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THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XXXIV.

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DECEMBER 5, 1891.



SUMMARY:—

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AS it will probably be several weeks before we can reprint the grano-chrome plates which were to form part of the illustration of last week's mutilated issue, we have decided not to print and deliver any of the other plates which should have accompanied them until we can make the delivery in complete sets of prints.

A DECISION was given in the New York Superior Court the other day which architects and builders will do well to note. Some nine years ago, Miss Alice M. Jarvis was sitting at the front window of a house on West One Hundred and Twenty-eighth Street, when a wall which had been built on the next lot fell over upon the house in which she was, and a mass of brick and mortar crashed through the roof and upper floor, and struck Miss Jarvis, breaking several ribs, and injuring her severely and permanently. The girl's father sued the owner, Mr. Charles Baxter, the architect, Mr. Charles H. Fenton, and the builder, jointly, for damages for the injury to his house, and, in his daughter's behalf, for further damages for her personal injuries. In both cases he obtained a verdict in his favor, the damages being fixed at twenty-five hundred dollars in each case, or five thousand in all. The testimony went to show that the mortar used in building the wall was bad, but it seems rather hard to hold the architect and the owner responsible for this, which was probably a violation of the contract by the builder. However, as was once said by a Supreme Court judge in a similar case, a defective wall or structure is to be regarded in the same light as a dangerous beast. If the beast escapes, and bites the public, all those concerned in keeping him tied up are jointly responsible for the damage he may do; and, while the architect and owner may not have caused, or even known, the vicious disposition of the wall, they should see, at their peril, that it is kept where it cannot, in any case, lay its claws on the neighbors.

THE City Government of Chicago evidently does not propose to take any radical steps to limit the height of buildings without proper consideration. A sub-committee of the general Committee of the City Council on Public Buildings has been appointed to make inquiries into the matter, and, a few days ago, held a meeting, at which three of the most noted architects of the city, together with General Sooy-Smith, who has had a very extensive experience with building work, as a representative of the engineers, and Mr. Birkhoff, of the Real Estate Board, were present by invitation. One of the members of the sub-committee, Mr. Dixon, is himself an architect, and the observations of the professional men appear to have been understood and appreciated by all. As might be expected, all the architects, Messrs. W. L. B. Jenney, Henry

Ives Cobb and Dankmar Adler, believed that there was no objection to the construction of high buildings in themselves, provided they were designed and supervised by competent men. It is obvious enough, from examples dating from the age of the Pyramids, that masonry, skilfully arranged and put together, especially in combination with steel and iron, could be depended upon to resist natural destructive forces for many centuries, and the difficulty of the problem in Chicago lay principally in the foundations, which must be carefully adjusted to the conditions of the soil, as ascertained by boring. In Boston, where, as is known, the height of buildings is now restricted by law, the streets, as one speaker remarked, are so narrow that the shadow of very lofty structures is objectionable; but this would hardly be the case in the wide Chicago streets. Mr. Cobb, who made some very interesting suggestions, observed that there was a possibility of changes in business localities, so that lofty office-buildings, designed for an extraneous load of twenty-five to fifty pounds per square foot of floor, and, at that rate, bringing all the strain on the subsoil that it could safely bear, might, after the migration of their tenants, be utilized as warehouses, and filled with goods weighing two or three hundred pounds to the square foot of floor. This could enormously increase the pressure on the foundations, and probably lead to great settlements, though not, he thought, to immediate collapse. Mr. Adler spoke in the same vein; and all the architects agreed that the main danger to be feared was that these complicated pieces of construction should be entrusted to careless or unskilful designers. To prevent this in some degree, they thought that architects in Chicago should be licensed, after proper examination, and that the license should be revoked in cases where an architect's work proved to have been improperly done. General Sooy-Smith agreed with the others as to the advisability of licensing architects, and thought that plans should be examined, on behalf of the city, by a competent board, before approval. He considered, like Mr. Adler, whose recent conclusions are known to the profession, that heavy buildings in Chicago will, in future, be mostly built on piles, driven to hard pan, or to rock, and believed that the foundation under such structures should be strictly inquired into by the public authority. His principal anxiety in regard to them was lest they should be occupied for storage of goods, and he believed that a serious fire among combustible material in them would bring them to the ground. Probably all architects will agree with him in this; but, so far, most of the extremely high buildings in our cities have been intended for offices or apartments, in which a fire could hardly occur which would affect the protected-iron structure now generally employed; and if architects were to take into consideration all the possible uses to which their buildings might be put, they would find it difficult to design anything.

WITHIN the past few weeks a great deal of malicious mischief is said to have been done by union carpenters in Chicago, in buildings in course of erection by non-union contractors. In one house, it is said that five thousand dollars will be required to make good the damage done, and it is estimated that the destruction of property in this way has amounted to forty thousand dollars within the last three months. It is to be hoped that the perpetrators of these outrages will be taught a severe lesson, and that the decent members of the union will be the foremost in hunting out the offenders and bringing them to justice. In all probability, if such acts are committed by union carpenters at all, which we doubt, it is by a few worthless and drunken shirks, who care nothing for the fact that they take from the pockets of their comrades, by exasperating owners, architects and the public against the union men, many times as much as they take from the contractors. It seems to take workingmen in the building-trades a long time to learn that the sympathy of the public is strongly in their favor, but that they are constantly repelling and disgusting their friends by their want of manliness, truthfulness and decency. Nine-tenths of our citizens would like to see every workman in the country, who understands his business, and lets whiskey alone, constantly employed, at the highest rate of wages. Every one can see that such a state of affairs would bring with it general prosperity. The workmen would have money to spend in good clothes, and shoes for their children, in books, house-rent and other modest luxuries, and

the people who make and sell these articles would profit accordingly. Instead, however, of taking an intelligent course to procure themselves constant work at good wages, the members of the building-trades appear determined to destroy the business by which they live. They usually begin by swearing implicit obedience to a few noisy blood-suckers, who have not a single interest in common with theirs, and whose sole aim is to advertise themselves, and keep up agitations which they may have the credit of leading. Then, under the guidance of these counsellors, they proceed to render the business of building and owning houses the most uncertain, unprofitable and unsatisfactory employment of capital that can be made by making it impossible for an owner to know when he will have his building ready for tenants, and for a builder to know where or when he will be able to get the labor he needs to fulfil his contracts, and how much he will have to pay for it. Naturally, under these circumstances the people who have money to invest, prefer to put it into some other kind of property, or, if they build, seek out the great contractors who are in a position to defy the unions, and pay them an extra price for the assurance, which they alone can give, that the building will be ready, and that leases can commence on a fixed day; and, meanwhile, the union mechanics, who have devoted so much time and money, under the leadership of professional mischief-makers, to spoiling other peoples' business, discover, too late, that they have effectually spoiled their own.

ARCHITECTS count among artists everywhere except in this country, where we have heard them described as "a sort of genteel carpenters"; and young architects may be glad to know that, when they get to France, where most of them would like to go, they may claim to be received into the fellowship of the new Association of American Art-Students, which has just been established in Paris, after the model of the New York Art-Students' League. The idea of this Association is due to an artist of distinction, long resident in Paris, and it seems to have met with an enthusiastic reception among those whom it concerned. At present, after only a year or two of existence, it has a membership of three hundred and fifty, and has hired for three years a small house, with a garden attached, where a library is provided, facilities for athletic exercise are furnished, with instruction in fencing and sparring; and coffee can be had, but no liquors. It is hardly necessary to say that the New York Art-Students' League, that most warm-hearted of all professional associations, takes a lively interest in its young sister in foreign parts, and mutual messages pass frequently. Last year, the New York League, anxious lest, amid the enticements of French cookery, the students abroad should lose their taste for the healthful mincepie and drumsticks of their ancestors, packed a box full of turkeys and other Thanksgiving dainties, and shipped it to their brethren in Paris. It was received in good order, the pies were unpacked, and, under a canopy of stars and stripes, the members of the Association risked indigestion for the honor of New England. Thanks, perhaps, to the vigor of constitution imparted by the athletic exercises which form a feature of the Association, no fatal results appear to have followed the feast, and we may be sure that those who were present would rather have endured a slight loss of appetite for the next few days than have missed the happiness of reviving home feelings and recollections. Those who have seen how poor American students have had to live in Paris can appreciate the good which may be done by such an institution. It is all very well to talk of the "enthusiasm for art," the "inspiration of novelty," the "contact with foreign minds," and so on; but, after a few months of enjoyment of these privileges, one begins to find that "enthusiasm for art" has lost its power to make the dingy restaurant, with its sawdust-covered floor and its eternal beans, seem inviting, and that the "society of foreign artists" of the cheaper sort, with their big hats and their flavor of gin, and, especially, with their unspeakable female companions, has ceased to be either improving or attractive, and the "*carità del natio loco*" begins to assert itself. Then come homesick dreams of bright America, of parents, brothers, sisters and cousins, and the student must be enthusiastic indeed who can keep himself hard at work. Upon many of them, indeed, the effect of poverty and loneliness is very injurious. A French Bohemian is bad enough, but an American Bohemian is intolerable, and one can not be shut out long from the softer feelings without finding something

Bohemian develop itself in their place. From this danger the new Association is well adapted to preserve students. In it they can find friendship, sympathy and amusement, besides American ideas of manliness and purity, and no young American worthy of the name, least of all one with brains and heart enough to be an artist, could fail to respond to its good influences. For the benefit of such of our readers as may be in a position to avail themselves of the privileges of the Association, we will say that the membership fee is six dollars a year, and that all American students are eligible. For those who have passed the student age, but who retain their sympathy for its trials, and have money enough, and the disposition, to show that sympathy, we may add that the membership fees only pay the current expenses of the Association, but not the house-rent, which has to be made up by outside subscription; and that if they would like to do something for it, they may, for the present, address Mr. A. A. Anderson, the President of the Association, who is now in this country, trying to obtain substantial assistance for it, and may be addressed at Fordham, N. Y.

AN experiment, about the success of which we have some doubts, has been tried recently by a Frenchman, M. Bigex, who has for many years been settled in Srinagar, in Cashmere, as the director of a great manufactory of rugs and carpets. About two years ago, M. Bigex had some designs made in Paris by M. Toché, an artist of great skill in such work, and these designs were executed in Cashmere by the Oriental workmen, and the finished carpets and embroideries were sent back to Paris for exhibition. According to M. du Cleuziou, who writes an enthusiastic description to *La Semaine des Constructeurs*, the translation of the designs into textile work has been very successful. M. Toché was left complete liberty as to his choice and treatment of his subjects, and tried a great variety. Among others, he produced what may be called historical, or high-art designs, representing Vishnu floating on the sea, and caressed by the houri Laksmi; Prakrite, the Virgin of the Himalaya, bearing the three sacred books; Ganessa, the god of Wisdom, seated on the great Lotus, and so on. People familiar with the way in which rug-weavers draw the human figure would not expect much in the way of solemnity or sentiment from the fabrics produced in accordance with these designs; but M. du Cleuziou informs us that "the devout persons who executed these works have necessarily put into the rendering a profound faith. They have produced masterpieces." Whether this means that it is possible to distinguish the heads of the personages from the feet, which is not always the case with Oriental work of the kind, or whether there is really some sentiment about the embroideries, which is hardly conceivable, we will not undertake to say. Besides these ambitious subjects, M. Toché produced, for imitation by the Cashmerians, some Saracenic designs, suggested by the rare remains of Saracenic art of the eighth century in France, with a series taken directly from Byzantine textiles. These, particularly the Byzantine patterns, are said to have been rendered with surprising success, and some ancient Assyrian, Persian and Egyptian motives, taken from the Dieulafoy and other collections, besides some modern Japanese designs, are said to have been charmingly reproduced; but a series of Renaissance patterns, with shaded relief, did not prove very successful. The most curious part of the experiment consisted in sending to Cashmere a large figure of a Breton peasant girl, dressed in the costume of the country, and holding the characteristic distaff. Of this model, as M. du Cleuziou says, the Orientals have made what would appear to be a sacred image of the goddess Devadassi, were it not for the big Breton cap and the cross hanging on the breast. Although we would rather possess a Cashmere rug in the native patterns than those imitated from anything else, the display of Orientalized European designs must be well worth seeing. We knew a man once who sent a photograph of his little daughter to Japan, where a native artist translated it into a beautiful figure, in Japanese costume, painted, as we recollect it, on a silk scroll. The face was an excellent portrait, and very sweet in expression, like most of the female faces painted by the best Japanese artists, and was just sufficiently Japanese in character to suit the rest of the figure. There is probably no other Oriental country where such work as this could be successfully done, but it would be interesting to see how conventional decoration, such as Byzantine mosaic-work, would be rendered in different parts of Asia.

ITALIAN ARCHITECTURE.¹—IV.

THE MIDDLE AGES.—(Continued.)

BEFORE entering Tuscany, where the Gothic style found its tomb, our attention is claimed by the church of San Petronio, at Bologna; it was begun by Antonio of Vincenzo († 1405) in 1390, when already the Renaissance was beginning to eclipse the Gothic school. Maestro Antonio must have been a very bold and imaginative artist. In San Petronio he essayed to build a church larger than any that had hitherto been reared. The arms of the cross were to be of extraordinary size; there was to be a dome 510 feet in height and nearly 165 feet in diameter; the four angles of the transept were to be flanked by four towers, in short, the building was to be colossal in its proportions. But Maestro Antonio's plan was entirely set aside in 1561. His name deserves, however, to be much better known than it is. He was likewise the architect of the magnificent spire of Saint Francis at Bologna.

In Tuscany it should be observed that there are some remarkable Gothic structures, especially in Florence. Such are Santa Maria del Fiore and the tower of Giotto. The Gothic exhibited here is, nevertheless, wholly unlike that of which we have been speaking; it is a Gothic of unique character, based on a polychrome system of decoration, on a constant tendency to horizontalism, on the tabernacle-form of the doors and windows, and on the use of terminal galleries with modillions and of openwork balustrades (Figure 12). How can

this style of exterior be rigorously termed Gothic! And how about the interior, with its massive pillars and its grave and majestic vaults resembling those of a Roman edifice!

