THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. LXI. No. 1179.

Entered at the Post-Office at Boston as second-class matter.

JULY 30, 1898.

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PROFESSOR NORTON is to be truly envied, because of the volume and character of the testimony to the real value to others of his life and life's work that is now being brought to his own attention through the attack that has been made upon both by a politician.

IT has been our good fortune within the last few weeks to examine with some care the exhibition of the year's work of the students in three of the architectural schools — schools really, inasmuch as they are largely self-controlled and conducted by a corps of instructors who do not have much to do with the other departments of the institutions of which these schools are mere departments, when administratively considered. As one of these schools is the oldest while another is the youngest of its class in this country, there is a temptation to attempt a comparative criticism of the work accomplished by these students under somewhat different auspices and subjected to distinctly different impulses and surroundings, with the object of discovering whether one school or another has succeeded in evolving or creating a curriculum better suited to American needs than have the others. But, frankly, so far as the actual work of the students stood for anything, it did not throw enough light on methods to justify a comparative criticism, and it would be unfair to draw on knowledge obtained at other times, since our inquiries have been accidental and not prosecuted with a view to getting together the same set of facts as they affect the different schools. But the mere examination of the year's work set in motion a train of reflections which may have some interest for the student and future architect, for, as we turned from one wall to the other, we could not but echo the aspiration of the novel reader: "Oh, I hope the story will end well!" If these young men who have in most cases now finished their school days could be brought face to face with the many cases of disillusionment that have been brought to our notice in these hard years of late, there must be a good many of them who would stop short where they are and take up some other career than the hard and uneven life of an American architect. Because an architect's life must, in the nature of things, be uneven, and, as a rule, more often hard from beginning to end rather than growing in ease as the years wane, it should be the part of those in charge of these schools to discourage a student from pursuing his studies where his abilities, or lack of them, seem to preordain him to failure. Doubtless instructors do exactly this, and doubtless they would do still more of it, could it be known just what elements of character were needed to make the successful architect, and if all characteristics were discoverably developed in the immature youths who are brought under the instructor's observation.

SUCCESS depends, of course, upon the aim and that in turn depends more upon the moral than upon the intellectual fibre. What one man would do in arriving at an end another would scorn either to endure or to undertake, and yet it might result in success of one kind and might win him renown as an architect — of a certain kind, but not the kind of architect that another man would be content to be. Yet worldly success is more likely to fall to the share of the man of coarse moral fibre, of stunted intellectual standards, of selfish instinct, rather than to the man whose sensibilities in all these directions are both quick and tender. If a young man is shy, self-distrustful, and particularly, if he is one of those unfortunates who find it difficult to make new friends, let him not hope for any great amount of worldly success, be he never so graceful a designer or well-read and accomplished as a man. Story-tellers have made the world familiar with the woes of the young doctor and the young lawyer in their struggles to secure a practice, but they have overlooked the greater struggles of the young architect, struggles that in most cases endure his life through. A doctor and a lawyer can "build up a practice": it is the common lot of man both to fall ill and to fall into squabbles, and it is equally common to turn for help in each recurrent mischance to the same intelligence that helped him out of it before, and to pay for such help. But building is not a recurrent incident in a man's career, it is an episode and usually an isolated one, so that an architect cannot build up a practice through once satisfying a client, he must find, as a rule, a new client every time; and if he does not start in life blessed with a large family or social connection he will find his failure almost inevitable if, in lieu of these, nature did not bless him with the happy faculty of making friends — monied friends, that is, with a taste for real-estate investments. This ability or endowment we consider the first and greatest of the elements that go to the make-up of a successful architect: without it even social and family connection will not wholly avail. Who does not know a score of middle-aged or slightly elderly architects, once pointed to with envy as really successful men, but whose business now seems mysteriously to have deserted them. As architects these men are as capable to-day as ever, probably more so, but their business has deserted them for the simple reason that they have already built for all their social and family connections and have forgotten the necessity of, or have been incapacitated by nature from, making new friends.

THE new friends who have real estate to improve are not found on the street corners and an architect who is to succeed must be fitted to seek them where such people are to be found, that is, in society of one kind or another. But people in society do not talk architectural "shop" and do not care to listen to it, so unless an architect is not only well-bred in manner but exceptionally well informed on a great variety of subjects he is not likely to succeed, for he cannot interest and retain the attention of the men he meets long enough for them to find out his really good points. The difficulty is not a new one, but it is a great one, and its successful solution is the key to many a thriving partnership, a partnership supposed to be established because one member is the artist and the other the constructor but which is often really formed because one man knows "how to get a job," while his partner knows how to both design and build it. This leads to the thought that that architectural school is the best where the curriculum is the broadest and most liberal, where the chief attention is not given to the mere education of fingers, but where the brain is not allowed to stagnate while the fingers are acquiring mechanical facility. Of course, all the schools teach other things than mere drawing and design, but some limit themselves to a stated curriculum of associated studies while others do not; some instructors still adhere too much to the old fashion of assigning "lessons" and then "hearing" them, and do not throw the student back on to himself and force him to really think and really study so that he may connect his thoughts and express them properly when connected, for, as a young friend recently wrote us from Paris "to be a first-class architect means to have an intelligent and well-trained mind, more than anything else."

TO these young men of the class of '98 we would like to say that they have now to confront most of the difficulties that faced those who have gone before them, but in addition are some that did not beset their elders. The times have changed and the conditions are distinctly different, so in their forecasting of the future, in their dreams of an established practice and a prospective family let them not be misled by deductions that can be drawn from the careers of those who have preceded them. The increasing output of the architectural schools has until now been absorbed into the producing ranks of the profession without breaking the market; but owing to the long business depression, and now the war, they will come into competition not only with other recent graduates but with a host of unemployed draughtsmen and also many architects who have had to return to the drawing-board if they would make even a scanty living. Even those who can find employment should remember that architects have been forced to become callous to the pain of discharging their assistants when work grows slack and cannot, as in former times, accept the risk of paying them wages for no remunerative return while waiting for the next job to come in, and hence no one who is so lucky as to find employment can count on retaining his berth if only he prove himself a satisfactory performer, as would have been the case in years before. This state of things will probably keep them in the ranks of the nomads longer than they at all relish and will probably cause many of them to throw up a profession in which it is so hard to gain a footing. This being so, it is well worth their while to seriously consider, before it is too late, whether after all they have the qualities which go to make a successful architectural practitioner. Still, there are other things that make life worth living than success as the world understands it, and if there be any who can really savor the pleasure of doing true artistic work, even if the chance to do it come but rarely, they can find that pleasure before them and they can enjoy it quite as keenly beneath a shabby exterior as when new clad in costly raiment.

