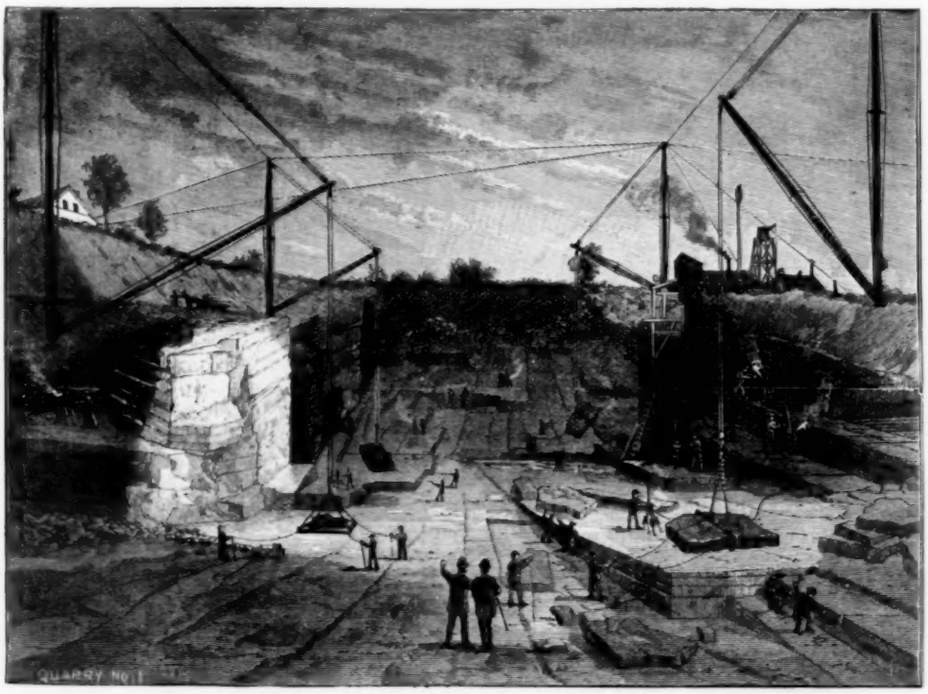
The table is compiled from Gen. Q. A. Gillmore's report to the Chief of Engineers, U. S. A., from Haswell's "*Engineer's Pocket-Book*," and from tests made by Ira H. Woolson, civil engineer, on the Emery testing-machine at Columbia College School of Mines, New York. The highest result is in each instance given. The samples of Potsdam sandstone were from the quarries of the Potsdam Red Sandstone Company, Potsdam, N. Y.

The following tests made at the laboratory of Rutgers' College Scientific School, for Dr. Smock, at that time New York State Economic Geologist, by Dr. Francis A. Wilber, professor of Analytical Chemistry, bears testimony to the remarkable resistance offered by the Potsdam stone to injury by frost:

Aberdeen (Scotland) Granite	Haswell	10,760
Albion (New York) Sandstone	Gillmore	13,500
Arbroath (England) Sandstone	Haswell	7,850
Aquia Creek (——) Sandstone	Haswell	5,340
Bardstown (Kentucky) Limestone	Gillmore	16,250
Bay of Fundy (Canada) Granite	Gillmore	12,020
Belleville (New Jersey) Sandstone	Gillmore	11,700
Berea (Ohio) Sandstone	Gillmore	10,250
Billingsville (Missouri) Limestone	Gillmore	7,250
Caen (France) Limestone	Gillmore	3,650
City Point (Maine) Granite	Gillmore	15,093
Cleveland (Ohio) Sandstone	Gillmore	7,910
Connecticut Freestone	Haswell	3,319
Common Italian Marble	Gillmore	13,062
Cornish (Wales) Granite	Haswell	6,339
Craigleith (Scotland) Sandstone	Gillmore	12,000
Dix Island (Maine) Granite	Gillmore	15,000
Dorset (Vermont) Marble	Gillmore	8,670
Dorchester (New Brunswick) Sandstone		
	Gillmore	9,412
Dublin (Ireland) Granite	Haswell	10 450
Duluth (Minnesota) Granite	Gillmore	19,000
English Magnesian Limestone	Haswell	3,130
English Anglesa Limestone	Haswell	3,600
Fond du Lac (Wisconsin) Sandstone	Gillmore	6,250
Fox Island (Maine) Granite	Gillmore	15,062
Glens Falls (New York) Limestone	Gillmore	11,475
Greenwich (Connecticut) Granite	Gillmore	11,700
Harbor Quarry (Maine) Granite	Gillmore	16,837
Haverstraw (New York) Sandstone	Gillmore	4,350
Hurricane Island (Maine) Granite	Gillmore	14,937
Joliet (Illinois) Limestone	Gillmore	16,900
Kasota (Minnesota) Sandstone	Gillmore	11,675
Little Falls (New York) Sandstone	Gillmore	9,850
Marquette (Michigan) Limestone	Gillmore	8,050
Marquette (Michigan) Sandstone	Gillmore	7,450
Marblehead (Ohio) Limestone	Gillmore	12,600
Massilon (Ohio) Sandstone	Gillmore	8,750
Medina (New York) Sandstone	Gillmore	17,725
Middletown (Connecticut) Sandstone	Gillmore	6,950
New Haven (Connecticut) Granite	Gillmore	9,750
Newry (England) Granite	Haswell	12,850
North Amherst (Ohio) Sandstone	Gillmore	6,650
North River Limestone	Gillmore	13,425
Patapsco (Maryland) Granite	Haswell	5,340
Port Deposit (Maryland) Granite	Gillmore	19,750
Potsdam (N. Y.) Sandstone (not crushed)	Woolson	**42,804**
Quincy (Massachusetts) Granite	Gillmore	17,750
Quincy (Illinois) Marble	Gillmore	9,787
Rockport (Massachusetts) Granite	Gillmore	19,750
Scotch Whinstone	Haswell	8,300
Seneca (Ohio) Sandstone	Gillmore	10,500
Tuckahoe (New York) Marble	Gillmore	13,594
Vermillion (Ohio) Sandstone	Gillmore	8,850
Vinalhaven (Maine) Granite	Gillmore	16,750
Warrensburgh (Missouri) Sandstone	Gillmore	5,000
Westerly (Rhode Island) Granite)	Gillmore	17,750
Williamsville (New York) Limestone	Gillmore	12,375
Yorkshire (England) Sandstone	Haswell	5,710

"A large number of stones were under investigation at the same time. Subjected to the severest freezing and thawing tests, Potsdam sandstone was absolutely unchanged. Submitted to the continued action of dilute sulphuric acid, Potsdam sandstone lost less in weight than any other stone—namely, two one-hundredths of one per cent, some stones losing over three hundred times as much (over six per cent). This result is of the utmost importance in view of the amount of this acid constantly present in the air of our cities and perhaps promoting the decay of building-stones used in them, as much as any other one cause. The percentage of loss or gain in weight when immersed in sulphurous acid gas was in the case of Potsdam sandstone six one-thousandths of one per cent only, many other stones being affected to an amount from ten to seventy times greater."

The following testimony to the fire-resisting qualities of the Potsdam stone is given by Prof. John C. Smock in a valuable report on the building-stones of the State of New York (Bulletin No. 10, New York State Museum, Albany, 1890). For purposes of comparison the prominent building-stones of the United States were included in the tests made: "Potsdam sandstone is unequalled by any stone in its capacity to withstand great heat. Subjected to a white heat (1,300° F., that of melted copper), it is unfractured, unchanged



Quarry No. 1.

in color and practically unchanged in strength. Subjected to this temperature, the strength and color of the granites were destroyed. All the marbles and limestones were calcined and crumbled at a touch. Some of the other sandstones were entirely changed in color, others were checked, cracked or disintegrated; the strength of others was seriously affected or destroyed."

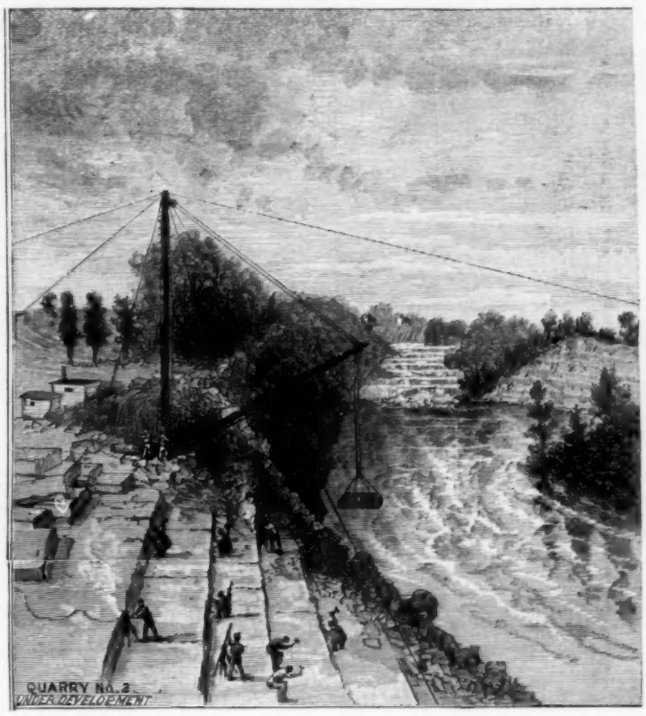
The fact that Potsdam sandstone is used for lining cupola-furnaces and lime-kilns, in preference to fire-brick, in which situations it is subjected to immensely higher temperatures than that of melted copper, is even better proof of its fire-resisting qualities.