The tradition which attributes the erection of Santa Maria del Fiore to Arnolfo di Cambio (1240–1301), architect of the Col de Valdesa, is not borne out by the facts. The church was founded in 1296 by Arnolfo, who, as architect of Santa Reparata, was exempted from taxation [Santa Reparata, was the name under which Santa Maria del Fiore was reared, the latter appellation having been adopted in 1412]. Arnolfo died in 1301; it has been insisted that he left a design or model of

the church (cf. Frey, "*Die Loggia dei Lanzi zu Florenz*," p. 69; and Guasti, "*Santa Maria del Fiore, La Chiesa e il Campanile*," p. xl) and even a model of the façade (Guasti, *loc cit.*, p. lxxv). The fact is that in 1334 after a suspension of the work, Giotto was chosen architect of the church—from 1334 to 1337; 1334 is the date of the foundation of the celebrated tower to which he mainly devoted himself. After Giotto, we find Andrea Pisano occupied on the tower from 1337 to 1348; then comes a long gap in the documents. Finally about 1350, Francesco Talenti was made architect or *capomastro* (chief mason) as the head architect was then termed. His work on the tower and even that on the church, which

was resumed with activity in 1357, was of prime importance. He was succeeded by Giovanni de Lapo Ghini, a learned but somewhat unscrupulous artist, who had been engaged for a good while in directing some part of the work on the duomo, even in Talenti's time. We find later the name of Talenti's son, Simon de Francesco Talenti, and that of Benci di Cione, and still other artists. It can, however, be said that the changes that were successively made in Arnolfo's original idea did not so alter the character of the monument as to exclude him wholly from among the architects of the cathedral. Naturally, a work of such great importance must have been a collaboration.

As for Giotto's tower, it must be remarked that only a portion of the basement is due to Giotto; the rest was by Andrea Pisano and Francesco Talenti—a really excellent artist who is becoming better and better appreciated.

An Arnolfo style did, however, according to certain writers, exist at Florence, forming a part of the Gothic school; but careful students are now inclined to treat the style of Arnolfo as somewhat apocryphal.

Gothic art took a surprising start at Sienna, where it assumed an original character in the combination of the pointed arch with the elliptical (Figure 13). See the façade of the beautiful town-hall, with its boldly soaring tower.

From Sienna, Orvieto is soon reached, where Siennese artists long held sway, although the inspiration of the cathedral is attributed to Arnolfo di Cambio, and the execution to a monk of Perugia, Fra de Benvignate. The façade surmounted, like that of the Sienna cathedral, by three great

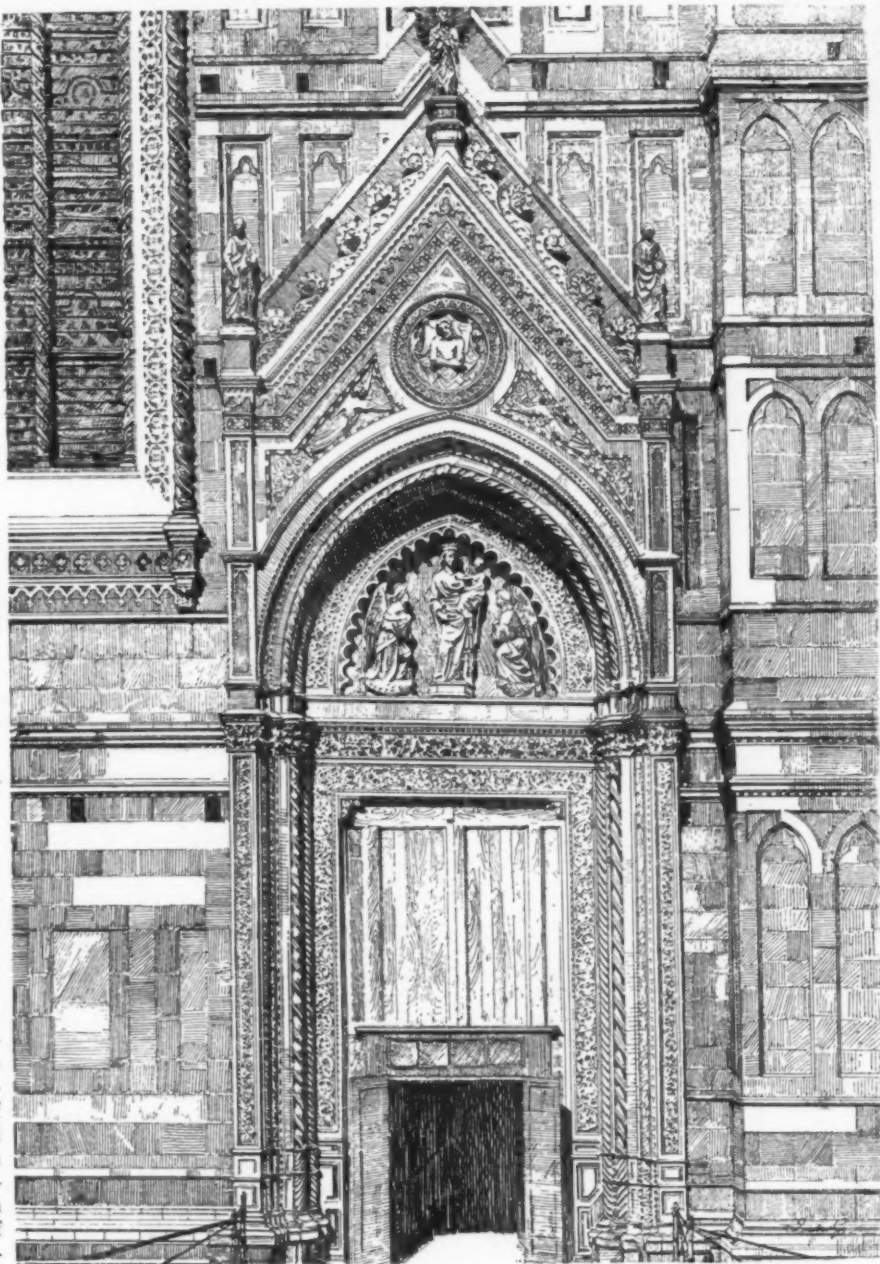


Fig. 12. Side Entrance of the Duomo of Florence.

¹From the French of Alfredo Melani, in Planat's *Encyclopédie de l'Architecture et de la Construction*. Continued from No. 831, page 130.

pediments, is largely the work of Lorenzo Maitani, of Sienna, who devoted more than twenty years of his life to the construction of this magnificent Gothic church, in which the pointed arch appears not as the key of the system, but as a decorative element, harmonizing perfectly with the semicircular (Figure 14). Superior in general disposition to the façade of the Cathedral of Sienna (begun in 1284, after the design of Giovanni Pisano [1250-1328?]), the façade of the Cathedral of Orvieto cannot but awaken genuine and profound admiration in any one who is at all susceptible to the nobler forms of art.

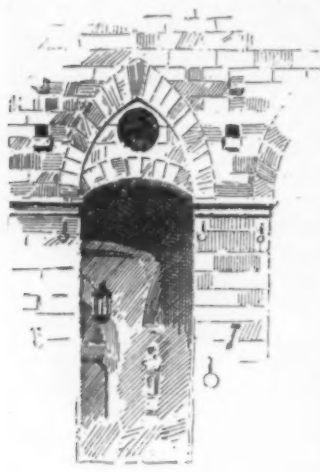


Fig. 13. Siennese Arch.

The Cathedral of Sienna is also an admirable edifice; it bears perhaps a close relationship in its forms to the Italian Gothic school, but it has very little in common with the legitimate Gothic, either in its constructive or decorative elements. It furnishes an excellent example of the way in which Gothic art submitted to the laws of adaptation in Italy; its history is full of vicissitudes. After the proportions had been fixed, they were subjected to such changes that in 1339 the



Fig. 14. Façade of the Cathedral of Orvieto.

question was agitated of making the old church merely a small section of the new; this suggestion was not carried out, either because of the defects discovered in the construction, or for lack of sufficient funds.

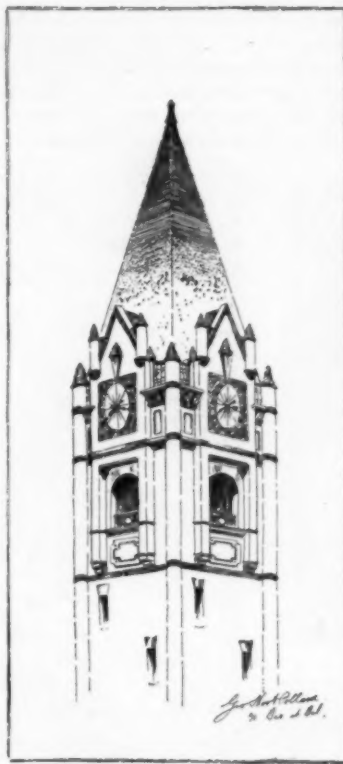
At Sienna there is also an interesting façade at San Giovanni, designed by Giacomo del Pellicciaio, exhibiting careful workmanship in the small columns, and in all the details; but unfortunately it has never been completed.

[To be continued.]

BORGHESE GALLERY SEIZURE—The action of the National Bank, the principal creditor of the Borgheze family, compels the seizure of the Borgheze gallery, and £320,000 is asked for the collection. — *Boston Herald*.

ARCHITECT, OWNER & BUILDER BEFORE THE LAW.¹—XI.

THE ARCHITECT'S AUTHORITY AS AN EXPERT.—EXTENSIVE AUTHORITY OF ARCHITECT IN HIS OWN PROVINCE.



A Sketch for a Tower.

WITHIN his own province, as a man skilled in the art which he professes, the authority of the architect is very considerable. In practice, his authority over the contractors in any particular case is usually fixed by the terms of the contract between the contractor and the owner, but even then the law generally interprets any doubtful expressions in such a way as to favor giving the largest discretion possible to the architect, or whoever may stand in the place of the architect as the skilled director of the work.

In a Massachusetts case,² a contractor agreed to build drains for a city, in a skilful and workmanlike manner, under the general direction and superintendence of a committee, and to cause the work to be carried forward and finished with as much rapidity as it could reasonably and beneficially be done. One drain was built, and preparations made for beginning the other, when, about the middle of October, the committee ordered the work stopped. It was resumed the next spring, completed and paid for; but the contractor made an additional claim for damages for having been

AUTHORITY OF SUPERINTENDENT EXTENDS TO TIME WHEN WORK SHALL BE DONE AS WELL AS TO MATERIALS AND WORKMANSHIP.

prevented from carrying on his work in the autumn before. The Supreme Court held that, "by reserving to the committee a general direction and superintendence, the plaintiff agreed to conform to the reasonable directions of the committee, as to the time of doing the work, of which they were to judge, acting with an honest and just regard to the interests of the city. Under this stipulation they were not to act arbitrarily, capriciously and unreasonably, but, exercising an honest and reasonable judgment, the plaintiff, by his contract, bound himself to conform to it, and the city is chargeable with no breach of contract."

It is probable that an architect, as being more skilled in the sort of work under his charge, and less likely to be biased in any way, would find his discretion sustained by a court under similar circumstances, at least as completely as that of a committee, but the question does not seem to have come before our highest courts.

ARCHITECTS AS EXPERT WITNESSES.

Architects, however, often have to appear before judges and juries, and the respect felt for their opinion is shown by the fact that a controversy between an owner and a contractor is almost always decided in conformity with the architect's judgment of the matter. Where architects are called as experts before a court, it is well for them to remember that they are entitled to privileges far beyond those accorded to ordinary witnesses; and, as the opposing counsel generally knows that

¹ Continued from No. 828, page 84.

² Chapman vs. Lowell, 4 Cush. 378.

their testimony will have great weight with both judge and jury, and will do his best to confuse them, so as to diminish the force of their evidence, they should not allow themselves to be hurried, but should insist upon having questions clearly put, and should take time enough to make sure of the correctness of their replies.

The main distinction between an expert witness¹ and one of the ordinary kind is that the former alone is allowed to testify to his opinion, while the latter can testify only to facts. Theoretically, all testimony should concern itself exclusively with facts, but the law holds that, in certain cases,² ordinary jurymen have not the special knowledge which will enable them to understand the facts shown, without interpretation, and a person skilled in the interpretation of such facts may be called in to assist them.

An expert witness,³ however, can give an opinion only as to matters in which he is specially skilled. In other matters he can testify to facts only, leaving the court to draw its own conclusions from them.

Unlike other witnesses, an expert is allowed, and generally required, to form the opinion which he is called upon to give from the accounts given of the facts by others. If he has personal knowledge of the facts in the controversy, his testimony will be so much the more valuable, for no one can observe the facts so intelligently as he; but in this case he must be prepared to give a full description of the facts on which his opinion is based.⁴ It has been held in Michigan that "an expert cannot give an opinion based on his personal examination, unless the facts on which the opinion is founded are all 'stated,'⁵ and he must endeavor to give the court a perfectly impartial and conscientious account of what he has seen, and what he thinks about it.

In most cases, however, he is not personally acquainted with the circumstances, and must hear them from others. He is then generally called in to listen to certain portions of the evidence, from which his opinion is to be formed; or he may be obliged to satisfy himself with reading a stenographic report of the testimony, or even with hearing a lawyer's version of it. Where facts are disputed, the expert may be called upon to say what his opinion would be in either case;⁶ but it has been held that experts are not obliged to form an opinion on theoretical propositions, and that they cannot be examined upon theories that are contrary to the uncontradicted facts of the case.

THE ARCHITECT AS AGENT FOR THE OWNER.—HOW FAR CAN THE ARCHITECT BIND THE OWNER?

The question of how far the architect is an agent for the owner, and is empowered to bind him by his actions or decisions, is one of extreme importance to the profession. The ordinary contract between owners and builders leaves this point somewhat indefinite, and architects, particularly the young and zealous ones, frequently get into trouble through not knowing how far they are entitled to help their employer without his consent.

GENERAL RULE.

The general rule is that "whatever may be necessary to 'complete an act that an agent is authorized to perform is included within the authority of the agent.' This rule was laid down by a New York court, in a case⁷ where the Springfield Iron Company had bought six hundred tons of old rails, which were, apparently by some mistake, landed on a wharf in New York. This landing was not by direction of the iron company, and it was not liable for the wharfage on the rails. The company sent a salesman, named Mack, to New York, to hurry forward the rails in all possible ways, and was instructed to see that there were no delays in shipping them, as it was important for the company to secure them at once. When all but seventy-five tons of the rails had been shipped, the wharf company refused to allow these to be removed, saying that it must keep these until its bill for wharfage, amounting, with the interest at the time of bringing the suit, to nine hundred and ten dollars, was paid. Mack asked the wharf company to let the rails go, saying that his company was good for the amount of the bill; but the wharf company replied that it had a lien

on the rails for the charges, and would not let them go until they were paid. Mack replied, in substance, that it was of importance to his company to get the iron through, before the canal closed, and that his company would pay the bill; and the wharf company then allowed it to be removed. There was some difference in the testimony as to Mack's exact words. The iron company, after it got the rails, refused to pay the wharfage bill, on the ground that Mack was not authorized to make such a contract on its account; but the court held that he was sufficiently authorized, and that his contract was binding on the company.

IMPLIED AUTHORITY IN MATTERS OF CONSTRUCTION.