IT is one of the alleviations of the situation that a really good education, such as most of the architectural schools now afford, fits a man very well for a good many other callings, most of which are more or less closely related to architecture, and a glance at the "Register of Graduates" of the Massachusetts Institute of Technology gives a clue to some of these side tracks which may be travelled with ease and profit by those who might be wrecked on the main road. Unfortunately, this "Register" gives the record only of those who were regular students and does not undertake to keep track of those who, for one reason or another, were "special" students, and this discrimination is an error and an injustice both to the Institute and to these special students, a great proportion of whom have made marks quite as high up in the world as have those who pursued the prescribed curriculum for four entire years. From this record we find that besides those who have remained merely draughtsmen, and besides those who have followed the obviously closely-allied paths of the decorator, the instructor in an architectural department, the editor or what not of an architectural journal, there are those who have become sanitary engineers, and others who are employed by heating contractors, by bridgeworks and by architectural ironworks; some have become interested in lumber and others in concrete, while some have become contractors out and out; yet in nearly every case it is easy to see how their architectural education has become in a measure profitable to them. One case only puzzles us: we cannot discover what connection there is between an architectural education and a final career as "instructor in vocal culture."

BEFORE the destruction of Cervera's fleet at Santiago, it seems likely that underwriters would have considered an armorclad ship a better fire-risk than a modern high building, partly because of the ship being in the main built of incombustible material, partly because it was armed with its own efficient fire-extinguishing apparatus, and partly, too, because there could never be any shortage in the water-supply. Yet several of the Spanish ships were more injured by internal fires than by shot and shell, and the immediate effect of this discovery has been to cause our Navy Department to reconsider its intention not to use in our new war ships any of the fire-proofed woodwork that has given so much dissatisfaction to the officers and crew of those vessels where it has been introduced already, because of its tendency to exude, or condense, moisture under certain atmospheric conditions. Doubtless naval constructors will see their way to replacing wooden with aluminium boats, and wooden upper decks with coverings of woven lead or the well-known iron and lead plates without any suggestion from us, but it is interesting to note that, at the time when armored ships are burning up, our well-built high buildings are giving fresh evidence of being really fireproof. The latest case occurred a fortnight ago at three in the morning in the tenth story of the Manhattan Building on Broadway, New York. The engineers and watchmen of the building had the fire apparatus of the building at work before the city apparatus reached the scene and, thanks to the construction of the building and to the further fact that the standpipe was found, as the chief said, for the "first time in his experience equal to the emergency," the fire was confined to two offices and the damage did not exceed one thousand dollars.

IT is curious how far-reaching are the effects of the present war and in what unsuspected directions they declare themselves. The connection between the accidental fires that occurred on July 4, in consequence of ultra-effervescent patriotism set aglow by successes in the East and West Indies is tolerably close, but surely no one could have supposed that the war could have any effect on the degree of promptitude with which firemen responded to the alarms! Yet it appears that in one case, at least, not a few of those precious first minutes were lost, and all because of the exuberant joy of Young and Old America, for at Asbury Park, N. J., cannon-crackers had been exploded with such persistency near the engine-house that the horses actually had their hearing destroyed and, instead of leaving their stalls promptly on the first stroke of an alarm, paid no heed to it but went on eating their dinners. The firemen, puzzled by this odd behavior, rushed to the stalls and shouted to the well-trained beasts, but even their familiar voices were not heard. The veterinary surgeons declare that the deafness will probably gradually disappear and the horses at length be as serviceable as usual, and until that time comes the men must be more than usually prompt themselves. Deafness in horses is a very unusual defect and it can do no more mischief than when it besets fire-engine horses on whose prompt movements so much depends, so we presume this incident will lead to a regular aural examination of all fire-engine horses.

MOST educated men know that they cannot be too careful in their choice and use of words, but we never expected to receive a lesson in their proper use from the formulation of an invitation for proposals issued by a public official. Yet the Fire Commissioner of Boston invites proposals for "erecting and partially completing" a veterinary hospital. The suggestion that a building can be erected and yet not completed may strike others, as it has us, as somewhat of a novelty, and yet we cannot find that the phrase is necessarily tautological, though it may be so. If a building really can be erected and yet not completed it can also be built and still left unfinished, and if this really be the case — and on the face of things it would appear easy for a lawyer to base his defence in a suit of breach of contract on this very use or misuse of common verbs — it behooves architects to revise the form of words they commonly adopt in their contracts and specifications and declare in both instruments that the contractor agrees to "erect [build] *and* complete" the structure described by the drawings and specifications.

AS the members of the various architectural clubs may be weary of making designs to satisfy the whims of the "rich amateur," we will make a suggestion which it may be worth while to act on. We note that there has just been erected in front of the cathedral at Clermont-Ferrand a monument in commemoration of the Crusades, and it would be a distinctly interesting undertaking for a lot of American students to set their nineteenth-century wits at work to divine, and express after divination, what kind of a monument it is that the sculptor, M. Gourguillon, and the architect, M. Teillard, have devised as a proper memorial of a most romantic historical episode to place in so interesting a site. While the students are working out the problem, the officials could easily procure photographs of the monument actually erected, and the comparison of what could be with what is would be both amusing and instructive.

THE COMPETITION FOR THE MEXICAN FEDERAL PALACE.

Cathedral, San Luis Potosi, Mexico.

CITY OF MEXICO, June 1, 1898.

THE competition for the Legislative Palace for the general government of the Republic of Mexico has been decided by the the jury of award, and although the promised official report of the jury has not been published in the *Diario Official*, the general proceedings and results of the competition are now public property.

The limited portion of the Mexican people that keeps informed of important public matters has taken an unusual interest in this competition, and it has seemed to be the opinion, even among some educated engineers and architects, that the jury would be almost deluged with designs from many of the leading architects of the world. They must have been disagreeably surprised, if they really understand, that, with the exception of that of Piocentini and Nataletti, not a design was received from even an architect of note in his own country, and that, with possibly one exception, no Mexican architect of note participated in the competition, although this capital can count quite a number of scholarly architects of large experience in their style of building. The reason for the non-participation of leading architects was freely expressed by the writer to some of the profession as soon as the programme was published. That the result as more than confirmed his predictions cannot be doubted. To the architect who has followed the courses of competitions on this continent and in Europe these reasons were evident at a glance.

To the authorities, who were evidently honest in their intentions, notwithstanding persistent rumors to the contrary, the result must have been a surprise. In the hope that these lines may come to their notice and be of benefit to them and others, a brief statement of the causes of the failure is submitted. In the first place, an unusually complete set of general working-drawings and specifications was demanded, and as a reward there was offered as a possible first prize one-half of one per cent of proposed cost, among a probable fifty to seventy-five competitors, a possible one-fifth of one per cent for the next two prizes and a gold and silver medal, respectively, for the fourth and fifth prizes; the design classed first was to receive an additional one-half of one per cent on making complete detailed plans and specifications for execution of the project.