The following, from Prof. Geo. P. Merrill's recent work on "*Stones for Building and Decoration*," relates to the physical structure of the Potsdam red sandstone:

"The Potsdam stone shows, however, a markedly different structure. Here the granules are wholly of quartz and very much rounded in form. The original rounded outline of the quartz granule is shown by the dotted lines and deeply shaded portions (referring to microscopic section), while every portion of the interstices is occupied by a clear, colorless, silicious cement, binding the rock into a hard, compact and impervious quartzite, almost absolutely unaffected by chemical and atmospheric agencies. This rock shows to beautiful advantage the secondary enlargement of quartz granules by deposition of interstitial silica, having the same crystallographic orientation as the granules themselves."

From the foregoing the author draws the following conclusions:

I consider this, from the standpoint of durability, almost an ideal stone. Composed wholly of quartz grains, it has, by deposition of interstitial silica, become converted into a compact quartzite, impregnated with just enough iron oxide to give it a reddish or brownish-red color. It is therefore practically non-absorptive, and its surface affords no foothold for growing organisms. Strong as the strongest granite, and not liable to chemical disintegration from atmospheric agencies, the stone deserves even a wider recognition than it has yet received."

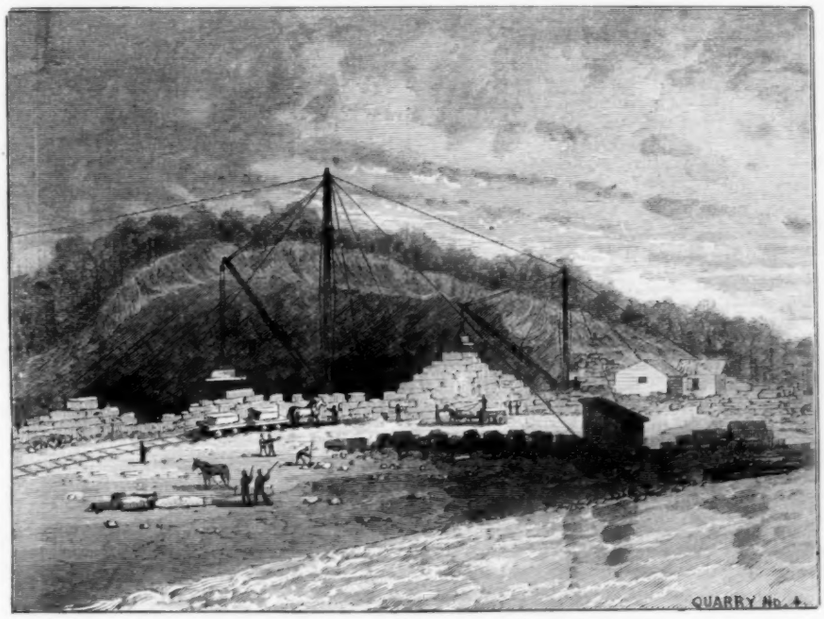


Quarry No. 2.

We give, finally, some of the general considerations respecting this stone contained in a report made by the late Prosessor Newberry, a highly esteemed authority on the subject:

"There are at least three marked varieties of this stone, possessing different degrees of strength and shades of color, affording to the architect a means of securing a wide range of effects, when used either singly or in combination. Also, that the stone which we had used at Columbia, though possessing greater strength than any sandstone submitted to trial, was far surpassed in this respect by some of the other varieties attained, and that the strongest not only exceeded in strength all other varieties of stone tested at the School of Mines, but even resisted the full crushing-force of the powerful Emery testing-machine, which we have recently had constructed, and which was supposed to be capable of reducing to powder any building-stone submitted to its action. The resistance to crushing-force in the specimens tested varied from 18,401 pounds to the square inch to 42,804, or rather to and beyond the extreme crushing-force of our machine; for it was found impossible to overcome with the machine the resistance of two-inch cubes of the strongest stone, although the pressure was carried up to 151,000 pounds. Hence we can say that the resistance to crushing-force, of the strongest variety, exceeds 42,000 pounds to the square inch, a result greater than we have obtained from tests on granite of any kind, from trap, or any other variety of building-stone.