In the case of architects, the rule appears to be that, outside of the duties expressly mentioned in the contract, they are impliedly authorized to order, and to bind the owner to pay for, work and materials which may prove to be necessary for securing the safety of the building under unforeseen contingencies, and even in cases where more mature consideration shows that it is necessary, for the same end, to vary from the letter of the original contract.

A Board of County Commissioners,⁸ in Indiana, contracted with a builder for the construction of a building, according to certain plans and specifications. The contract provided that the Commissioners might order changes from the plans and specifications, "the value of said change being first agreed on in writing, and the subsidiary contract endorsed on or attached to this contract."⁹ Nothing was said, apparently, about the architects having authority to order changes, but McDonald Brothers were named in the contract as the architects to superintend the work on behalf of the Commissioners, and the work was to be performed under their supervision. During the progress of the work, one of the McDonalds ordered certain iron columns to be made eight inches in diameter, instead of six inches, as shown by the plans and specifications. No contract was made in regard to the change, nor did the Commissioners, or any person for them, ever ask for any agreement as to the price of the extra work. The building was finished, and accepted by the Commissioners, and a charge made for the extra weight of columns, which the Commissioners refused to pay, on the ground that the extra work and material were not ordered as the contract provided. The case was brought before the Supreme Court, which said, confirming previous decisions to the same effect,¹⁰ "it has been held by this Court 'that where the Board of Commissioners has power to appoint 'a superintendent to act for them in the supervising of work, 'he becomes the agent of the county for the purpose of constructing the work, and that he may bind the county for 'work done beyond that contemplated by the written contract.'"

On the other hand, where the contract authorizes the architect to order extras, but specifies the manner in which he shall do so, he must be careful to give his orders in the way prescribed. In a Missouri case,¹¹ the superintendent was authorized by the contract to order variations, but in case of omissions or additions, the cost or expense thereof were to be agreed on in writing, signed by the contractor and superintendent, "before the same should be done, or allowance claimed therefor." The superintendent certified to the value of work done, and it was claimed that his certificates included allowances for extra work, although the signed orders for such work were not produced. The Court of Appeals held that the superintendent had no power to waive the requirements of the contract in regard to orders for extra work.

[To be continued.]

WHEN LIME BECOMES VALUELESS.—A decision of interest to all lime-owners has just been reached at Rockland. The question at issue was whether the chemical change caused by the wetting of lime destroys the value of it before there is any fire, or whether combustion commences the moment the lime is wet. A. F. Crockett & Co. claimed that the fire began when the lime was wet, fire-insurance companies taking the opposite view. The question was referred to referees in the case of some lime destroyed at Rockland last spring, and at the hearing this week the referee decided that combustion commences the moment lime is wet, and therefore awarded Crockett & Co. \$1,900, within a few dollars of the full amount of their claim. The referees were unanimous in their decision.—*Lewiston, (Me.) Journal*.

¹ Commissioners vs. Motherwell, 123 Ind. 364.

² Commissioners vs. Motherwell, 123 Ind. 364. Benton Co. vs. Patrick, 54 Miss. 240.

³ Board vs. Byrne, 67 Ind. 21. Bass vs. Board, 115 Ind. 234. Board vs. Hill, 122 Ind. 215.

⁴ Ahern vs. Boyce, 19 Mo. App. 552.

⁵ Daniels vs. Mosher, 2 Mich. 183. Harris vs. Panama R. R., 32 N. Y. 427.

⁶ People vs. Hall, 48 Mich. 482. Dewitt vs. Barley, 9 N. Y. 371.

⁷ Daniels vs. Mosher, 2 Mich. 183.

⁸ Keith vs. Lothrop, 10 Cush. 453.

⁹ Hitchcock vs. Bengt, 35 Mich. 501.

¹⁰ People vs. Hall, 48 Mich. 482. Jewitt vs. Brooks, 134 Mass. 505.

¹¹ Robinson vs. Springfield Iron Co., 39 Hun. 634.

GERMAN CASTLES.¹—II.GROUND-PLAN OF
WARTBURG.

Fig. 4.

WE saw in the preceding introductory article on German Castles that native authorities decide most of the existing strongholds of the oldest date, to be original Teutonic structures as well as some of more recent date. A minor number of remains are Roman; and these are most abundant in the provinces of the Rhine. Castles were distinguished in respect of their political importance from the earliest times to the tenth century as tribal or boundary forts, and secondly, as private interior seats. Subsequently, and during the Middle Ages, they were distinguished as dynastic courts, and castles of liegemen. To the first, or the dynastic courts, belonged the extensive strongholds of powerful subjects, dukes, princes and counts, as well as those of majesty. In the latter class are reckoned the castles of knights, or of noblemen of second degree, and the castles of several combined noble families (*Ganerben-Schlösser*).

As respects their situation, castles are distinguished as hill castles, and as water or flat-land castles.

Many thousand sites of old castles remain, and the number of semi-preserved and wholly preserved seats amounts, it has been estimated, to near twelve hundred.

The type which results from a comparison of these numerous examples includes: (1) A moat or a ring-wall, or both, with draw-bridge, portal tower and shield-wall; (2) a *burgfried* or keep-tower; (3) a *zwinger*, or bailey; (4) a domestic court with stables, kitchen, granary, lodges or retainers' houses; (5) a *palast* or lord's house and *kemenate*, or lady's chambers, with inner court, staircase, towers and chapel; (6) a bath-house, and a well or cistern.

The castles of late construction show a development of a single one of these parts of a *schloss*, or of the "*palast*" only. They are predominately domiciliary. They possess nothing of the old defensive character and aspect of strongholds; or possess the parts degenerated into mere decorative motives. For this reason they are considered as belonging in another category, and are seldom taken into account in the present series of papers. Where they have not been described as "*seats*," they will be portrayed later as "*palaces*."

Illustrations have been given of typical castle-sites, castle-rounds and moats.

The walls that rise from these sites are in conformity with ideal plans of military architecture. In water or flat-land castles, they are more or less geometrically exact, and take the ground-form of squares, triangles or rectangles. In most *burgs* or hill-castles they conform to the structure of their hilly perch. The ground-form of small hill-castles and of extensive castles, varies considerably and is different in almost every individual case. Yet as far as the situation admitted of it, the shape of a castle pile approached a square or a rectangle.

Such castles as are designed upon other forms than these must be regarded as exceptions. They are the experimental works of engineers and architects, or the elaborate creations of princely bishops and sovereigns.

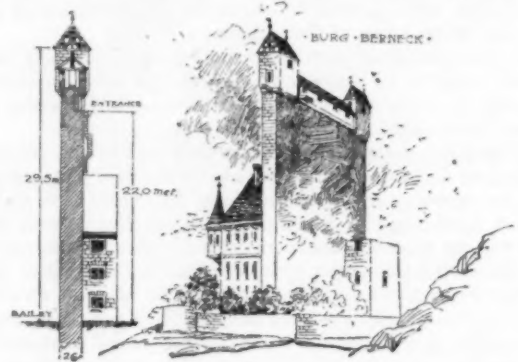
The Wartburg, one of the most famous castles in the country, affords a good example of the arrangements of the several parts of a *schloss*, and its original ground-plan may be given as the typical plan of such castles as are situated upon the spur of a hill (Figure 4.)

Its dry moat is hewn at the narrowest point of the neck of the headland. From this point the encircling wall extends like a sling thrown around the edge of the irregular, oblong-shaped surface of the hill. The drawbridge represents the slip-knot of the noose, and formed the sole entrance to the *burg*. The rampart, or ring-wall, fulfilled the office of a fence at some points, and extended upward and composed the façade of the *palast*, *kemenate*, stable, retainers' lodges and portal tower at other points. It is like a string, in fact, on which nearly all the different portions of the castle were ranged like so many beads; and it is easy to see how its breakage at any point meant the destruction of the *burg* as a single complex. The ring-wall, for this reason is particularly massive in construction in all castles; it is more massively constructed indeed, than any other part of a castle, save in the single case of the *burgfried* or keep-tower.

The material of the masonry depends upon the geological composition of the soil in almost all examples, except those of Roman origin, and of a few dynastic courts. In the northern provinces therefore, the wall is found constructed of rubble and limestone, or of rubble and brick. Marienburg and the walls of other strongholds erected by the Knights of Malta are rare examples of ramparts constructed wholly of brick. The rule in Middle and Southern Germany is walls of rubble laid in parallel lines, in abundant mortar, with interior and exterior linings of hewn blocks of sandstone.

A common thickness for the ring-wall is six feet. The height is too various for any approximate average to have been made. It differs not only in every plan, but differs also at numerous points of one and the same plan. The loftiest height of a rampart is attained when the wall forms the façade of the *palast*, and in the portion seen upon some Rhenish and some hill castles, called the shield. This latter is an extraordinary construction, and always purely defensive in origin. Where it occurs, it rises at the side from which an attack was possible from a point higher than the castle site. Thus, if a castle stands upon the lower terrace of a hill, the shield-wall is projected up and along against the face of the terrace above.

At Berneck Castle (Figure 5) in the valley of the Nagold, the site to be defended is the extremity of a narrow hill spur. On three sides the hill sinks with a steepness sufficient to make approach from



Figs. 6 and 5.

them impracticable; the fourth side is commanded, on the contrary, by a rising ground; it is a side that was most vulnerable to siege through catapults. An outer rampart, of five feet thickness and five feet in height, serves the *burg* therefore on all sides for protection, save upon this one side. Here an extra defence was necessary. The *palast* wall, accordingly, was carried up on this side, to a height of thirty metres (101' 6") and extended to a width of twenty-two and a third metres (77' 6"). The thickness of the wall, which is composed of hewn square blocks of sandstone, varies from eight feet at the base, to six feet at the entrance, near the top; and these measurements are known to have been the original ones, or the same during the five hundred years (495 years) that the *burg* has been in the possession of the family of the owner, Baron von Güllingen.

The shield-wall is massive throughout its breadth and throughout its entire elevation up to about eighty-one or eighty-two feet. The inner side is broken into six feet below this point, for an entrance and platform. A flight of steps then leads from the platform upward inside the shield-wall (Figure 6); thus the coping is reached. From this point the wall becomes a gallery, hollowed inside and lighted by a row of square loop-holes or windows. At the two extremities of the wall, the gallery expands its base and rises a story in height, forming watch-towerlets, as well as affording lodging-room, in case of necessity, for the family of the besieged knight. The lodging-room for retainers was the gallery and the lower stories of the end towers; and, here outside the lower story, at the gable ends of the two towers, were once floorless, covered balconies, or *peck-nasen* (literally—"tar noses"—nostrils for pouring boiling tar through, down upon besiegers at the base of the wall) Figure 7. The projecting beams, seen in the illustration below one of the windows of the gallery, served as the floor-timbers of a water-closet.



PECK-NASEN.

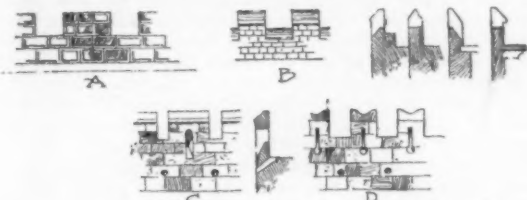
Fig. 7.

In the gallery itself we have undoubtedly one of the earliest types of German battlements. It is roofed and cut precisely after the pattern of a house in miniature so far as practical, just as the breeches of the children of the day were cut in precise imitation of the clothing of their parents. The oldest castles are apt to have such galleries on the copings of their ring-walls anywhere; and, especially where the rampart is high and out of the reach of firebrands and the stones shot from catapults. Roofing was preferred even where the gallery was within the reach of missiles, if the range were only wide enough to enable a strong roof to withstand the weakened effect of blows. In the court-yard of Castle Eltz, stones were to be seen which were shot over from the neighboring hill, but which glanced down the rampart (lodge) roofs, the force of the blows being unable to crush them in.

The inclemency of northern skies made roofed battlements imperative. The hill castles were exposed to cutting winds, and the powerful draught of open copings misdirected arrows from the instant they left their bows. The same draught was a danger and a nuisance in preparing water and boiling tar. Nor must it be forgotten that in the earliest times in Germany, the men who manned a castle, were of a class that enjoyed consideration: more thought was given to their protection against the weather, than was given in the Orient to the slaves that sweltered upon the open battlements of their despots.

¹ Continued from No. 825, page 42.

For all these reasons, we see in German castles better than in the castles of milder climes or more tyrannic countries, the evolution of the battlements, one of the most characteristic and beautiful of architectural ornaments. For take off the roof of such galleries as that of Berneck Castle—and roofs had to be taken off voluntarily at points within close range of missiles, or else they were removed forcibly—and you get the primitive battlements. The embrasures are unroofed windows, and the crests were the wall-spaces between them (example of German battlements. Figure 8 a). The open



GERMAN CASTLE BATTLEMENTS.

Fig. 8.

spaces, or windows, were loop-holes for shooting from. The more men that a burgher had to provide for, the more loop-holes or embrasures were cut in the gallery walls. And it is hardly contrary to human nature to surmise that the embrasures were cut, even where the men were wanting. They represented men. Later, after the artistic effect of embrasures and crests against the sky-lines had been observed, and wealth and travel had led the owners of castles to pay attention to the artistic side of architecture, battlements were often adopted in place of galleries (but by no means universally). Crests were constructed in close conjunction, at regular intervals (Figure 8 b), and in time became pierced by shoot-slits (Figure 8 c). The oldest examples of the latter are adapted for shooting from (see vertical section). But by degrees the shoot-slit also took on purely ornamental forms (Figure 8 d). Castles of the sixteenth century already possess battlements that are wholly ornamental, and *pechnasen*, or machicoulis, as numerous as the crests of the battlements. Closed at the bottom as they are, the machicoulis, in fact, look like mere friezes, and are no longer, indeed, anything else. Their function as "tar-noses" expired when the earliest forms of the feudal art of warfare died out.

In modern adaptations of the old German battlements, *pech-nase* and shoot-slit, even the arrangement of the several parts is altered; the (ornamentally-shaped) shoot-slits being placed below the *pechnasen* frieze (Figure 9, Babelsburg. See Illustrations.). The external balcony, too, which, in old castles projects from the top story, is much lowered.

As a rule, where these balconies occur, their situation is upon the portal tower. But they occur seldom. Their material was wood. And where other portions of castles that were wont to be constructed of this fragile material have been replaced with stone or brick, a balcony, when it decayed, was left unrenovated. In Schöna Castle (Figure 10) nothing remains of it but a row of protruding corbels, (see at the right, on the gate-tower).

With the German necessity for shelter, a hanging towerlet or protruding window is preferred to the balcony with its open top and sides.