It ought to be thoroughly impressed upon the authorities here, that but few, if any, reputable architects can be induced to make even preliminary drawings at one-half of one per cent, unless they are reasonably assured of the commission at a reasonable rate, and that to furnish practically working-drawings at this rate, and to gamble among fifty or seventy-five others, with their $5,000 to $7,000 invested in their drawings as a stake, was a preposterous proposition. With this view as to the first prize, what kind of a lottery would it be as to the second, third, fourth and fifth prizes, where the gambler stakes his $5,000 to $7,000 value of drawings against a chance of one in seventy-five for 2,000 *pesos* or a medal? Again, it may be possible that those who had been burned by contact with the fire of previous competitions noted that while three of the jury were directly selected by different departments of the Government, the four others were to be elected by the competitors from a list of ten experts proposed by the Ministry of Public Works, which practically, in spite of its seeming fairness, put the whole matter under the control of the Government, and unfortunately, when it came to the selection of the ten from whom to choose, none but Mexican engineers were in the list. Add to the above the fact that not the slightest information was given as to the nature of the soil at the site, although an accurate distribution of pressures on foundations was required, and there is presented a rather difficult and indefinite proposition to solve.

Designs were received up to the 1st of April, 1898, and one was even received after that date, when, as it had been stated by the press of the city, the jury had already reached a decision. These drawings were all accepted on equal terms with those received on or before November 30, 1897, the statement being made that they were deposited with some Mexican foreign representative before the date last named, though it does seem a little mysterious how it could require from two to four months for so many of them to reach this city. The awards made by the jury were as follows:—

No. 17. Motto "*St. Georgius, Equitum Patronus*," Architect, Adam Boori, 2d prize.

No. 26. Motto "*Minerva's Head*," Architect, J. P. Weber, Chicago, 2d prize.

No. 44. Motto "*Roma, Mexico*," Architects, Pio Piocentini and Philippo Nataletti, 2d prize.

No. 52. Motto "*Majestas*," Architect, Pietro Paolo Quaglia, Mexico, 3d prize.

No. 18. Motto "*Golden Star*," Architect, Antonio Rivas Mercado, 4th prize — gold medal.

No. 45. Motto "*Roma, Roma*," Architect, ———, 5th prize, silver medal.

None of the premiated designs showed indications of various loads on foundations, only one design, in an obscure corner, making a feeble attempt to comply with this requirement.

Aside from those premiated there were not to exceed two or three designs worthy of even a passing glance. The authors of the remainder may be classed as young or struggling architects, civil engineers, with no experience in design, contractors and wall-paper artists. Many of the drawings were such crude pencil sketches that it was impossible to decipher the intentions of the authors. The designs were exhibited to the public in the colonnaded *patio* of the old Custom-house, which was roofed with white cotton cloth, thus giving a strong well-diffused light from above only. The *patio* was divided by numerous low partitions against which the plans were arranged, and it would have been difficult to show them to better advantage. The rendering of the elevations and perspectives of the premiated designs was fairly good, those of Piocentini and Nataletti being especially noteworthy for the delicate treatment of pen-and-ink work in a warm brown color. Owing to the restrictions of the site there seems to be but little originality and variety in the planning. No. 26 suggests the ever-recurring type of what might be called the Standard American State-house.

No. 18 had a very complete set of drawings, and seemed to be the great favorite among the younger engineers and architects of the city. Its lettering was a mixture of English, French and Spanish. The borders and lettering of sheets were in the Mexican national colors. From these and other indications it might have been the work of some syndicate of young architects.

No specifications or estimates were to be had by the public.

It is the opinion of many good judges that the cost of any of the premiated designs would have exceeded by fifty per cent the limit of 1,500,000 *pesos* of the programme and that some would cost double that sum.

The jury unanimously decided at first not to award the first prize to any of the competitors, as none of them had complied with the programme of the competition, and also voted, as before indicated, to divide the second prize, of 6,000 *pesos*, among the three named as entitled to that position. At a subsequent meeting the jury reconsidered this action and voted to divide the 15,000 *pesos*, first prize, among the three named for second place.

This certainly shows a generous and just intention on the part of the Government, for by a strict interpretation of the programme not one competitor was entitled to a prize, and it further goes to strengthen the opinion, expressed elsewhere, that the promoters and jury were actuated by just motives and only erred from lack of experience in such matters.

On the whole, this is another case where the promoters, had they been compelled to read your exhaustive article on competitions before undertaking this affair, might have derived from it incalculable value to themselves and to those they endeavored to serve.

There is at present no information obtainable as to when, if ever, and after which design the building is to be proceeded with. The limits of the site are being marked by a wall of adobes showing the elliptical shape, but this has been going on for five or six months and in this *manana*-land is no indication of definite progress.

J. W. PERKINS.

TO PROTECT COPLEY SQUARE. — The City of Boston, by City Solicitor Thomas M. Babson, has filed a bill in equity for an injunction restraining the trustees of the Westminster Chambers, on the corner of St. James Avenue and Trinity Place, from exceeding the limit of 90 feet established by the Copley Square act, passed by the last Legislature. This will bring the question of the constitutionality of the act squarely before the courts, for undoubtedly the owners will contest the matter. The act allows any one who was constructing a building at the time of its passage to recover for losses occasioned by it, so far as they arise from non-use of materials, etc., already contracted for, changing of plans and structure to conform to the law. — *Boston Herald*.

PILES AND PILE-DRIVING, NEW AND OLD.[1] — VII.

DISCUSSION — (*Concluded.*)

Doorway, Rue St. Etienne-des-Tonneliers, Rouen.

Mr. S. E. Tinkham: During the past year there have been driven about 4,000 piles for the foundation of the sea-wall which the City of Boston is building in Fort Point Channel, near the new South Union Terminal Station; and, as the material here is a soft clay, we have been obliged to content ourselves with a penetration, at the last blow of the hammer, so much greater than any mentioned in the paper that it may be of interest.

The material which we found at this point is a soft blue clay, changing in a few instances to a soft yellowish clay, and it extends to a considerable depth. A series of borings, made along the line of the proposed wall to a depth of 65 feet below mean low water, failed to show any other material. I understand that just across the channel, not more than 1,000 feet away, the same material was found to extend to a greater depth than 170 feet below mean low water. With material of this nature we must depend almost entirely upon the increased friction which is developed after the pile is allowed to rest, and can derive very little assistance from any formula based on experiments which gave final penetrations of one-half inch or an inch.