"The element of beauty is no less important in a building-stone than strength and durability. In these three qualities this stone is certainly unrivalled. It is stronger than any granite and much more durable, since granites are composed of quartz, feldspar, mica and hornblende, all of which, except the quartz, are liable to decomposition on exposure. From this danger this stone is free; composed as it is practically of pure silica, it will bid defiance to the tooth of time; and had the obelisk now standing in our Central Park been composed of such a dense, homogeneous sandstone as Potsdam sandstone it would to-day be as perfect as when erected at Tanis, 1500 B. C.



Quarry No. 4.

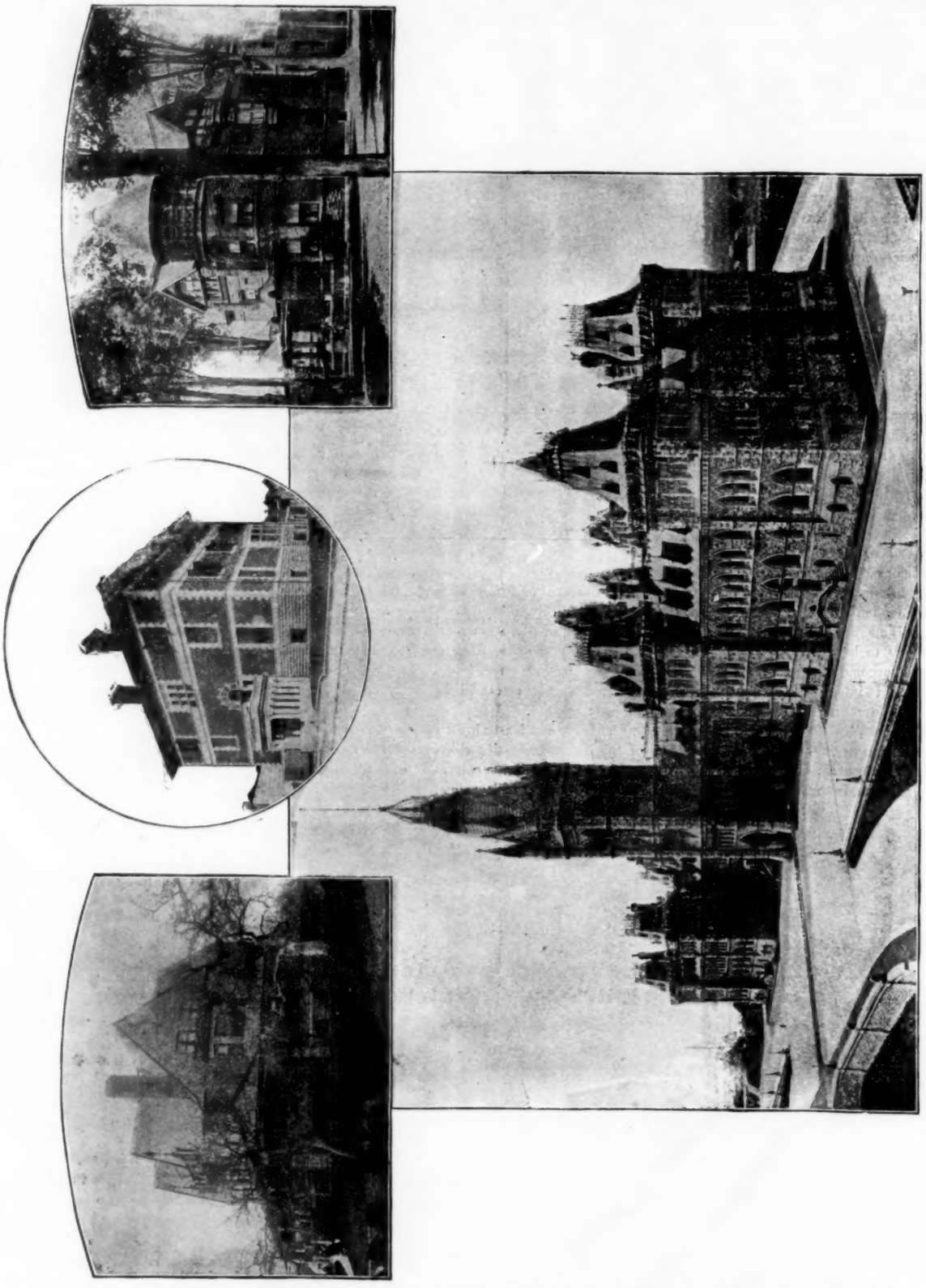
"As I have said, I was surprised to find in the different quarries of this company so many varieties of color in the stone. In the west quarries, the typical 'Red Potsdam,' either