The exterior of ring-walls, for the rest, have few interruptions, either in the way of projections, or of inlets. Where windows occur in the low lodges or stables, they peep like eyes from under eyebrows, close under the coping or the eaves of the roofs. Where they occur elsewhere they have been broken through in recent times. Very often they show their new whitewash conspicuously, while the rest of the castle rampart is darkly tinged by age and



Fig. 10. Schloss Schöna near Meran.

blotches of moss. Few buttresses break the monotony of the exterior surface of the wall, but no architectural decorations whatever. A vast number of castles depend like Schöna, upon the irregularity of the roof-lines for nearly all their picturesque-ness.

The illustration of a few exceptionally fine castles must always be the resource of writers bent upon making the merits of archi-

tecture known; but this habit of selecting the admirable bits of a National architecture for show, must not be given away to, without admitting the exceptional character of the selections, and without referring to the typical—the average character of the great mass of castles.

Now in Germany what is typical and home-bred in castles pertains to the roof. The Gothic breaking-up of surfaces to place the skeleton or scaffolding of the structure outside is a foreign importation; so too, is the Renaissance emphasis of the horizontal lines of construction and decoration of surface. The average old *schloss* has plain walls. It was built after the Thirty Years' War, or was restored after that period of incredible havoc; and, having no superiors, owing to the impartial ravages of the war, it was built without emulation, for durability alone. The Gothic style of architecture, that exposes the intricate frame of a structure to the weather, was well enough for churches which are paid for and sustained by contribution. But a castle, that is put up at private expense, needs to see its constructive skeleton well tucked-in under the shelter of a roof. If there are to be plain, smooth walls anywhere, their place is *outside*, where missiles, water and snow are to be shed. Such was the logic of the provincial knights who built the average-looking *schloss*, and left descendants with average fortunes. Of course it has happened that the fortune or the ambition of these descendants has risen, and in these cases, naturally, the student finds a Gothic, a Renaissance, or a Rococo appearing castle. But the plain castle is the rule.

In the genuine old average *burg* meanwhile, where this rule of plainness is varied from in the exterior walls, the exception occurs almost invariably as to the gate-tower first.

The approach to the castle is narrow and often winding. Even such a modernized approach as that to the ducal castle of Aldeburg (Figure 11. See Illustrations.) is calculated only for a pair of



Fig. 12. Gate-Tower, Albrechtsburg.

horses abreast. The tortuous roads of provincial hill-castles seldom admit of more. A calvacade, therefore, as well as a posse of besiegers was brought to a halt or to a slow advance by the castle gate, and care was taken to arouse the admiration of visitors by the richness of the portal, as well as to convey an impression of the resisting power of the castle by its portal's strength.

The wall of Schöna Castle near Meran, in Southern Germany, is rounded and projected out, bastion-like, at the low, round, arched entrance. Its drawbridge is transformed into a permanent bridge of stone.

The gate-tower of Albrechtsburg (Figure 12) at Meissen, in Saxony, is a late Gothic structure—plain and massive masonry below, pierced by a single, low gateway. The upper portion of the wall is divided vertically by three blind arcades of varying breadth and height, the middle arcade being over the portal, and the largest in size. A *caillou* or *pech-nase*, hangs like a miniature gable on the roof over the centre of the fourth story, and watch-towerlets project from each of the corners. The roof of the tower is tall and steep, and terminates bluntly in a contracted rectangular platform.

In Liegnitz, Silesia, the gate of the Piasten Schloss (Figure 13) is dated 1533, and affords a remarkable contrast to the Gothic portals of which the Albrechtsburg gate is an example; for whereas the decoration of the latter is spread over the upper portion of the tower front, it is concentrated in the Liegnitz Castle gateway upon the ground-story front. The upper stories are wholly barren of sculpture.

The moat of this quondam water-castle is filled-in. A level carriage-road and sidewalk leads round the rampart to a rectangular projection in it, the corners of which projection are formed by broad buttresses that slant upward leaving a middle space between with a perpendicular rise. In this space is built the elaborate construction of the portal. Four engaged columns divide it at equal distances with room for two arched entrances, the base and shaft of one of

the columns being omitted in order to make the carriage-entrance at the right sufficiently spacious — for the fashion of state carriages which had come in, made the narrow single gate of the equestrian, feudal, Gothic period quite inadequate; wherever a new gateway was built in the sixteenth century by princely or pretentious lords, it was built for the passage of these vehicles. The office of a draw-bridge was supplied by a stationary wooden bridge easily destroyed in case of alarm or need (the great width of the fashionable new

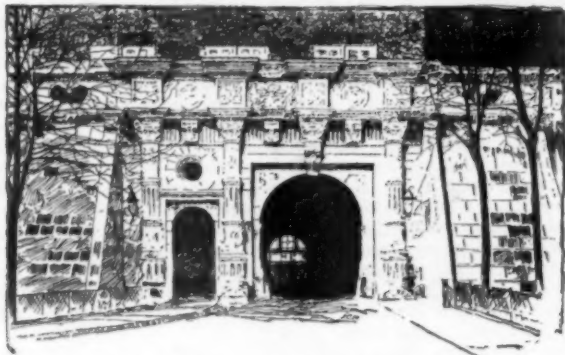


Fig. 13. Gate of the Royal Palace, Liegnitz.

gateways necessitated a corresponding width in drawbridges which made them too ponderous for handling readily; iron-clad doors hung in the front of the archway and a portcullis was provided at the back end of the arched passage. The coping of the entire breadth of the projection, including the corner buttresses, is an entablature, in the frieze of which sculptures are set: floral designs over the capitals of columns, and the medallion portraits and coats-of-arms of Duke Fredrich and his wife Sophia between the last, over consoles.

The old chronicles and traditions of the country represent the Piasten as a family of Slavonic blood, extravagant, dissolute, fond of pomp and at the same time the flower of the shameless tribe of princes that used up their yearly revenues in one month of hospitality and debauch and then quartered themselves upon the towns or their neighbors for the other eleven months of the year. Freytag, the historian and novelist, draws his pictures of these noblemen from this very Duke Fredrich and his successors. This gateway, devoid as it is, of the last architectural reminiscence of defence, (shoot-slits, *pech-nasen*, battlements, etc.), speaks the same story of uncommon recklessness.

Noblemen of the time did not go generally so far as this. They followed the fashionable rage for elaborate gateways, but they followed it without surrendering the whole front of the tower's ground-floor to the new sort of gateway. The ground-floor is the critical point in moments of attack, and the near points above and about it, are the effective stations for defence. No plan met with approval that sacrificed these considerations. Where they are left out of question, the gateway is very recent in date: a mere arch with no walls to speak of.

In Württemberg, and the mountainous provinces of the Empire, the tower portion of the gate is omitted long before it disappeared from the flat-land castles of Brandenburg, Prussia and Pomerania. Bartizans or watch-towerlets on the corners of low gateways, provided the site were elevated, sufficed as well in hilly countries

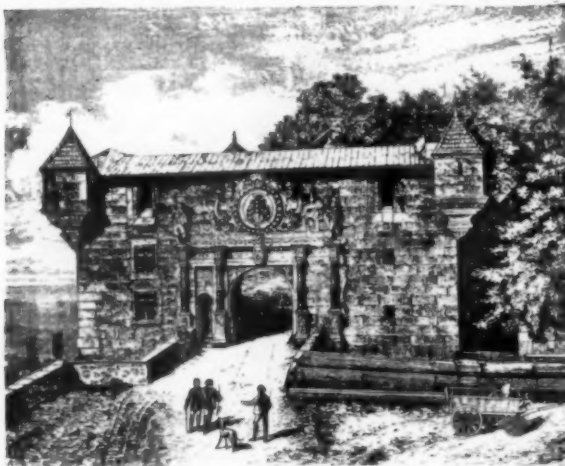


Fig. 14. The Outer Castle Gate at Tübingen.

probably, as the three or four stories of a tower in level districts, for surveying the neighborhood, and commanding it.

In the Castle of Tübingen the gate (Figure 14) must have looked

once like the gallery of the shield-wall of Berneck Castle transferred from a high post to the ground. For it is broad like the Berneck wall, with plain peak-roofed towerlets at the extremities, and inside the wall between the towerlets runs a gallery provided with narrow windows fitted for shooting from. The number of windows was once three (or perhaps four as in Berneck). But when increased space was needed for the elaborate, new frame of the portal, the middle window was filled-in. The old, plain, homely style of roof, however, remains, and nothing, scarcely, could be conceived that is more incongruous than its niggardly aspect of hugging the wall, when compared with the expansiveness of the gate. The frame of this is treated more in the manner of a cartouche, or mere ornamental adjunct, than as a decoration. Its design has no fraternity with the simple ponderous structure upon which it appears. It has very little fraternity with any stone architecture: but resembles cabinet-work.

Remains of colors and gilding are visible upon the flat vegetable ornamentation of the Liegnitz Castle gateway, and in those of its contemporaries. In gateways of the date of the Tübingen Castle portal — from sixty to a hundred years later — gilding was replaced by copies in stone of metal ornaments. Stripes, bands, "curls," all appear; even the heads of nails, and the faceted surfaces of inlaid stones are copied.

In the chapel of the Castle of Gross Kreechen, in Silesia, I saw a tombstone affixed to the wall, in 1889, where this ornamentation, hewn in limestone, was painted realistically — the vegetable designs between the bands, with green, the bands and nail-heads yellow, the faceted surfaces ruby and blue (sapphire).

Coats-of-arms, which are found hewn in German castles over the gateway, upon the tower, inside or outside, over the front door of the *palast*, on the keystone of the stair-tower arch — almost anywhere, in fact — are placed upon gateways of the Renaissance, where they still exist certainly and invariably. The proud pompousness of their cartouches contrasts strikingly with the massive masonry of the rampart and of the gate-tower, with its cowardly, narrow peep-holes and threatening shoot-slits.

Gate-towers are rarely replaced in modern castles by lodges. The examples that are met with in the Western provinces and Mecklenberg are not typical, but are copied from English seats. The seventeenth and eighteenth centuries saw portals built, both



Fig. 15. Castle Erbach, Hesse Darmstadt.

arched and open; they were things of state and parade. But the lodge, if one were provided for the keeper, was an insignificant affair. It is situated at a distance in the great royal *schlösser*, out of the way of the unfolding vista opened up by the great avenue of approach; or is represented by a wooden movable guard-box. In minor, provincial castles, where the gate-tower has been allowed to fall to pieces, as being no longer of practical use, but where all other buildings have been kept in repair, a pendant arch is built between the gable ends of the buildings (barns) right and left of the entrance to the court. But no gate-keeper is booked on the castle inspector's list of *gesinde*. The old office is obsolete. The function of keeper is fulfilled by the castellan or porter, whose lodgement is within the *schloss* proper.

While the gate-tower, and every representative of it, is characteristic of the German castle, other towers that occur along the rampart are not. A number of examples exist of many-towered burgs. Such a castle is Moritzburg in Saxony, and such is the castle of Count Erbach (Figure 15) in Hesse Darmstadt. A tolerably regular rectangular ground-plan, is flanked at the four corners by round towers, with roofed parapets or tops. But all examples of this kind are exceptional. The typical *schloss* has a single tower. This is, or was once, the keep or *burgfried*, and will be the subject of the next paper.

COUNTESS VON KROKOW.

[To be continued.]

A LONG LOGGING CHUTE. — One of the longest logging chutes in America, if not the longest, is that near Clifton, Oregon, which is three-quarters of a mile in length and was built in 1880 at a cost of \$60,000. For a considerable distance the bottom is lined with iron. It takes a log just twenty seconds to travel down the incline. If the log happens to get caught in the chute near the bottom and is followed by a larger one, the force of the concussion is such that it splinters both into matchwood. When the log plunges into the river, it sends a spout of water 200 feet into the air. — *New York Evening Post*.

ARCHITECTURAL SHADES AND SHADOWS.¹—XIII.

CHAPTER X.

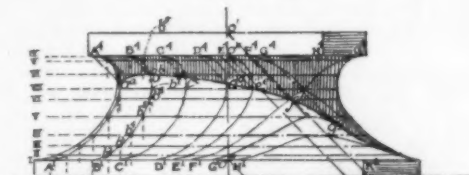


Fig. 129.

Shade and Shadow on Scotia.

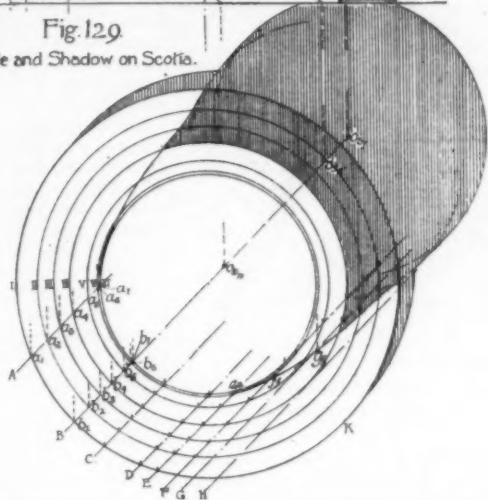
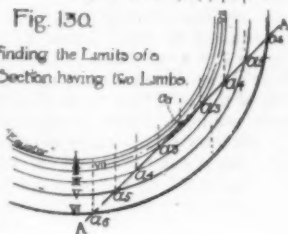


Fig. 130.

Finding the Limits of a
Section having Two Limbs.

These three cases, which however form only a small minority of the actual problems encountered by the draughtsman, are easily managed by the method of slices. This will now be discussed in detail.

157. The operations it involves are best illustrated by surfaces of revolution which, like the scotia or gorge, intercept a part of their own shadows. In practice the axis of revolution is generally a principal line, and it will be assumed to be so in this discussion. The secant-planes are then taken perpendicular to one plane of projection, so that on that plane the projection of the "slice" will be a right line at 45° to GL , as already explained, this line being the trace of the secant-plane. In Figures 129-131, the axis and secant-planes are both vertical, and the horizontal traces are at 45° to GL . The vertical projections of the slices are found by the aid of circles of revolution, which may be assumed at will. The vertical projections of these circles are horizontal lines; their horizontal projections are circles, each intersecting the trace of the secant-plane in two points, or touching it in one, or missing it altogether. The points of contact or intersection of each circle, projected up upon its vertical projection, give points of the required contour of the slice, and by taking a sufficient number of the circles, we may obtain as many points as we please of this contour. The work is simplified if as in Figures 129 and 131, each circle in the plan is made to do duty for two circles of revolution having the same radius, and represented in elevation by two horizontal lines, giving two points for each one found in the plan.

158. In solids having concave profiles, like the scotia, certain of the "slices" or contours of section are split into two distinct parts or "limbs." This happens whenever the secant-plane lies wholly outside of the "equator," or smallest circle of revolution that can be drawn on the solid, but intersects larger circles above and below the "equator," as in Figure 130. To complete the two branches or limbs, we draw additional circles. One of these (as VII, in the figure) is drawn tangent to the secant-trace, and the point of contact, projected up onto the two horizontal lines which correspond to this circle in the elevation, marks the lowest point of the upper limb, and the highest point of the lower limb of the slice (a' , a''). Additional circles afford greater precision in drawing the curves.