In the work to which I have alluded spruce piles were used not less than 7 inches in diameter at the point, and at least 9 inches in diameter at the butt; they varied in length from 35 to 55 feet, according to the stiffness of the clay in which they were driven and the load they were intended to carry. The driver used was mounted on a scow and had a hammer weighing 2,300 pounds, the rope or fall being attached to the hammer. Under these conditions the total maximum penetration allowed for the last five blows, with a fall of the hammer of 8 feet, was 24 inches.

Some experiments were made to see how much the resistance would be increased by allowing the pile to rest for three or four days, and I can give one or two illustrations which may be of interest: —

A spruce pile 35 feet long, 7 inches in diameter at the point and 10 inches at the butt was driven 20 feet into the clay with a 2,360-pound hammer falling 8 feet. The total penetration for the last five blows was 27½ inches. After a rest of four days the pile was struck twenty blows with the same hammer, falling the same distance as before, and the result was a total penetration, for each set of five blows, as follows: First set 4½ inches, second set 7½ inches, third set 9½ inches and fourth set 7½ inches. The average penetration for each of the twenty blows was almost exactly 1½ inches, as against a penetration of 5½ inches per blow at the end of the first driving.

A second pile, of the same dimensions as the first, was driven in material slightly softer, the hammer and fall being as before. The total penetration for the last five blows was 38 inches. After a rest of four days the pile was struck fifteen blows, and the total penetration was found to be, for each set of five blows, as follows: First set 8 inches, second set 8½ inches and third set 8½ inches, or an average of 1⅝ inches for each of the fifteen blows, as against over 7½ inches per blow at the end of the first driving.

Mr. James W. Rollins, Jr.: If some of the piles which engineers think so well driven could be pulled out, I think their condition would be such as to materially change such a conclusion.

We are at the present time driving piles for foundations for masonry — in the Back Bay district, on Ipswich Street, Boston — and the results of this work have satisfied me that while piles are apparently going down under hard driving, they may be either crippled or broomed up, so as entirely to lose their efficiency.

We drove the piles, some 360, for the foundations of a bridge across Stony Brook, using 30 to 35 foot piles, driving them down to grade 30; one pile, an average one, going down, under thirteen blows of a 2,000-pound hammer, in 40 seconds.

We then started on the foundations for a highway bridge under Charlesgate East, about 300 feet west from the bridge at Stony Brook, above referred to. The abutment was L-shaped, and we started in the end of the wing, piles being driven to saw off at grade 5; and material being, as shown by borings taken later, about 10 feet of coarse gravel filling; then 25 feet of silt and sand, and a natural bottom of gravel at grade 30. The piles were spaced 2 feet on centres each way, and the first row at end of wing went quite decently, being good, fair driving.

Very soon difficulty developed in trying to get the piles down through the gravel filling. A pounding of 100 blows by a 2,300-pound hammer would only get the *head* down a foot. We then tried a water jet, and under a pressure of 260 pounds to the square inch on the jet, through a 1-inch gas-pipe fastened to the pile, we had no better success, it being impossible to keep the jet in place while pounding through the gravel. Meanwhile we had shod the piles with a cast-iron point, held in place by a ⅞-inch iron dowel 15 inches long.

After consultation with the city engineer, he wished us to try in another place and find whether bottom was uniformly hard, in which case he proposed to abandon the piles and "float" the masonry on the gravel filling.

At this stage two soundings were taken, and both proved the material to be as previously stated, 10 feet of gravel overlying a soft stratum. This gravel filling had been in about fifteen years, and had been under a pressure of 30 feet of filling above the bottom of our excavation.

We moved our driver and began at junction of centre line of wing and main wall, at the point where the sounding was taken. The first pile driven went all right, and we thought our trouble ended, and continued on main abutment on outside row. In a day or two we found the same difficulty, and concluded to experiment a little. According to theory and the soundings, the piles should go easily after getting through the 10 feet of gravel, and we so concluded that if the pile continued to drive hard after this distance something must have happened to the pile.

We drove a pile 12 or 15 feet into the bottom, it still going hard, and then pulled it out, finding it crippled with a broom 3 feet in length at end. Another pile did the same thing, and a third, after driving hard down 15 feet, suddenly went easier. On being pulled it showed another cripple, without the broom. The piles were of spruce, and 35 feet to 40 feet long.

These experiments proved that it was impossible to drive piles into that gravel when spaced 2 feet on centres, so the engineers told us to try to drive half of them. We tried this plan, and got ahead quite well until we approached the other piles previously driven with an area of 10′ x 16′ between the two bunches of piles. We were then unable to get a single pile down without crippling in the gravel. One pile was pounded down with 1,300 blows, one foot taking 357 blows, and three consecutive feet over 700 blows; but our opinion is that its foot is spread out somewhere through the silt, and nowhere near the hard bottom the engineers were after. We then put in the middle of main wall a new machine with a 2,700-pound hammer, and went ahead with no trouble, on half-space driving, until we approached the piles in the wing, and here again we found the same trouble and could not get the piles down. Of eleven consecutive piles tried, we drove one on outside row down, and drove and pulled the other ten, finding nine of them crippled, the piles being driven only 5 feet into gravel and driving being stopped on first evidence of trouble, which showed itself in the springing of a pile under the blows and even under the rebound of the hammer.

One pile, being selected as the best of the stock on hand, was tried in the same hole where two had previously been driven and pulled out, and under blows of only 2 or 3 feet drop of hammer (such blows taking 60 to drive the pile one foot) crippled in 5 feet of driving. In this one place we tried four piles, and could not get one through the gravel. This same place was within 4 feet of one of the borings.

This experience has shown that, in certain kinds of material, it is impossible to drive piles 2 feet on centres; also, that, while the head of a pile may go down, it does not follow that the bottom is going equally far.

Experience on railroad work, where piles were driven to carry the tracks while a road was cut through under them, has shown the same results; that while the piles have been driven into the ground under very hard pounding, they have been crippled or smashed to pieces by this pounding, and no good has been derived from them for supports.

At Brockton, in an effort to do work of this kind, we used very heavy oak piles, and managed, after pounding each pile some four or five hours, to get it down. The material was sand, and on excavating we found the piles all solid, but showing signs of hard wear.

This latter is the only case in my experience where piles have been driven into natural ground, for supporting tracks, and have kept their shape; and this I think due to the kind of pile used. When a pile requires several blows of any hammer of decent weight to drive it a quarter of an inch, I do not believe that such a movement means any actual movement of the bottom of the pile, but more a crippling or compression of the timber.

The accompanying photograph shows some of the piles driven at Ipswich Street, under Charlesgate West, and pulled out after having been driven as long as the piles "stood up." One shows the beginning of the crippling process, it having the shoe still on.