plain or banded, prevails. On their southern tracts are out-crops of homogeneous and monochrome, chocolate-colored stone in heavy ledges, which will yield blocks of any desired size, while in their quarries on the east side are exposed about fifty feet of rather massive layers, separated by a band of fifteen feet of foundation or bridge stone. The upper and lower bands composing the fifty feet referred to are mainly of light-colored homogeneous stone, to which I was a stranger before visiting the quarries. This is of a reddish-cream color, very uniform in tint and pleasing to the eye. It comes out in layers from two to six feet in thickness and splits with ease and certainty in any direction.

"With the chocolate-colored stone, to which reference has been made, it may be combined with fine effect, one variety being used for trimming to the other, as corner-stones, door and window caps, porches, etc., or associated as block-stones in plain walls.

"This cream-colored variety works with comparative ease, and may be wrought into moulding and ornaments much more cheaply than the harder varieties, which will be best used when hammer-dressed, a style of treatment to which every phase of the stone will lend itself, as it breaks true and even under the hammer.

"The different tracts of land controlled by the Potsdam Red Sandstone Company comprise about two hundred acres, distributed for about a mile up and down Racquette River, and selected with judgment so as to embrace the best outcrops of stones found in the district. On all these tracts the Potsdam sandstone is practically the surface-rock, being covered only with a layer of greater or less thickness of boulder clay. In quantity, therefore, the quarries are practically inexhaustible, and it is not too much to say that they may be worked for centuries without embarrassment."



Parliament Buildings, Ottawa, and Private Residences built of Potsdam Red Sandstone.

We conclude by referring incidentally to the accompanying illustrations, showing the Potsdam Red Sandstone Company's quarries and methods of dressing the stone, and a

number of characteristic buildings in the United States and Canada in which this admirable building-material has been employed. They need no special description.

POTSDAM RED SANDSTONE CO.,
POTSDAM, N. Y.

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We are assured that for gearings, cams, spinning-chucks, stamping, drop and hammer dies these castings have proved very satisfactory and economical, the material possessing just those qualities which are of the greatest value in the manufacture of such goods.

Manufacturers of high-class machinery will doubtless find it profitable to correspond with the Chrome Steel Works regarding their product.

PHILADELPHIA, PA. February 21, 1893.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Owing to our fast-increasing business, we have decided to open a store and office in New York City, and have secured facilities at 231 Water St., where in the future we will carry a full stock of our special brands of bright tin, roofing-tin, solder, galvanized iron and tinners' trimmings generally. This agency will be in charge of Mr. Benj. B. Morrison, a gentleman who is fully conversant with the trade in New York City and vicinity, having been in our line for many years.

We are also represented at Chicago, Omaha, Kansas City, Galveston and New Orleans, and in addition to this we have several hundred sub-agencies. Our special brands are carried in stock by all the leading jobbers throughout the country.

Our works are in full operation and the plates we are turning out are perfectly satisfactory. The demands are simply enormous, particularly for our Genuine Old Style brand, extra heavily coated, which is the finest roofing-tin made, and also for our other brands, such as the Taylor Roofing Tin, Taylor's Columbia, Maple, Knoxall, etc., etc.

Very truly yours,
N. & G. TAYLOR CO.

NOTE.

ON or before May 1st the Bridgeport Wood Finishing Company will move their Chicago office from 211 E. Randolph St., where they have been located for several years, to 206 E. Lake St. They will there have better facilities for shipping than at their former place, and as the demand for their Wheeler wood-filler and other products has lately largely increased this change will be very desirable.

MR. FRANK SHAY, formerly manager of the New York branch of the Detroit Heating & Lighting Company, will represent the Capitol Heater Company in New York, Eastern Pennsylvania, New Jersey, etc.