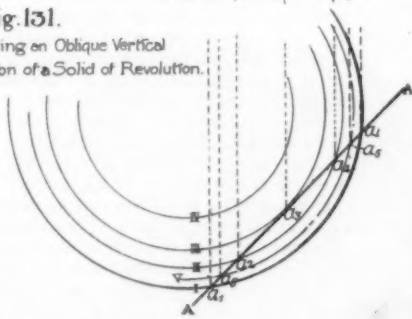
159. In Figure 131 is shown a single slice taken from a torus, this being one of the simplest cases imaginable. AA is the secant-trace, cutting the circles I, V, II in the points a_1 , a_2 , a_3 , a_4 , a_5 , and touching III in a_6 . The points corresponding to these in the elevation are twelve in number, and determine a contour which is very nearly an ellipse,² and whose highest and lowest points are the two vertical projections of the point of contact a_6 .

160. Having thus drawn the outline of the slice, the application of the 45° triangle marks, by its contact with the curve or extreme points of the slice, a point of the line of shade (as A' or B' in Figure 129) and by its crossing the same contour, (as at b^b a^a) point in

the required line of shadow. By using a sufficient number of slices and thus finding the shade and shadow on each, we determine with any desired degree of accuracy the lines of shade and of shadow on the object. In the case of the scotia, the visible line of shade is readily enough seen to lie mostly on the lower edge of the upper lip of the solid, and the shadow is what mostly



Fig. 131.

Finding an Oblique Vertical
Section of a Solid of Revolution.

concerns us; but in the torus, and in convex bodies generally, the line of shade has to be ascertained by means of the slices, as it cannot be determined by simple inspection.

161. As a precaution against confusion, it is well to number the circles of revolution, and to letter the secant-traces, or vice versa. The points of intersection are then each marked by a letter accompanied by a number, written above the letter in the elevation, and

The Method of Slicing: general theory and applications; its processes in detail; shadows on plane surfaces, surfaces of revolution, and irregular surfaces. Secant-planes oblique to the axis; axes parallel to GL ; Method of auxiliary planes of projection; detailed investigation of the annulus. Slices parallel to VP or HP . Tuscan capital. Concluding remarks.

155. The "Method of Slicing," as the only serviceable general method for finding shades and shadows is sometimes called, has already been briefly explained in Chapter III of these papers.² It is now time for a more detailed discussion of its processes, as the special cases presented by the common geometrical solids have been disposed of in the preceding chapters. The principle of "slicing" is simple enough; it consists in passing any convenient number of planes parallel to the direction of the light through the object under investigation as well as through the surface or object on which its shadow falls; and finding the contours or profiles of the resulting intersections. These intersections will be plane figures presented "edgewise" to the light, and their edges (as explained in Chapter II, 22 and Figure 16)³ are half in light and half in shade. By drawing rays tangent to the contour or edge of each section, we find its dividing points of light and shade, which are points of the line of shade of the object. Wherever these rays prolonged to represent the invisible shadows of their points of contact with the contour, again touch or intersect the same contour or another cut by the same plane, we have points in the shadow of the object. In practice, the "slices" or secant-planes are taken at 45° to one of the planes of projection, and perpendicular to the other, so that the "slice" or contour of intersection appears in one projection as a straight line at 45° to GL , and in the other as a plane figure obliquely projected (see Figure 131). The accuracy of the result is, of course, directly proportional to the number of "slices" taken.

156. This is simple in theory, but in practice the drawing of the outline of even a simple "slice" is not always easy, while a large number of slices close together are apt to result in a bewildering confusion of lines. On this account "slicing" is never resorted to except when the special methods described in the foregoing chapters are unavailable. This happens, first, whenever the solid whose shade and shadow are to be found, does not come under the special rules already given; secondly, when the solid, although otherwise provided for by the rules, presents itself in some exceptional position not covered by them; and thirdly, when the surface of incidence is not a vertical or horizontal plane, or a group of vertical or horizontal mouldings such as are treated in Chapter VIII, (§127 and 128).⁴

¹ By A. D. F. Hamlin, Adjunct Professor of Architecture in the School of Mines, Columbia College. Continued from page 105, No. 730.

NOTE.—[In view of the inconvenience of having to refer to back-numbers for explanations of the notation used in these papers, the following memorandum will be found of service.]

HP —horizontal plane of projection; VP —vertical plane of projection; GL —ground-line or horizon. Capital letters designate points and lines in space, small italics their horizontal projections, and the same accented or "primed," their vertical projections. Subscript figures indicate points of shadow; small figures above the line indicate points of shade. Greek letters ($\alpha, \beta, \gamma, \theta, \delta$) designate angles. The diagonal of a line or dimension is its length multiplied by $\sqrt{2}$. Shadows are indicated by vertical shading; shades by horizontal shading; shearing light by oblique shading parallel to the projections of the luminous ray.

² In No. 694, April 13, 1889.

³ In No. 690, March 16, 1889.

⁴ In No. 706 of the American Architect for August 30, 1890.

⁵ It is in reality a "Caustic oval."

below it in the plan, as in Figures 129-131. Any other systematic designation that avails to distinguish one set of lines and points from the other, will, of course, serve the same purpose.

162. So much of the shadow as does not fall on the object itself, (that is, the whole shadow of convex solids like the sphere or torus) must be cast upon the ground, upon a wall or roof, or upon some other object, which it is not always easy to determine at first sight or by any mere inspection. When the surface of incidence is a wall or other vertical plane, the shadow is easily found by noting where the secant-trace meets GL . Directly over this point, and upon the ray of light belonging to that "slice," is a point of the shadow on that plane, and the others are easily found in the same way. Similarly, shadows on the ground or on horizontal planes are found in plan by prolonging each ray in elevation, till it meets the ground-line (or trace of the horizontal plane of incidence); directly under this point of meeting, and on the corresponding secant-trace, will be found the point of shadow. The process, in other words, is the ordinary one, already made familiar in earlier chapters, for finding the shadow of any point or figure on either coordinate plane. In Figure 129 a part of the shadow of the scotia falls on the ground. As it obviously must consist of the shadows of the upper and lower rims of the solid (the theoretical line of shade on the concave surface being swallowed up in the shadow already drawn) we need only cast the shadows of the three centres o' , o'' , and o''' (which we find to fall at o_{alt} , o_{alt} and o_{alt}) and from these centres describe circles with the same radii as the rims respectively. We complete the shadow by drawing the oblique shadows of the short cylindrical "corner"

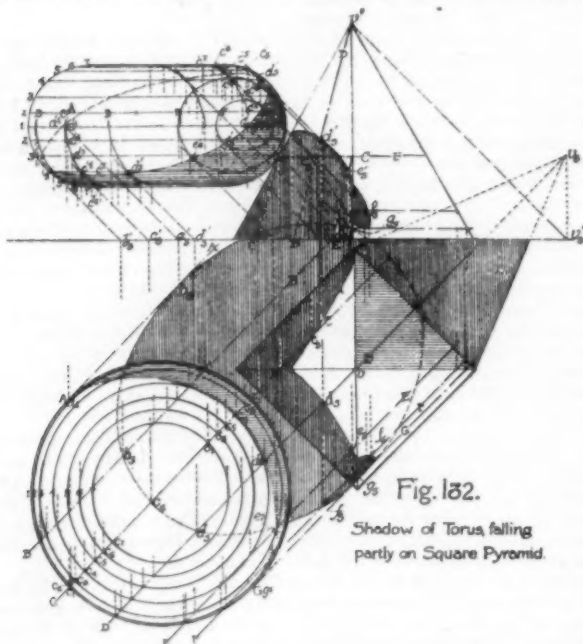


Fig. 132.

Shadow of Torus falling partly on Square Pyramid.

elements, K' and H' and of the corresponding ones on the further side.

163. When, however, the surface of incidence is not a plane, it becomes necessary to ascertain, by slicing, the position of each point of shadow. This is done by prolonging the secant-traces already drawn till they encounter the projection of some surface or object, and finding upon the other projection of the latter, the form of the resulting slices or sections by the same method already employed for the object whose shadow it receives. Each of these new slices is a figure in the same plane with one of the slices of the object casting the shadow; whenever, then, the tangent ray, after touching a slice of the latter finally enters the corresponding slice of the surface of incidence, it marks a point of shadow of the object on this surface, and we may locate as many of these points as there are slices.

164. If the surface or object receiving the shadow is a solid of revolution (as when the shadow of a capital of one column falls upon the base of another) the slicing proceeds exactly as described in §§ 156-159. In the majority of cases, however, the surface of incidence is a wall, roof, or group of mouldings, in which we cannot make use of circles of revolution to determine the outlines of the slices. If none of the special methods can be applied, we then have recourse to any set of geometrical elements of the surface which may most conveniently serve in determining these outlines, the simplest right-line elements being the best. If the surface be an oblique plane, the slicing will result in oblique lines, of the first of which we need determine but two points, while the others are determined each by a single point, and drawn parallel to the first. The horizontal elements of a roof, the edges of a pyramid or prism, the right-line elements of a cylinder or cone, if correctly located in both horizontal and vertical projection, will enable one to draw the slices of these forms accurately.

165. Figure 132 shows a circular torus casting its shadow upon a square pyramid set cornerwise. In this figure seven circles in

plan, representing fifteen in elevation, are used in determining seven slices $A B C D E F G$, the first and last being mere points, the points of contact of the extreme tangent rays. To avoid crowding, only a few of the points are lettered, and it will also be observed that in most cases only a part of each slice has been drawn, as the omitted

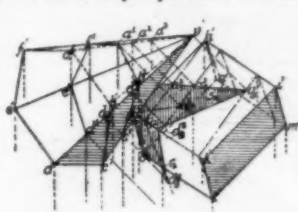


Fig. 133.

Shadow of Pyramid upon Parallelepiped both being in oblique positions.

portion would have been of no service. Five of the secant-traces cut the pyramid. As one of the slices is taken through the apex, this point and that where the secant-trace cuts the base of the pyramid determine the line $DD'e'$ in elevation, to which the other intersections with the same side are of course parallel. The ray through the upper point d' in the torus-slice D meets the line $DD'e'$ at d'_e which is therefore one point of the shadow. The others are found in the same way. The intersections with the two adjoining sides of the pyramid are horizontal lines, since the horizontal elements of these sides are parallel to those of the secant-plane, that is, at 45° to GL .

166. In Figure 133 neither the object casting the shadow nor the surface of incidence is a surface of revolution. The slices of the oblique pyramid and of the oblique prism are found in the same way, by noting where the secant-trace cuts the edges of either solid in plan, and projecting up the points so found onto the corresponding edges in elevation.

167. When either the shadow-casting or shadow-receiving surface is geometrically irregular or indeterminate, having no geometrical elements that can be identified in both projections, the absolute geometrical solution becomes impossible. One has to make use of approximations, guesses, and experience in such cases. One cannot determine the projections of a slice of a carved rosette, an acanthus leaf, or a statue. But if the draughtsman is well versed in its correct modelling and proportions, he can approximate fairly well its true section by the secant-plane; sometimes, however, even such experience fails, and he has to resort to guess-work, whose divergence from accuracy will generally be an unimportant defect. For such forms rarely occur on a large scale in architectural compositions, whose masses are generally rigidly geometrical: and in the minor details of decoration absolute quantitative accuracy in delineating shades and shadows is unimportant, provided always the shades and shadows are qualitatively true and approximately correct in dimension. Thus in Plate V, No. 1, the slices of the acanthus-leaves have only been guessed at, and the shadows upon them drawn mainly by the help of experience and observation. *Per contra*, a large amount of labor spent on the delineation, by slicing, of the shades and shadows on the abacus and bell, as shown in No. 3, is found to be thrown away when we complete the capital as in No. 1. Having once worked out the shade and shadow on the edge of the abacus, one will generally be able to draw it quite accurately upon similar abaci in one's subsequent practice, without resorting to the tedious process of making half-a-dozen slices like those in No. 3.

168. In the examples shown in Figures 129-132 the secant planes are all parallel to the axes of revolution of the solids investigated. But they need not be so, and Figure 134 shows the procedure when the axis is perpendicular to one plane of projection and the slices are perpendicular to the other, and therefore oblique to the axis. In this case the secant-traces appear in the vertical plane, and their intersections with the horizontal lines representing the circles of revolution are projected down upon the horizontal projections of these circles. The resulting slices or contours in plan are here

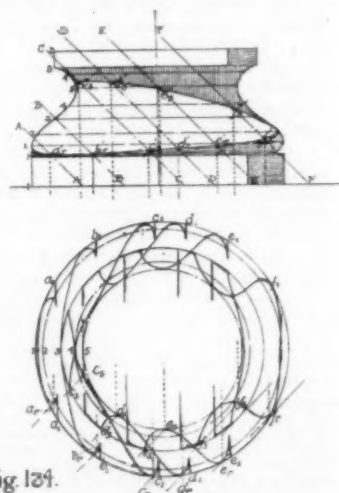


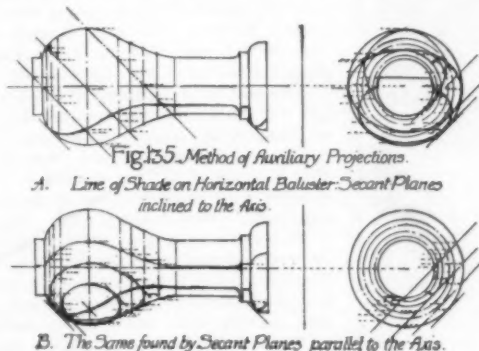
Fig. 134.

Shade and Shadow of Solid of Revolution (Slices perpendicular to vertical plane of projection)

represented by heavy lines, and the points of shade found upon them by drawing tangent rays on the plan. These points are then projected up upon the secant-traces, giving $a'r$, $b'r$, $c'r$, etc., as points of the line of shade in elevation, and $c's$, $d's$, $e's$, etc., as points of the shadow of the upper lip.