Mr. Frank W. Hodgdon: The cases cited by the previous speakers were mostly of hard driving. I have in mind a case where, in building Pier No. 4 for the New York and New England Railroad Company, the spruce piles for the foundation of a part of the sea-wall were driven through a considerable depth of soft mud into a soft clay such as Mr. Tinkham found in Fort Point Channel. The piles drove so easily that the contractors drove many of them just as they came from the woods, no attempt being made to square the ends. Notwithstanding the soft bottom, into which the piles penetrated at least a foot at the last blow, the sea-wall has shown no apparent signs of settlement, although a large storage-shed has been

[1] A paper by Horace J. Howe, member Boston Society of Civil Engineers, and read before the society, March 30, 1898. Continued from No. 1178, page 30.

built on the pier and has been filled with heavy goods at various times for a number of years.

While I was discussing the question of pile-driving with an old contractor a few years ago, he told me that while building bridges on what is now the Boston and Maine Railroad, near Conway Junction, at one point they found the mud so deep that although the longest piles obtainable (some 60 to 70 feet long) were used, yet the penetration at the last blow was 2 feet or more, and he anticipated that the bridge would settle badly when the trains began to run; yet, although he visited and examined the bridge at least once a year for a number of years, he found no evidence of settlement. On the other hand, in many cases he had driven piles into sand where it was very difficult to drive them, they going only a fraction of an inch at the last blow, and yet the shaking caused by the passage of trains over the bridge caused the piles to penetrate farther and the bridge to settle.

On the south shore of Massachusetts, and along Vineyard and Nantucket sounds, the use of the water-jet to drive piles is very common, both for wharf piles and for the fish-weir poles. Formerly these were driven by a hammer running in guides, but now the pile is stood up in position and water is pumped through a small pipe ahead of the point of the pile, forcing the sand aside, and allowing the pile to settle into the bottom, either by its own weight or by the addition of a weight placed on top of the pile. In this way the pile can be placed exactly in the required position, and is controlled much better than when driven by a hammer. This process cannot be used in gravel or coarse material, as the water will wash out the finer portion, leaving the stones in the hole.

I wish to emphasize the fact, stated by Mr. Francis, that no dependence should be placed on a pile foundation to resist any lateral forces. In building a sea-wall in 1888 on the South Boston flats, the foundation piles were driven through 10 to 18 feet of soft mud and 15 to 18 feet into the clay beneath. Around the heads of the piles, for a depth of 3 to 4 feet, was placed broken-stone ballast, and a spur pile was driven between the main piles every 7½ feet to stiffen the foundation. Notwithstanding this, when the mud and clay filling was placed back of the wall a section of the wall moved forward, the greatest movement being about 2 feet. The wall itself moved out bodily, the foundation piles probably bending forward through the soft mud, the spur pile being forced slightly deeper into the clay. In order to avoid such movements in the walls we are now building, the mud and fine sand are excavated to the depth of 15 to 20 feet below mean low-water, and the space around the piles and sloping out in front of the wall is filled with coarse gravel, and the exposed slope is covered with a layer of broken-stone rip-rap on a slope of 1½ to 1, this slope of 50 feet from the face of the wall to deep water in the dock or slip being covered by a pile platform or wharf, alongside of which the vessels are made fast. This pile of gravel holds the piles in place and gives the necessary lateral strength to the foundation of the wall, the piles simply supporting the vertical pressure of the wall and preventing its settlement.

Our piles are driven at least 15 feet into the soft clay, it taking three to four blows of a hammer weighing about 2,000 pounds falling 6 to 12 feet to drive them the last foot. When these are first driven the heads are readily swayed as much as 2 feet, with about 15 to 20 feet of the pile projecting above the material into which they are driven; but at the end of a week it requires considerable force to move them. When trying to remove guide piles which have been driven two or three weeks, and to a depth of only 5 or 6 feet into the clay, they have frequently broken before they could be pulled out. The tenacity with which clay clings to a pile increases with the length of time the pile has been driven. This was well illustrated by a bulkhead which was built to retain filling on South Boston flats. The bulkhead consisted of a row of spruce piles driven 6 feet on centres planked up on one side and supported by two spur-shores on the other. Both main piles and spur-shores were driven about 12 feet into the clay. The main portion of the bulkhead was built about three years before the filling was placed against it. A gap was left for the passage of scows, and this gap was closed about two months before the filling was placed against it. When the filling was being done the older portion of the bulkhead held its position, but the newer part was pressed out; and the main piles were partially pulled up by the straightening up of the spur piles, the clay not having had time to become so firmly attached to them as it had to the piles of the older portion.

MR. CARSON: In the case of the wall which moved out 2 feet under pressure from behind, what offered the resistance that caused it to stop at 2 feet?

MR. HODGDON: The spur piles were forced into the clay, and the forward movement of the wall must have compacted the material ahead of it to a certain extent. The farther ahead it went the more resistance it had to overcome, and the material in the rear had a chance to dry out and set, and so exert less pressure.

MR. CARSON: As to piles having power to resist lateral pressure, you mean vertical piles?

MR. HODGDON: Yes.

MR. SIDNEY SMITH: I am reminded of some soundings made with a ⅝-inch rod of iron for a railway pile bridge over the Black River, at Holland, Mich., in 1872. The different materials thus found were platted on a profile, to enable the chief engineer, Mr. Wm. A. Haven, to estimate the lengths of piles required. Subsequently the average penetration of the four piles in each bent were platted upon the same profile. The depths to which these piles were driven indicate that a good estimate of required lengths may be made by this method, for they followed closely the depths of the soundings. When better and more expensive methods are not available to test the materials to be penetrated, a very useful study may be made by sounding with a common iron rod.

At another pile railroad bridge 40-foot piles were driven where 6 to 12 inches was a common set. In one bent the first pile drove very hard, the second easily and the third with very few blows. For the fourth a 45-foot pile settled into place without a blow. It was lengthened by splicing another pile to it, and the combined length penetrated the mud about 80 feet under the weight of an 1,800-pound hammer. That was the last work done that day. The next morning the chief engineer was present, when this pile received several blows with a fall of 16 feet, which failed to start it.

In a portion of the covered channel of Stony Brook, in Boston, built in 1888, the timber platform supports two arches of masonry, each 12.5′ x 12′, with their contents, and a paved roadway whose surface is about 4 feet above the crowns of the arches. Borings had been made there with the improved appliances in 1887, some of them showing mud or very soft clay 83 feet or more below the platform. As pile-driving progressed, it was observed that those first driven would rise. Therefore the bents were not capped until the piles were in place about 20 feet ahead. At this distance the upward movement had ceased. No subsequent settlement of the structure has been noted.

MR. RUDOLPH HERING (by letter): The paper of Mr. Howe, which he has asked me to discuss, is valuable for the collection of data and opinions of experts which it contains. These data and opinions, although partly published elsewhere, were scattered, and, to the busy engineer, it is a great help to find them collated for easy reference. It would, of course, have been still more valuable had he taken the further trouble of segregating the isolated facts, so that it would have been more convenient to apply them to new cases, and so that the relative value of the data to the case in hand could be more readily appreciated.

It has appeared to me that we should treat the subject of the strength of bearing piles similarly to that of the strength of beams. That is to say, we have, for the latter, first a mathematical expression or formula for the translation of forces, which are due to the form and dimensions of the structural elements, and to the character of loading and support. Then, to reach the practical from the theoretical case, we introduce into the formula numerical coefficients, including the factor-of-safety, which are determined by experiment or general experience, for the particular materials used, and for the future exigencies arising from the location of the structure or from its intended use.

Proceeding in the same manner with piles, we should first have the mathematical expression which deduces the bearing power from the frictional support given the pile by the material surrounding it, and then have the coefficient which determines the degree of friction for the particular materials ascertained by experiment; and allow for the future exigencies arising both from the nature of the soil into which the piles are driven and from the magnitude and frequency of the vibrations to which the structure resting upon the piles will be subjected.

The difficulty we meet with here lies in the determination of such a coefficient within reasonably close limits. In the case of a beam we have certain well-known materials of uniform texture, for each of which numerical values have been ascertained with a fair degree of accuracy, and we can nearly always safely apply them for a new structure. But in the case of a pile the material into which it is driven is of great variety in its sustaining power, and is often known to us only in a general way as being sand, clay, loam, muck, etc. We have, further, the element of time, namely, the changes taking place in the degree of compactness with which the material settles around the pile, sometimes increasing and sometimes reducing the original friction. It has therefore been customary to provide for all these unknown elements by assuming large factors-of-safety.

Engineering science is constantly seeking to diminish the extent of the realm of the unknown, and practical business men, in competition with each other, are seeking to get the best results with the least expenditure of money. Therefore, in engineering structures the factor-of-safety, otherwise called the factor of ignorance, is being constantly and properly reduced. How can it be reduced in the bearing power of piles?

In my opinion, it can be reduced only by the use of test piles driven on the site, which expedient is equivalent to taking, in the case of beams or small structures, the published experimental data for their breaking strain under well-known similar conditions to those of the new structure. The driving of test piles between periods of rest, and from the result ascertaining the actual and safe sustaining power of the soil in question, is justified because the material into which the piles are driven may vary considerably from that upon which our previous experience was based. In every important case, and for safety and economy, I consider that the true frictional resistance and the degree of its continuity should be directly ascertained by driving test piles repeatedly after periods of rest.

Professor Kreuter, in a paper on this subject (see Proc. Inst. C. E., Vol. CXXIV, pp. 273), which is alluded to by the author, mentions

the defects of the formulas hitherto proposed, in ignoring the true effect of elasticity and weight of the pile, and suggests a way of utilizing to the best advantage the results derived from test piles. It is practicable by this method to eliminate many of the uncertainties due not only to the pile itself but also to the material into which it is driven. In addition to the precautions quoted by the author, regarding the allowance of time for rest after driving, and with regard to the maintenance of a sound and solid surface to receive the blows, Professor Kreuter later added, in an addendum, the further important precaution that the heights from which the hammer shall fall in the testing sets of blows must not be widely different from one another, and must be as near as practicable to the height under which the hammer no longer does any useful work. Experience will have to demonstrate how far Professor Kreuter's method is practicable. In any case, it seems to be a move in the right direction.

Spencer Cosby, First Lieutenant U. S. Engineers (by letter): In 1895 we had occasion to drive over 4,000 piles inside the walls of Fort Delaware, and I made an effort then to ascertain whether any further settlement had taken place in the walls of the fort since the date (1868) of Major Delafield's paper. I could, however, find nothing in our records in regard to this matter, nor could I ascertain the location of the old bench-marks. To the best of my belief, however, there has been no perceptible settlement since the average of 3.19 inches recorded by Major Delafield.

The fort stands with a single small unimportant crack in one casemate arch. No other evidence of settlement has anywhere been observed.

We made attempts to pull up two of the old Sanders piles. One resisted an estimated pull of 60 tons; the other broke off at the point where the chain was fastened, 3 or 4 feet below the head. In making our excavation for the new work we came across a number of Sanders piles, as well as others, driven, it is believed, by Major Delafield between 1834 and 1838. All exhibited the same characteristics. The wood was thoroughly water-soaked and soft; the outer layers of sap were decayed, often for several inches in from the surface. The heart seldom, if ever, appeared to be affected, and the decay extended less and less deeply into the wood below the water-line, and seemed to disappear entirely within 5 or 6 feet of it. The piles were so soft, and crushed so easily, that it was found impossible to apply any test to them by re-driving.

Prof. W. M. Patton (by letter): I have not been able to examine tne paper with that degree of care to which its value and importance entitle it. I have, however, read it over carefully, and have been very much interested in it.

You, of course, understand my position on this matter, which, simply stated, is that there is not and cannot be any kind of relation existing between the weight of hammer and height of fall and the bearing power of a pile.

By this I do not mean that I am disposed to discard all formulas, but simply that, while I may use such formulas, I have little confidence in their reliability; and, in the absence of some precedent, I should regard nothing of value except direct experiment.

It is very probable that, in driving piles in compact sand and gravel, we are entirely deceived in regard to penetrations unless the jet is used. I know of piles which have been battered and crushed at the point from 1 to 2 feet after hard driving.

My understanding as to the foundation of the New Orleans Custom House is that it is simply built on a grillage or platform of timber. I may be mistaken, however.

Horace J. Howe: I was quite well aware that it was advisable for some one to draw conclusions or progress statements, as suggested by Mr. Hering, and I consider that it is much more advisable now, in the light of the able discussion we have had.

At this stage of the reader's patience, however, it is impossible to do more than emphasize a few points: —

First. — (*a*) That a single test pile, when driven separately and apart, and loaded with an ultimate load, is inadequate. (*b*) That a single test pile in a cluster, loaded with an ultimate load, is inadequate. (*c*) That a test is accurately adequate only when it fulfils all of the subsequent conditions of loading, and is made over a sufficient period of time.

Second. — That a pile frequently crushes at the bottom in hard driving, so misleading at times the most experienced inspector; and that any calculation, in terms of set of pile, would be thereby rendered useless.

Third. — That with piles not subject to vibrations the bearing power increases after driving up to a maximum, and that this maximum does not decrease with time, *provided* that there is no easing of the foundation as a whole internally by water, or externally by neighboring deformations in the soil.

Fourth. — That piles resist pressure reliably only along their length, and not laterally, for any length of time.

Satisfactory as far as it goes. — To the query, "What specific legislation do you suggest?" put by the Kansas Labor Commissioner to railroad employés in that State, more than twenty-five per cent of those replying said: "Let the railroads alone." — *N. Y. Evening Post.*

NEW IDEAS IN LIBRARY BUILDINGS.[1]

Doorway, Rue aux Rats, Rouen.