169. There is still to be considered the case of solids of revolution with axes parallel to GL ; that is, to both planes of projection. In this case the circles of revolution appear in both projections as vertical lines, of no possible service in determining the contours of the slices. It thus becomes necessary to assume a new vertical plane of projection, perpendicular to GL , and which we may designate as the lateral plane of projection, or $L'P$, and treat precisely as in Figures 129-132 we treated the plan. That is, we draw upon this plane the circles of revolution to correspond with either the plan or the elevation of the solid (according as the secant-traces are drawn on the plan or elevation) and project the points of intersection of each secant-trace and circle of revolution laterally upon the new lateral projection of the corresponding circle. Then, drawing the lateral projections of the rays of light, we obtain the points of contact of each slice, which are then projected laterally back, each upon its own secant-trace (Figure 135, A). Or else, in order to avoid the resulting confusion of lines upon the lateral elevation, we may reverse the process, drawing the secant-traces not upon $V'P$, but upon $L'P$, as shown in Figure 135, B, and projecting their intersections with each circle laterally back upon the vertical or horizontal projections of these circles. The slice-contours are thus obtained upon the original instead of the auxiliary projection, and the points of shade and shadow found as in previous cases. The first of these two methods of procedure resembles that shown in Figure 134; the second, that of Figures 129-132.

170. As the circular torus or annulus is, among architectural forms, the typical convex solid of revolution, it is worth our while to examine its shade with some care, and at the same time to illustrate a variation from the above-described methods of operation in "slicing," which presents certain distinct advantages especially for thorough geometrical investigation. It is shown in Plate VI, and



has for its object to exhibit the true forms of the slices; to enable one to draw them without their crossing each other and thus producing confusion; and to avoid encumbering either plan or elevation with the bewildering network of circles, traces, slice-contours, rays, and lines of shade, in which the draughtsman so easily loses his way and his patience.

171. This method employs an auxiliary plane of projection parallel to the vertical secant-planes, and upon which is drawn an auxiliary projection of the solid, with its right-line projections of the circles of revolution. Upon these we project the points where the secant-traces intersect the circles in plan, precisely as we should ordinarily operate upon the original vertical projection. The resulting slices, being thus projected upon a plane parallel to themselves, are shown in their true form and with a common centre. The points of shade on each slice are found by drawing the rays of light at their true inclination of $35^{\circ} 16'$ to the new ground-line, since the new plane is parallel to the direction of the light.¹

172. These points of shade together determine the auxiliary projection of the line of shade. Its plan may be found by projecting each of these points back onto its own trace in the plan. The elevation of each point of shade is found directly over its plan or horizontal projection, by measuring off on the elevation, above or below any convenient reference-line (as, for example, the "equator" or middle circle of revolution) the distance between the corresponding point and reference-line in the auxiliary projection. The line of shade is then drawn through the points so found, both in plan and elevation, with a minimum of confusion of lines, which more than compensates for the extra labor involved in the process.

173. The auxiliary projection may, if desired, be drawn upon a piece of tracing paper pinned upon the board, and the points of shade pricked off directly onto the plan by removing the tracing-paper and applying it to the plan so as to bring each point of shade successively upon its own secant-trace, keeping the auxiliary projec-

tion always at 45° and carefully centred upon the plan. The saving of labor by this device is, however, not great, and the chief advantage of using a separate piece of paper for the auxiliary projection is to avoid covering the original sheet with drawings or lines other than the original plan and elevations themselves.

(To be continued.)

EQUESTRIAN MONUMENTS.²—XLV.



Chastity and her Symbol.

This youthful military saint has been, next to St. George, the saint most often associated with the horse in sculpture, and as most of these early Christian sculptures were somewhat crude and undecipherable, sculptors agreed to represent St. Martin always as dividing his cloak with the chilly beggarman who, later, revealed himself in a vision as the Savior of mankind. To determine the number of effigies of this warm-blooded saint, one would first have to know the number of churches, convents and so on dedicated to his memory, for somewhere about these structures, inside or out, there is likely to be an effigy in the round or in the flat, little or big, which would proclaim the patron saint of the building even if local history were



St. Martin, Ratisbon.



Bas-relief over Door of the Church of San Martino, Pisa.

silent. The group³ on the front of the cathedral at Lucca represents

¹ As the new ground-line is itself inclined at 45° to the horizon, the inclination of the rays to the horizon will be the difference between these angles, or $9^{\circ} 41'$, and for convenience in using the T-square a triangle of card-board may be used for drawing the rays, having $9^{\circ} 44'$ for one of its angles.

² Continued from No. 829, page 105.

³ See the American Architect for January 30, 1890.

one of the best-known examples of the treatment in the round, and another example of a similar treatment is to be found on the wall of the Cathedral of Ratisbon, where stands upon a corbel an archaic figure of the saint, dating from the first half of the fifteenth century, and believed to be the work of Conrad Roritzer, a head-mason of the day.

As for bas-reliefs, besides those to be found on ecclesiastical buildings, as on the church of S. Martino at Pisa and elsewhere, a number of them are to be found upon buildings which now have only secular associations connected with them, as, for instance, the chubby little group that can be seen above a doorway at the end of the Calle al Pioran at Venice.

Then, too, a St. Martin on horseback, sometimes of considerable size, is now and then found as the topmost feature of an elaborate high-altar of wood or stone, as in the Church of St. Martin at Alost, or in the Church of Notre Dame at Hal, both being small towns in Belgium.

But of all the statues of St. Martin, quite the most interesting because of its palpable anachronism is Donner's leaden group which now stands outside the wall of the Cathedral of Presburg, although it, too, formerly stood over the high-altar within, up to a date at least as late as the crowning of Leopold II, in 1790, for it appears in that position in an engraving which represents the ceremony in question. Just what style of uniform Martin of Tours would be likely to wear on a cold day, in the year of grace 332, when he is alleged to have met the beggarman, might not be easy to determine, for even fairly contemporaneous artists have been content to show him bareheaded and wrapped in garments more suited to an Arab sheik in midsummer, than to a Frankish soldier in midwinter; but it is safe to say that he was not dressed in a style that approaches so nearly the hussar uniform of the Hungarian army of to-day as does this statue of Donner's, which no one, were it not for the partly divided cloak, could ever imagine was intended to represent one of the early saints.

The bronze group over the entrance of the church of San Martino, at Valencia, which is said to weigh several tons, should be interesting, seeing that it was erected in 1495 and so is one of the earliest works in bronze at a large scale that had been produced since the time of the ancients.

Military saints are more likely to be associated with horses than those whose more domestic virtues brought martyrdom upon them, so after St. Martin and St. George, the saint most honored in this kind of sculpture, is St. James the Great or St. James of Compostella, perhaps better known as Santiago, the patron saint of Spain since the year 939, when he miraculously appeared in the fleshly semblance he had discarded nearly nine hundred years before, to lead the Spanish troops of King Ramirez against the Moors. The peculiarity of the martial character of James's saintship is that he only appeared as a leader of armies after his death, while during his lifetime he was but a peaceful taker of fish, a modest disciple and apostle and a worker of miracles when the occasion called for them.

Of such a character—to whose leadership on thirty-eight occasions Spain owed victory—there must be somewhere in that country an equestrian statue of capital importance, but our search has not brought it to light unless it may be the one in one of the chapels of the Cathedral of Granada by Pedro de Mena.

Apart from this, the most important group seems to be the figure high up on the great tower of the Cathedral of Burgos where, flanked by rich pinnacles and coming just above a wilderness of rich and heavy stone-carving, it seems but part of the general scheme of enrichment and not a very individual feature which all the rest was but intended to enhance. Doubtless there are many other similar groups in Spain, at least as important as this; if not, there can hardly fail to be bas-reliefs of the saint as imposing and interesting as the one that is above the portal of the Convent of St. Mark—himself not a rider of horses—at Leon; and in some of the Spanish

cities of Central and South America there may be other bas-reliefs than the one on the present University building—formerly the old vice-regal palace—at Antigua, in Guatemala, which shows Santiago prancing along upon the summits of three volcanoes. Local history makes this bit of sculpture about one hundred and fifty years old, so it is at least venerable, as things go in America.

Another warrior saint who may be by the unwary now and then confused with St. George since he is represented sometimes as trampling on a dragon—is St. Theodore, the whilom patron saint

of Venice before the bones of St. Mark were, in 815, brought to the island city from Alexandria. It is not strange, therefore, that even in St. Mark's itself there should still be found a reminiscent piece of sculpture which has St. Theodore for its subject.

St. Maurice, leader of the Theban Legion, who with his 6666 followers was slaughtered by the order of Maximian, a part of whose army they formed, because they declined to obey his orders and take part in the extermination of the Christians in Gaul, has had churches erected to his honor in Germany, France and Italy, but though the buildings may bear the sculptured figure of the saint, he is not always shown on horseback. In the tympanum over the entrance to the Church of St. Maurice at Lille, however, there is a modern and animated equestrian bas-relief of St. Maurice which in character is vastly different from the stiff figure, about ten inches high, which adorns one end of the twelfth-century reliquary—known as the "grande chasse des enfants de Saint Sigismund." This relic is to be found in the Abbey de St. Agaune which is established in the valley of the Rhone in Switzerland, near the town of St. Maurice, which is so named because legendary history has it that here it was that St. Maurice and his steadfast followers were slaughtered.

The odd little statue of St. Wenzel, the tutelary Saint of Bohemia, in the Rossmarkt at Prague, is mainly interesting for its oddity and evident age and from the fact that it is one of the few instances in which a minor saint is represented by an isolated equestrian statue in the round.

Saints as a class seem to have enjoyed in about equal parts two peculiarities of temperament: one, which might with justice be called a spiritual trait, was the enjoyment and alacrity with which they underwent martyrdom, while the companion attribute which can certainly be called only human, was the readiness with which they visited death and punishment on mere unbelievers and controversialists. One of the saintly host in whom this peculiarity was so strongly marked that he is usually represented in painting and sculpture as actively plying a scourge, was St. Ambrose, the patron saint of Milan, who was also held in regard in neighboring cities: amongst others was Pavia, in the luxurious enrichments of whose famed Certosa are to be found several bas-reliefs in which this saintly mitred bishop is shown as trampling beneath his horse's feet the contemned Arians.

St. Isidore, one of the patron saints of Seville, is another of the amiable wearers of aureoles whose functions were largely correctional, and he is represented on horseback over the door of the Collegiate Church of S. Isidoro, at Leon, riding as rapidly and smiting as fiercely as that celestial horseman who overthrew the treasurer Heliodorus when he came to sack the treasury in the temple at Jerusalem.

But of all the saints in the calendar one would suppose that he who was the special patron saint of horses would be more often than any other shown on horseback, yet, seemingly, Saint Eloi of Noyon has never been represented in sculpture in this guise. But the legend which accounts for his being held the patron of horseflesh is illustrated on a little bas-relief beneath the mitred figure of the good bishop, which stands in one of the niches in the front of Or San Michele at Florence. Here, in marble, is told how once, when the saint was on his travels performing his allotted daily stint of miracles for the furtherance of the true faith, he came to a town where lived the owner of a fine horse who was quite useless to him because he



St. Martin in the Calle al Pioran, Venice.

was possessed by a devil. The owner apparently thought he was not altogether incurable and hoped that he could get some work out of him if only he could get him shod. The neighboring smiths declined the job and the owner was almost reconciled to the idea of killing his useless beast when he accidentally heard of the miracles performed by the wandering saint. Here was his chance. The horse was brought, the difficulty explained, and the crowd gaped in awed enjoyment when the saint with a murmured blessing removed one of the beast's legs, took it to a neighboring anvil, fashioned and then fixed a shoe in undisturbed leisure; this done, he restored the leg to its natural place and repeated the steps with each of the remaining legs.

It is difficult to believe that the legends about the minor saints are anything but inventions, but the fact that equally improbable stories are told of the apostles and personal disciples of Jesus makes one less willing to scan closely the credibility of the narration, so it is that the conversion of Saul on the road to Damascus, which is often represented in sculpture, is looked upon as merely the artistic chronicling of an actual occurrence, while the exploit of St. Eloi is held to be merely an amusing tale. As important a piece of sculpture as any which deals with the former incident is the large and animated pedimental group in the west front of St. Paul's Cathedral in London by Bird, while certainly as curious a treatment as any is to be found in the life-size group of overthrown horse and rider, which forms the feature of chief interest at the foot of the pulpit in the Cathedral of St. Rombauld in Malines. Executed in chestnut, this pulpit is but one of the remarkable series of carved pulpits which are to be found in different parts of Belgium, and give such impressive evidence of the deftness of the sculptor's hand, while the composition of the structures declares with equal plainness that the artist's imagination was but indifferently trained. A nearly identical *chaire* is to be found in the neighboring town of Louvain.

As explained in an earlier chapter, it is not always easy to determine from the sculpture the saint to which the building it decorates should be ascribed. Thus, in the case of the St. Paul in the Cathedral at Malines, a church which is dedicated, not to him, but to another saint, it is not by any means clear that the prostrate group represents the overthrown Saul, and not the dissolute Norbert, who was checked in his evil courses and put on the right road to sainthood by a very similar celestial warning.

Similar perplexity in the mind of the observer is likely to be experienced in trying to understand the bas-relief over one of the doors of the church of Santa Croce at Florence, where there is shown a horseman and his attendants halted by the appearance of a cross in the heavens. But it should be noted that in this case the horseman is not unhorsed, so it cannot be Saul since he, as well as

his horse is always shown overthrown. The presence of the cross, moreover, declares that the carving represents the miracle that led to the conversion of the Emperor Constantine. This particular sculpture is the work of the sculptor Zotti, who, we believe, still lives. But so notable an occurrence as the conversion of the leading civilized potentate of his time was, of course, seized on by sculptors in all later ages and we find the incident typified in various places and in sundry ways. One of the early examples is found in the mutilated effigy of a horseman in a large niche in the façade of the old church at Chateaufort (Charente).

The same incident is represented by a marble group in the round, in the porch of St. Peter's at Rome, the work of the sculptor Bernini, and of such indifferent merit that it is strange it should have held its present position through so many years.