Noticeable is the increasing tendency, on the part of library boards, to recognize that the librarian himself is — or ought to be — the expert authority to be consulted within the field of technical library details. An ideal way of bringing the librarian into closest contact with every successive step in the planning and construction of the building is by making him either the secretary or a member of the committee, board, or other sub-organization of the governing body which has the immediate charge of erecting the building. Should this be done at the very outset, before even the building lot has been secured, the resulting benefit will be seen in the fact that each separate division of the general subject, as it comes up, will be considered, discussed, and finally agreed upon, in the light of the suggestions which the librarian is able to bring forward. This has been done in the case of the New York, Newark, and Providence public-library buildings.

Mention should be made of several architectural competitions which are of exceptional interest. The first of these is that of the New York Public Library. The preliminary arrangements were conducted by a committee of the board (with a special advisory committee of three, consisting of the executive officer of the library, Dr. Billings, Prof. William R. Ware, of Columbia University, and Mr. Bernard R. Green, of the Library of Congress). It is not pleasant to be obliged to add, that owing to a peculiarly unenlightened course of action which the New York City Controller has felt obliged to adopt, this admirable building remains unbuilt, and not even begun. A letter from Dr. Billings, dated May 19, 1898, says: "The matter is now before the Department of Public Parks and the Board of Estimate and Apportionment, and it is impossible to say when action will be taken. I think it probable that ultimately the necessary funds will be granted and the work go on to complete the contract made by the city, but this may not be done before next fall, or possibly not for a year."

One of the most elaborate schemes of architectural competition is that embodied in the pamphlet of thirty-nine pages, entitled "Programme for International Competition for the Phebe Hearst Architectural Plan of the University of California" (including a library building for 750,000 volumes), which is dated "Berkeley, Cal., December 3, 1897," and which was distributed to architects and others in both continents early in 1898. The estimated cost of the building is not stated, but the fact that the sum of $50,000 has been set apart simply for the purposes of this competition, including the payment of the awards, makes this a noteworthy architectural incident.

Among instances of buildings not yet begun, but now in the earliest stages of preparation, there may be named the New York State Library at Albany (now moving for a location distinct from the State Capitol; the Cleveland Public Library (now making comparison of plans), and the St. Louis Public Library (which on March 24th last, purchased a lot 324′ x 282′ for its new building). To these should be added the New York Public Library and the Jersey City Public Library, neither of which has yet advanced beyond the stage of securing plans.

Seven libraries, costing in each instance more than $100,000, are now in process of construction, namely, the Lynn (Mass.) Public Library, the Fall River (Mass.) Public Library, the Providence (R. I.) Public Library, the Free Public Library, Newark, N. J.; the Wisconsin State Historical Society Library, Madison, Wis., the Milwaukee Public Library and Museum, and the Omaha (Neb.) Public Library.

The record of noteworthy library buildings which have been opened to the public since January 1, 1895, is a striking one. It includes the Boston Public Library, January 31, 1895; the Carnegie Library, Pittsburgh, November 5, 1895; the Pratt Institute Library, Brooklyn, May 26, 1896; the Peoria (Ill.) Public Library, February 11, 1897; the Hart Memorial Library, Troy, N. Y., May 12, 1897; the Kansas City Public Library, September 1, 1897; the Chicago Public Library, October 9, 1897; the Columbia University Library, October 12, 1897; the Library of Congress, November 1, 1897, and the Princeton University Library, November 7, 1897.

Several of the public libraries above named show a striking resemblance in general type of architecture. It is obviously only a superficial observation which would classify them as "reproducing" the architecture of the Boston Public Library Building. It would be more correct to say that both the Boston Public Library and the others named below show strongly the influence of the Sainte Geneviève Library in Paris, as that, in turn, shows the influence of some of the Italian palaces of the Renaissance, such as the Pitti Palace at Florence, or the Pompei Palace at Verona.

This is a phenomenon which should possess not only interest but instructiveness for both the librarians and the architect who are studying

[1] From a paper by William E. Foster, Librarian, Public Library, Providence, R. I.

the future of library architecture. Some of the subordinate bearings may be stated as follows: —

1. The architectural strong point of this type seems to consist in the symmetry and simplicity of its outlines; in the main, two parallel lines extended horizontally only so far as symmetry demands. It does not include such a feature as a tower as one of its outgrowths, and it seems to embody the counsel of an eminent English architect, quoted in a recent paper: "If you have height, do all you can to emphasize it and make it tell," and similarly, if you have length, emphasize that. In this case it is length that is emphasized and made effective.

2. Provided the other dimensions are so pronounced as to preserve the symmetry above indicated, this is an architectural type that even lends itself well to buildings of so great a height as the Chicago Public Library. This is a building whose fenestration — practically only two horizontal lines of window spaces — gives the spectator at first no real conception of its true size, its height being ninety feet. Much the same may be said of the New York Public Library, though this is classified under another heading below.

3. It is also a treatment which lends itself equally well, so far as architectural considerations are concerned, to very different treatments of the ground spaces, including the quadrangle, as in the Boston Public Library; the interior courts in buildings treated like the Library of Congress; the stack in the interior of the building, as in the Chicago Public Library; the stack built parallel to the main building, or even absorbed in it, architecturally, as in the Fall River instance, and the stack built at right angles to the main building, as in the Kansas City, Newark, and Providence instances. In the last-named instance — Providence — where the stack building is compelled, by the nature of the library lot, to be a prominent architectural feature, the treatment of this "refreshing" problem — to quote Mr. Russell Sturgis — has been conspicuously successful, from an architectural as well as a practical point-of-view.

4. It is a type of architecture which lends itself well to the demands of purely practical considerations, such as lighting, ventilation and arrangement.

While it is true, as stated above, that this is a type which possesses many obvious advantages for library purposes, it does not by any means follow that it should be regarded as the exclusively "library" architectural type. When such a feature as a dome is rendered necessary, it combines well with the other features of this type, but, when prominently in sight, with the inevitable result of something distinctly different in effect. This may be seen in the Library of Congress, the Wisconsin State Historical Society Building, the Milwaukee Public Library and Museum, and other instances. The Columbia University Library Building, one of the most exqusitely beautiful buildings recently erected in America for any purpose, while it is of the Renaissance style of architecture, has nothing in common with the type above referred to, the dome in this instance being one which very distinctly emphasizes height.

Finally, in touching on the details of library arrangement, it should be said that the library building of the future will of necessity cover more space than has been planned for in the past, quite independently of the question of the constantly increasing number of volumes. Rooms such as the children's reading-room, the art-room, and the lecture-room are here to stay, and must be reckoned with in plans for any library of the larger size. But, more than that, provision must be made for a large use of the books on the premises, in such rooms as study-rooms, reference-rooms, class-rooms, etc.