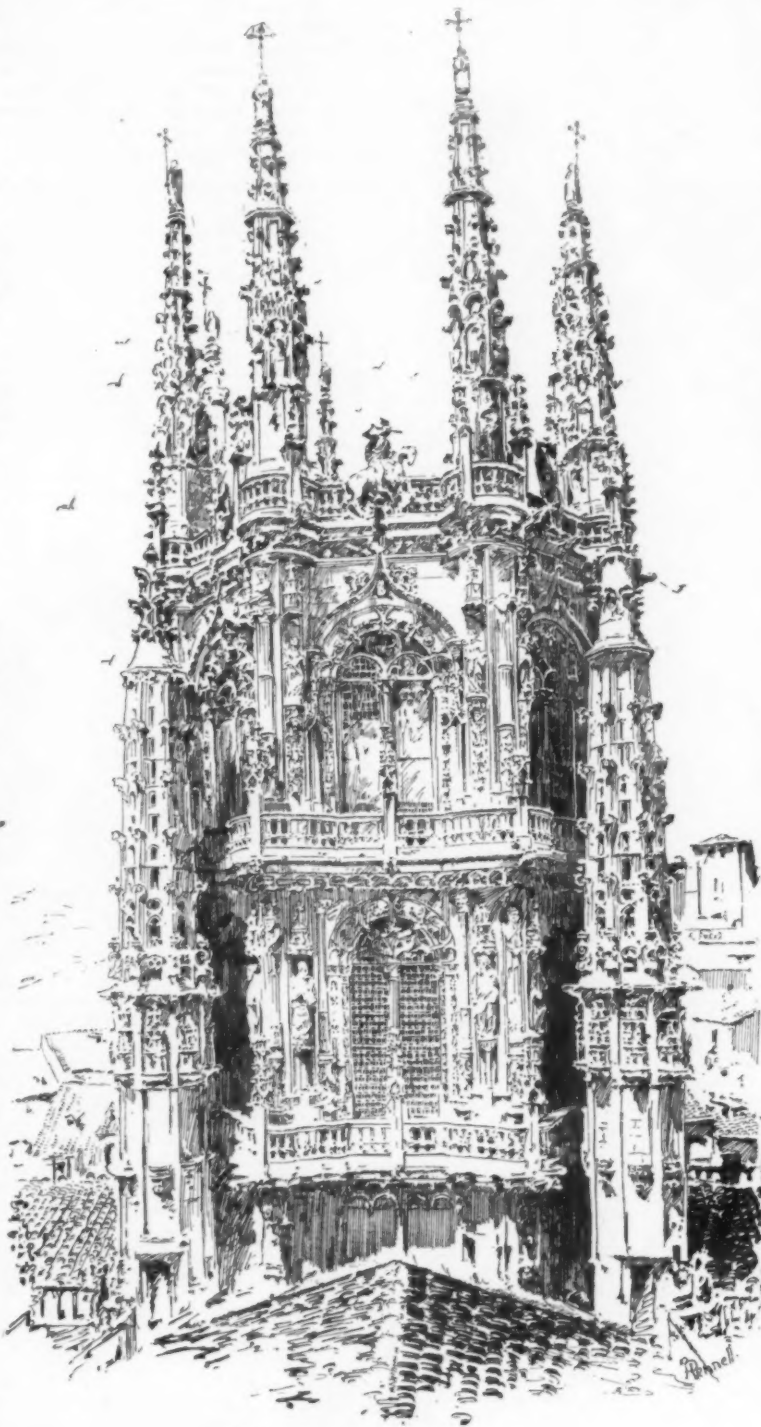
DONNER.—Raphael Donner was born at Esslingen in 1696, and studied the works of the great masters in Italy. His principal achievements are an equestrian statue of St. Martin at Presburg; a bas-relief on the altar of the cathedral in that city; a statue of Karl VI at the Belvedere, in Vienna; the fountain in the New-Market and that on the old Rathhaus, Vienna, and the crucifix over the high-altar in the chapel of the Kaisersburg. Donner died in 1741.

NANNI DI BANCO.—Nanni di Banco was the son of Antonio di Banco, a sculptor, and learned his art from his father. He was often aided by Donatello. His works include the statue of St. Philip and a group of four saints, both on the exterior of Or San Michele, and a bas-relief of a sculptor's studio, placed below the group. He also made the relief of St. Eloi on the same church, and the statue of the saint which stands above it has been attributed to him; but this is a mistake (according to Perkins). There is also a relief of the Madonna della Cintola on the exterior of this church by Nanni, who died in Florence in 1421.

CONSTANTINE.—Constantine, the first Christian emperor of Rome, was born 272 A. D.; proclaimed emperor at York, 306; defeated Maximian and Maxentius, 312, and became supreme in the West by the defeat of Licinius near Byzantium; was sole Emperor; assembled the Council of Nicæa, 325, which condemned Arianism, and adopted the Nicene creed; transferred his court to Byzantium, 328; died at Nicomedia, 337, being baptized just before his death.

To be continued.]

A GRAVEYARD SUPERSTITION.—There is an old saying that all things grown in a graveyard are unfit to eat, and it seems to be verified by a circumstance observed in St. George's Cemetery, Middletown, Del., which the *Transcript* of that town reports. When Benjamin Raymond, a civil engineer on the Delaware and Chesapeake Canal, was buried in the cemetery in September, 1824, one of his friends stuck an apple-tree switch in the ground near the grave, and from this cutting a fine tree grew in course of time. Every August it bears fruit of tempting appearance, which nobody, however, is disposed to gather. The other day a colored woman—Mahala Dudley—asked the cemetery-keeper to allow her to carry away several bushels of the apples for her pigs. To her surprise, the swine, although very fond of apples, refused to touch the graveyard fruit, and even the pangs of hunger did not make it more palatable. The woman believes the pigs are "under a spell."—*New York Evening Post*.



Santiago on the Tower of the Cathedral of Burgos.

THE EFFECT OF SALT IN MIXING CEMENT MORTAR.



St. Martin, Presburg. Donner, Sculptor.

THE variance between the results of recent experiments and the conclusions and results announced in text-books and earlier engineering papers as regards the relative effect of fresh and salt water upon the strength of cement-mortar, led the writer to make tests upon the subject the work of a thesis. The tests were begun in February, and were limited to thirteen weeks.

In the tests seven brands of cement were used, three of which were Portland and four natural cements; 500 briquettes were made of each brand of cement, 200 with fresh-water, 200 with salt-water, 3 per cent salt, and 100 with salt-water, 10 per cent salt; fifteen briquettes of each kind were broken at the interval of every week from the time they were made for a period of thirteen weeks, excepting those made with a 10 per cent solution, which lasted but seven weeks.



St. Isidore, Leon.

Making the Briquettes.—The cement was first carefully weighed in small batches from fifteen to twenty pounds, depending upon the rapidity with which the cement sets, and placed in a large galvanized-iron mixing-basin. The water was also carefully weighed and added, the minimum amount being used that would thoroughly mix the cement. The exact percentage of water used may be seen below. The cement was thoroughly mixed by hand. Experiments were made looking toward a machine mixer, but none were found to give as good satisfaction as hand mixing. Experiments with a jig-machine, on the same principle as that described by Mr. A. Bent Russell, C. E., in *Engineering News* of January 3, 1891, and used by the St. Louis Water-Works Extension with alleged good results, showed the cement to be rolled up in small balls or lumps after shaking. Satisfactory results may be obtained with a small quantity of cement sufficient for one briquette, but where the briquettes are machine-made and a considerable quantity of cement is required at each mixing, the results are not as good as could be desired. After

mixing, the cement was moulded into briquettes by the machine designed last year by Professor Jameson for that purpose, and described in *Engineering News* of February 7, 1891. This machine gives a pressure of 150 to 175 pounds per square inch which aids in reducing the amount of water to a minimum. When made, the briquettes were placed in a galvanized-iron pan and covered with a damp cloth for twenty-four hours, and at the end of this time immersed in water in similar pans, those made with fresh-water immersed in fresh-water, and those made with 3 per cent and 10 per cent solutions in similar solutions. The temperature of the making and immersing rooms was kept at a nearly constant temperature of 60°-65°.

The average breaking-strain of the fifteen briquettes broken each week was taken as the breaking-strain of that cement for that week, and the tables and diagrams made from these strains. They were tested with a Riché Bros. standard cement-testing machine, with the addition of rubber buffer clips, which gave the breakage of fully 90 per cent of the briquettes at the minimum section.

TABLE OF CEMENTS TESTED, WATER USED AND BRIQUETTES PER POUND OF CEMENT.

No.	Brand.	Kind.	Per cent Water.	No. B's per lb.	Address.
A	Utica Black Ball.....	Natural.....	22.3	.4	La Salle, Ill.....
B	Gibbs' Portland.....	Art. Port.....	15.6	3.8	Grays Essex, Eng.....
C	Milwaukee.....	Natural.....	20.8	4.8	Milwaukee, Wis.....
D	Buckeye Portland.....	Art. Port.....	16.6	3.6	Bellefontaine, O.....
E	Utica J. Clark.....	Natural.....	24.1	4.9	Utica, Ill.....
F	Hoffman Rosendale.....	Natural.....	20.0	4.1	Kingston, N. Y.....
G	South Bend Cem.....	Art. Port.....	19.2	3.7	South Bend, Ind.....

The accompanying diagrams and table [both here omitted] show the average breaking results for each week for each kind of cement



St. Maurice on the Reliquary of the Sons of St. Sigismund. From the *Gazette des Beaux-Arts*.

with fresh and salt water solutions. It will be seen that salt-water increases the strength of cements considerably at first, but does not seem to continue the strength, at least not with the same percentage increase as at first, as the cement mortar grows older. By looking at the diagrams, it will be noticed that the line representing the averages of salt-water breakages drops below the fresh-water line in some of the cements during the last two or three weeks. Here it would be interesting to continue the tests further in order to see if this drop is a permanent one, or whether it is due simply to some irregularity in the cement, which latter is rather improbable. One significant fact is obtained from the diagrams, that the considerable percentage of increase in strength shown at first by the use of salt-water does not continue the same with increasing age.

Briquettes mixed with a 10 per cent solution of salt-water were stronger in every case at first with the natural cements than those made with a 3 per cent solution, while with Portland cements, with

¹ A paper by M. I. Powers, Jr., '91, Univ. Ia., in *The Transit*.

one exception they were weaker. From this and the diagrams showing the averages of Portland and natural cements with salt and fresh

TABLE 3.

NATURAL CEMENTS.				PORTLAND CEMENT.			
Weeks.	Average of fresh-water tests.	Average of salt-water (3%) tests.	Per centage of increase in strength of salt over fresh.	Average of fresh-water tests.	Average of salt-water (3%) tests.	Per centage of increase in strength of salt over fresh.	
1	86.7	103.9	20	331.9	406.7	22	
2	104.0	135.4	30	380.4	506.7	33	
3	118.5	152.7	28	376.7	509.0	35	
4	143.0	133.1	-7	403.1	550.9	36	
5	154.2	170.1	10	492.4	531.7	8	
6	180.2	195.3	8	443.5	487.9	10	
7	190.7	189.2	-5	508.0	515.0	1	
8	200.9	207.3	3	513.0	564.6	10	
9	221.8	213.4	-3	532.9	540.0	1	
10	233.5	216.7	-8	624.1	543.6	3	
11	252.7	247.9	-2	668.2	584.3	3	
12	271.2	247.8	-9	582.3	554.3	-5	
13	279.8	260.3	-7	578.1	542.6	-6	

water it will be seen that the effect of salt-water upon Portland and natural cements is noticeably different.

In *Engineering News* of December 20, 1890, is a statement of tests which were made by Mr. John Gartland, at Governor's Island, New York Harbor, for the purpose of comparing the relative strengths of cement mortar when mixed with fresh and with salt

water. From the results of his tests the conclusion is stated that the permanent gain in strength in Rosendale cements due to the use of salt-water was about 20 per cent, and in the case of Portland cement not less than 10 per cent permanent gain; 2,531 briquettes were broken and fifteen different brands of cement were used. In the tests which form the subject of this paper, seven different brands of cement were used and 3,500 briquettes broken, thus giving a

much larger number of tests for averages than were used in the New York Harbor tests. In the former tests, the gain at first in both natural and Portland cements, taking the averages of the several brands of natural and Portland, was about 30 per cent; but in the third month in both, and in the second month with the natural cements, the gain becomes a minus quantity and the cements become weaker than those mixed with fresh-water. Here, too, the results as shown by Table 3 are sufficiently uniform to show that the variation can scarcely be credited to irregularities in the cements in testing.

There can be no doubt that cement mixed with sea-water gains considerably in strength during the first few weeks, but that it does not hold out is clearly proved by these results from the cement



St. Wenzel, Prague.



St. Eloi. From the Front of Or San Michele, Florence.

laboratories of the University. The gain also seems to be greater and more permanent with the Portland than with the natural cements.

The effect of using a 10 per cent solution seems not so good as with a 3 per cent. The tests were not carried out for the full thirteen weeks and cannot be directly compared.—*Engineering News*.



THE ARCHITECTURAL LEAGUE OF NEW YORK.

THE Seventh Annual Exhibition of the Architectural League of New York (1891-1892), will be held at the Fifth Avenue Art Galleries, No. 366 Fifth Avenue, New York.

The Exhibition will be open to the public on Thursday, December 24, 1891, and continue until January 9, 1892.

The galleries will be open for the reception, by card, December 23d. Press: 10 A. M. to 4 P. M.; and reception in the evening.

The exhibition will consist of drawings, etc., not before publicly exhibited in New York, representing as far as possible the present condition of architecture and the allied arts. All kinds of works are admissible, such as architectural designs embodied in plans, elevations and sections, or shown in perspective; designs for decoration, furniture and the like; photographs of executed work; cartoons for stained-glass, full-size drawings for ornament and the like; models of executed or proposed work; completed work, such as



St. Ambrose. From the Certosa, Pavia.

carving in stone or wood, wrought-iron, mosaic-glass, stuffs and furniture; sketches, drawings and paintings of architectural or decorative subjects.

Works will be received only at the Fifth Avenue Galleries on December 16 and 17, 1891. No works will be received before or after that date.

If the Secretary is notified on or before December 14th, drawings will be called for and returned without expense to the exhibitors. Collections to be made December 16th and 17th.

The blank form attached to this must be filled and sent to the Secretary by December 14th.

A card must be attached to the back of each drawing or exhibit, giving the title, name of exhibitor, the address, and where to be returned.

All works intended for exhibition will be at the risk of the owners.

All rules customary at exhibitions, and not above mentioned, will be considered to apply equally to this exhibition.

All drawings and photographs must be framed or mounted.

Exhibits will be catalogued by title with name of exhibitor, and it is especially desired that the name of the draughtsman may appear; any other data may be on the margin.

EDWARD T. HAPGOOD, Secretary.

42 West 42d Street.

SPECIAL NOTICE TO NON-RESIDENT EXHIBITORS.

Send blanks to the Secretary, and all packages and cases to some consignee in New York, who will receive and unpack them, deliver at the Fifth Avenue Galleries, and return at the close of the exhibition.

The following are among those who attend to such business; namely, Thos. A. Wilmurt, 54 East 13th Street, and J. H. Meeker, 84 Nassau Street.

Notice.—Works will be received between 9 A. M. and 5 P. M., at the Fifth Avenue Art Galleries, No. 366 Fifth Avenue, on December 16 and 17, 1891.



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

DETAIL OF THE CONVENT OF SAN MARCO, LEON, SPAIN.

DOORWAY OF THE CHURCH OF SAN MARTIN, SALAMANCA, SPAIN.

DOORWAY OF THE CHURCH OF ST. MAURICE, LILLE, FRANCE.

THE DUCAL PALACE, ALTENBURG.

This plate illustrates, as Figure 11 of the article on "German Castles," the appearance of a modernized approach to a hill-castle.

THE TOWER OF BABELSBERG CASTLE, POTSDAM, PRUSSIA.

This plate forms Figure 9 of the article on "German Castles," elsewhere in this issue.

SHADES AND SHADOWS. PLATE 5.

SEE article elsewhere in this issue.

[Additional Illustrations in the International Edition.]

NOTE:—In view of the emergency occasioned by the fire last week, we find ourselves constrained to make use of a series of gelatine prints of drawings which our Viennese correspondent persisted (in contradiction of direct orders) in including in his shipments. These we had laid aside as not worthy of a place in the International Edition; the recent catastrophe must be our excuse for using them in this and next week's issues.

ENTRANCE TO CHAPEL OF THE VIRGIN IN THE COLLEGIATE CHURCH OF OIRON.

[Photogravure.]

DESIGN FOR AN ACADEMY OF FINE ARTS. HERR F. HOFBAUER, ARCHITECT.

[Gelatine Print.]

DESIGN FOR A MEMORIAL CHAPEL. HERR JULIUS DEININGER, ARCHITECT.

[Gelatine Print.]

DESIGN FOR A SUMMER THEATRE, CIECHOCINEK, AUSTRIA. HERR THEODOR TALOVSKI, ARCHITECT.

[Gelatine Print.]

VILLA PAWLOWITZ. HERR ZIAK, ARCHITECT.

[Gelatine Print.]

OLD HOUSE, WEST STREET, CHICHESTER, ENG. ATTRIBUTED TO SIR CHRISTOPHER WREN.

ENTRANCE TO KENSINGTON PALACE, LONDON, ENG. SIR CHRISTOPHER WREN, ARCHITECT.

ST. OSWALD'S CHURCH, SMALL HEATH, BIRMINGHAM, ENG. MR. W. H. BIDLAKE, ARCHITECT.

AN OLD MILL IN NORTH WALES. DRAWN BY MR. EDWARD B. LAMB.



FRAGRANT WOODS.—Few of our native trees have odoriferous wood like the sandal-wood of the islands in the Pacific Ocean; but a few of the coniferæ on the Pacific Slope have sweet-scented woods. The fine church at Metlakatla, built by the civilized Indians of Alaska, is as fragrant as if incense was continually floating through the air, from the wood of the great arbor vitæ—*Thuja gigantea*—of which it is built. *Libocedrus decurrens*, found further south, is known as "incense cedar" from its fragrance. The yellow cypress, *Cupressus nutkensis*, and the Monterey cypress, *Cupressus macrocarpa*, have also scented wood.—*Meehan's Monthly*.

A "HOODOOED" BUILDING.—We are apt to think that superstition is dead, or at least confined to the ignorant and illiterate. But this is far from being correct. Recently, for instance, in St. Louis, a large building in one of the best business streets of the city was torn down simply because it was thought to be "hoodooed."—*New York Tribune*.



THE volume of business is growing, when compared to corresponding dates last year. The increase is due to exceptional causes. Money is plenty, according to financial reviews, but, in reality, scarce among the one million or more smaller tradesmen, firms and corporations of the United States. Agricultural land-values are increasing throughout the West, and much more land than usual will be taken up next year from present indications. A multitude of feeders will be built next year from the main lines to develop traffic, and a stimulus is being imparted to emigration from some of the older States. Travelling agents of manufacturing and mercantile houses East all report very favorably concerning trade prospects. The large crop has not yet produced much change, but there will be undoubtedly a very great demand for hardware, wagons, plows, machinery, engines, equipments, lumber, house-furnishings, etc. Eastern interests have been looking up next year's probabilities, to determine how hard to work this winter to meet a heavy next year's demand. From the Massachusetts boot and shoe maker to the Illinois flour-maker, preparations are being made for active winter work. Raw material is not being bought rapidly as yet, nor will it be, because of the immense capacity to be called upon. Lumbermen will soon begin logging operations on a large scale in the Northwest. Iron-makers began three months ago to accumulate stock, and the wisdom of their course was demonstrated to some extent last week by the placing of orders for about two hundred thousand tons of steel rails, the largest week's business transacted this year. The iron trade was further encouraged by the placing of contracts for the construction of between fifteen and twenty thousand cars. There have also been placed large orders for locomotive engines, and there will soon be placed a large volume of business by railway companies, which will make an active demand for iron and steel products. Last week large orders were placed at Lake ship-yards, and next month it is probable the Government will place large contracts with ship-builders. Private advices from large machinery manufacturing establishments in the New England and Middle States justify this statement: that there are at this time in progress negotiations for a greater amount of machinery for steam and electrical motive power than at any time. Electricians are particularly busy. Engine-building and boiler-making are active. Implement manufacturers are equipped for a busy winter. Stone manufacturers are discouraged by low prices. Paper-makers are not restricting production, though all departments are abundantly supplied with stock. The building of many new mills indicates a healthy condition in that industry. In textile departments matters are unsettled. Not for years has there been such enormous hosiery importations, most from Germany, and at prices which must undersell much home production. Carpet manufacturers are realizing better margins on the better grade of goods than a year ago. Cotton goods are in fair demand, but New England corporations are barely able to pay dividends, and in some instances have passed them. Woolen manufacturers are doing better. Recent tariff legislation is being tested, and no conclusion is yet in sight. The building interests have done much better than the signs of last spring indicated. A series of inquiries among Western contractors and builders seem to settle this fact: that there was a greater degree of activity in small towns than in cities, and the present opinion as to future probabilities is that at least ten per cent improvement can be counted on. One satisfactory result has been reached this year; viz, that prices have reached the lowest probable limit in many industries. Charts of prices will show less than usual fluctuation. Production has been steadied down to market requirements. Fuel has sold well, at least ten per cent over last year. Commercial enterprise is studying the problem of profiting in a large export trade, and American shipping interests will be, no doubt, greatly stimulated during the coming year. So far as financial affairs go, the harm is not in scarcity at financial or commercial centres, but at remote points; but the answer to this is, that as soon as the agricultural section demonstrates its ability to promptly pay interest on obligations, capital will be ready to go there. It is doubtless true that much of the scarcity of money in the West is due to the fact that there is a large volume of overdue indebtedness, and for which the only cure is continued good crops and an active demand at remunerative prices. The contest in silver politics will of necessity end in the triumph of a heavier volume of the best currency that circumstances admit of. The matter will of necessity become a political issue. The commercial agencies show a remarkably healthy condition of trade. Retailers in all channels are carrying small stocks, and are, as a rule, meeting maturing obligations. When the farmers and cotton-growers succeed in doing the same thing, a much desired equilibrium will be established. A good foundation has certainly been laid this year for an exceptional year in 1892. Many adjustments have been made and some evil tendencies have been checked. The fealty of the government to its adopted silver policy is one strong point with the rank and file of traders, much as financial wisacres question the wisdom of it.



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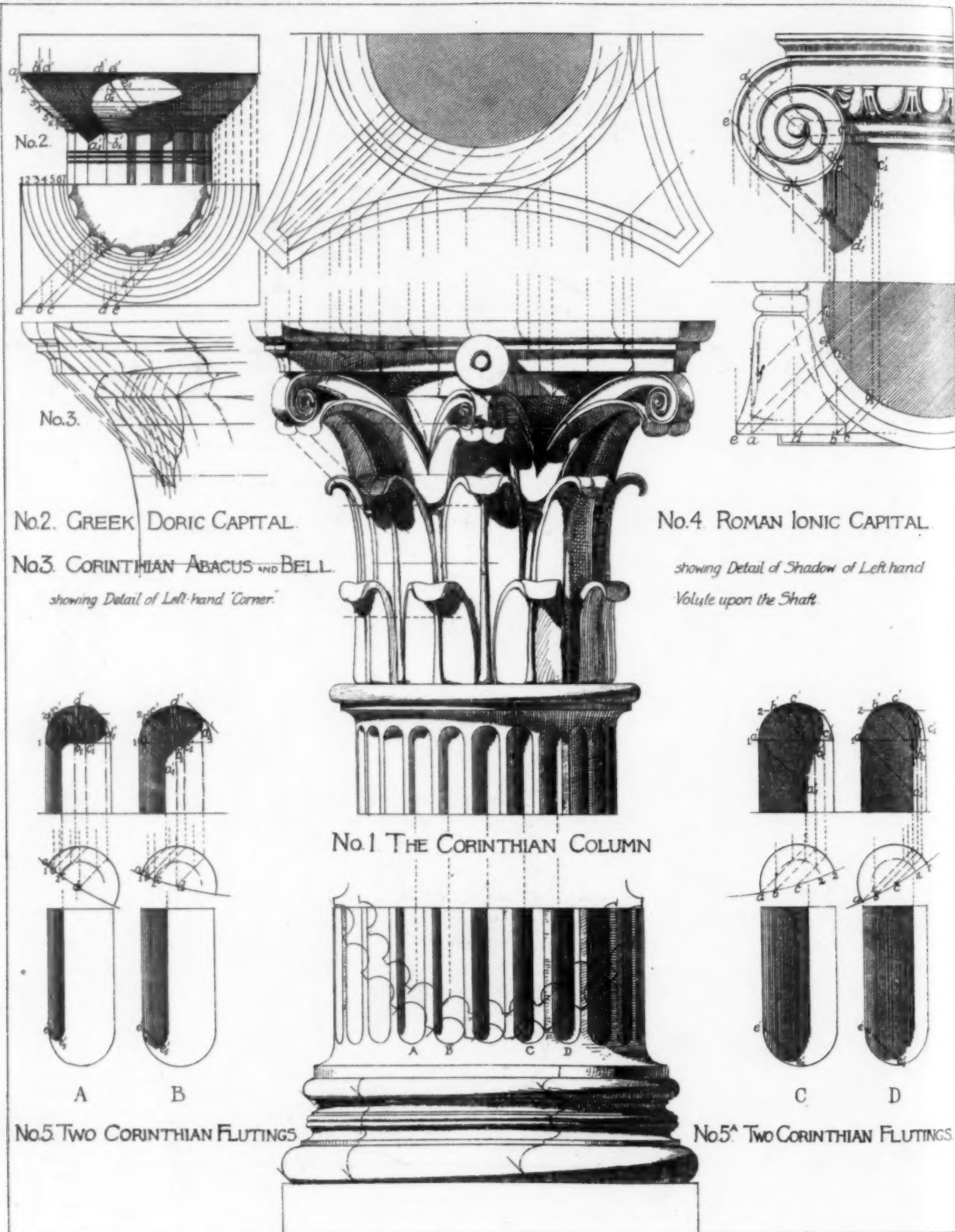
• MODERNIZED • APPROACH • TO • A • HILL • CASTLE : THE • DUCAL • PALACE • ALTENBURG •

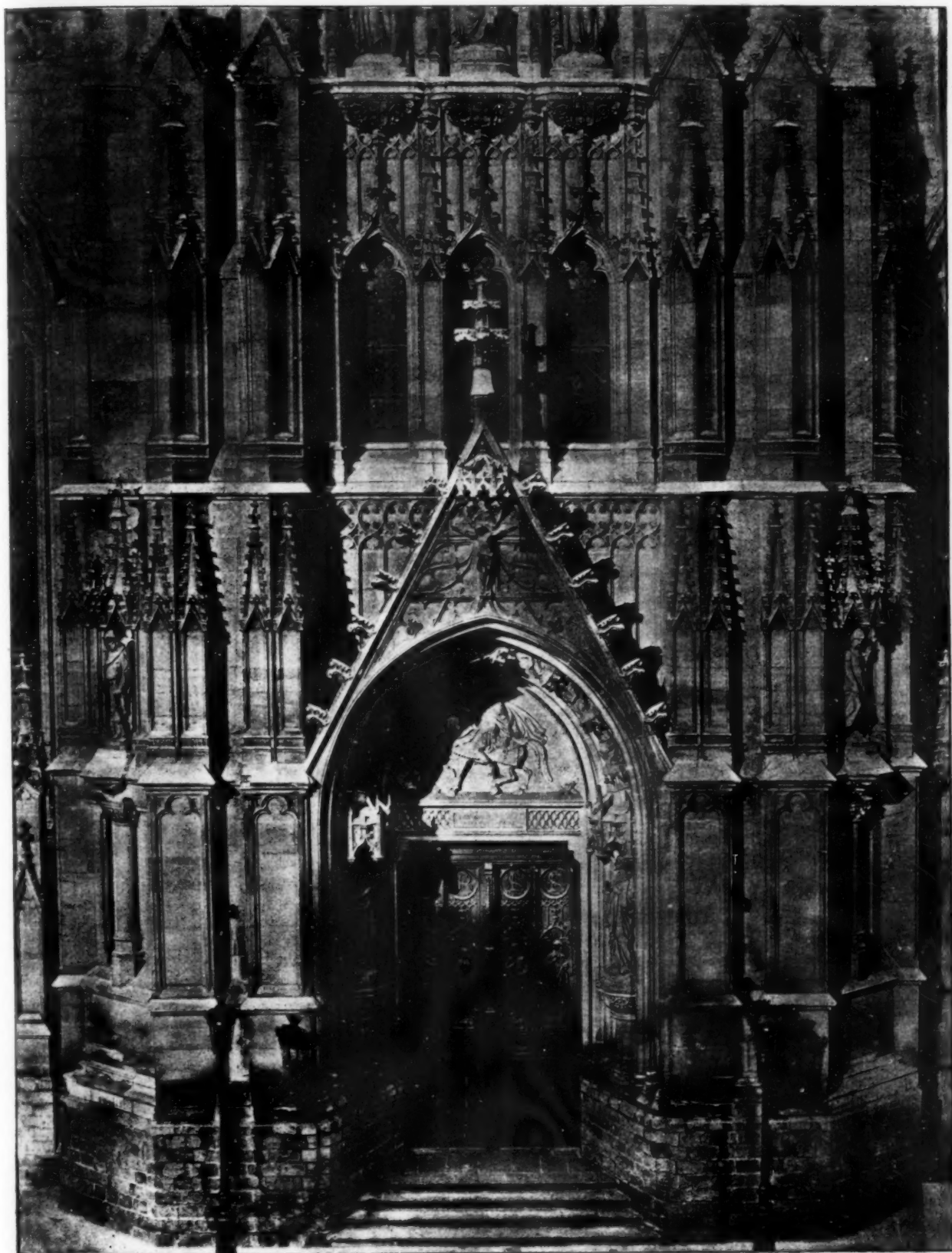


• DOORWAY • TO • THE • CHURCH • OF • SAN • MARTIN : SALAMANCA • SPAIN •

SHADES AND SHADOWS.

PLATE 5.





DOORWAY TO THE CHURCH OF ST. MAURICE, LILLE, FRANCE.

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• TOWER • OF • BABELSBERG • CASTLE • : POTSDAM • PRUSSIA •



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