It is evident from a study of these recent buildings that the stack is not yet eliminated as a feature in library arrangements and construction. Yet it is noteworthy that the movement in the direction of open shelves is very well intrenched, even in those libraries which have a stack. Thus, to take what is perhaps an average case — the Providence Public Library will have at least two-fifths of its volumes elsewhere than in the stack, these volumes being accessible on open shelves, in such rooms as the reference-room, the art-room, the patent-room, the medical library, the educational library, etc. (and an even more striking result has been reached in the Newark building).

One other feature of library arrangement should here be mentioned, namely, the delivery-room. It seems like a truism to say that it should be in close contact with the stack, yet the experience of one of the largest libraries in the country shows that the statement is not wholly unnecessary. Acting on the principle that a straight line is the shortest distance between two points, we might naturally wish not only to place the delivery desk at the intersection of all the lines in a horizontal plane, as in the Library of Congress, but also at the centre, so far as the vertical lines are concerned. The library of Cornell University makes an interesting approach to this ideal. The delivery-desk is not only at the point of junction of two stacks running at right angles to each other, but it is midway of the distance from top to bottom of the seven-story stack, owing to the sharp descent of the hill on which it is built. The Providence Public Library cannot reproduce these conditions, owing to the much less decided slope of the hill, but it makes as close an approximation to it as it can. The delivery-room projects into the stack itself, as a tenon extends into a mortise, so that there are stack floors above and below the delivery-desk as well as just beyond it.

ANOTHER WASTE-PRODUCT UTILIZED. — Thanks to science, which has provided cold storage and refrigerating apparatus, the rabbit is no longer a pest in New Zealand. This year a million and a half rabbits will be exported, yielding a return of some $500,000.

ILLUSTRATIONS

[*Contributors of drawings are requested to send also plans and a full and adequate description of the buildings, including a statement of cost.*]

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INTERIOR VIEWS OF THE NATIONAL PROVINCIAL BANK OF ENGLAND, PICADILLY, LONDON, ENG. MR. ALFRED WATERHOUSE, R. A., ARCHITECT: THREE PLATES.

NOTES AND CLIPPINGS

LITTLE MARBLE IMPORTED NOW. — The importation of marble to the United States has almost ceased. It is only now and then that a cargo arrives at this port, while a few years ago a fleet of sailing vessels brought many cargoes annually from the famous Carrara quarries in Italy to Philadelphia. Marble buildings seem to be becoming things of the past, and the tombstone makers find little demand for marble tombs, slabs or monuments. Granite has taken the place of marble everywhere, even in the cemeteries where marble shafts and slabs were formerly the only proper things. Granite, unlike marble, does not require very frequent cleaning and looks well without being touched up for years. It also admits of a high polish, and does not show the marks of rust by contact with metal as marble does. — *Philadelphia Record.*

THE INDIANA NATURAL-GAS SUPPLY. — The advantage enjoyed by Indiana of cheap natural gas as fuel for manufactories is not likely to remain long, the State Geologist says. The residents have been lavish with nature's bounty. They not only waste the oil in their furnaces, grates and stoves, but they have been allowing 20,000,000 or more cubic feet to escape daily, through neglect in capping the wells which have been bored for oil. Last year's production of oil in the State's gas territory was 327,000 barrels less than in the preceding year. This is one indication that the end of the natural-gas supply is rapidly approaching, and there are other signs. Originally, the gas territory embraced 3,000 square miles. To-day it is less than 1,500 miles. The average rock pressure at the beginning was 325 pounds to the square inch; now it is 200 pounds or less. During 1897 the pressure in the heart of the Indiana gas field declined 30 pounds per square inch. The geologist estimates that at the present rate of consumption the store of gas cannot last more than five years, while it would not be surprising if it failed in one year. Salt-water is spreading through the wells in many parts of the field heretofore rich in gas, and the most sanguine do not anticipate the supply to be maintained but for a few years. The manufacturers regard the situation complacently, however, believing that they will find in petroleum a ready and cheap substitute for the gas. — *N. Y. Evening Post.*

Two Instances of Iconoclasm. — The iconoclastic performances of the Salvation Army women in destroying nude statuary at the Omaha Exhibition recalls to mind the conduct of that Duke of Marlborough who burned the masterpieces of Titian at Blenheim for fear of the harm that might result from the contemplation of the nude figures portrayed by the greatest of mediæval painters His successor was a man of very different character. — *Marquise de Fontenoy in the Philadelphia Press.*

Invention of the Telescope. — One day nearly three hundred years ago, a poor optician was working in his shop in the town of Middelburg, in the Netherlands, his children helping him or amusing themselves with the tools and objects lying about, when suddenly his little girl exclaimed: "Oh papa, see how near the steeple comes!" Anxious to learn the cause of the child's amazement, he turned towards her, and saw that she was looking through two lenses, one held close to her eye, the other at arm's length; and calling her to his side, he noticed that the eye lens was plano-concave, while the other was plano-convex. Taking the two glasses, he repeated his daughter's experiment, and soon discovered that she had chanced to hold the lenses at the proper focus, thus producing the wonderful effect that she observed. His quick wit saw in this a wonderful discovery, and he at once set about making use of his new knowledge of lenses. Ere long he had fashioned a tube of pasteboard, in which he set the glasses at their proper focus, and so the telescope was invented. — *Chambers' Journal.*

Architectural Models at the Paris Exhibition. — One of the most attractive parts of the Paris Exhibition of 1900, at least for architects and builders, should be the annex, which will contain models of some of the most important modern buildings of the city. They will be very costly representations. The model of the Hôtel de Ville is to cost 58,000 francs. As the model of the great church of the Sacré-Cœur on the top of the hill of Montmartre will not be in plaster but in cut stone, the expense will reach a larger sum. The New Sorbonne is also to appear, but the model will cost the comparatively small amount of 25,000 francs. The two palaces of the exhibition in the Champs-Elysées, and the Pont Alexandre III will be among the structures to be reproduced on a small scale. Architectural models, which at one time were not uncommon, appear to be out of fashion, but if the collection which will be seen in Paris attains the success that is anticipated, we may expect to see a revival of an art with which Shakespeare was better acquainted than with architectural representations on paper. — *The Architect.*

Silence Laws in Berlin. — No other large city is as quiet as Berlin. Railway engines are not allowed to blow their whistles within the city limits. There is no loud bawling by hucksters, and a man whose wagon gearing is loose and rattling is subject to a fine, says the *Washington Post*. The courts have a large discretion as to fines for noise-making. The negro whistlers who make night shrill and musical in Washington would have a hard time of it in a German community. Strangest of all, piano-playing is regulated in Berlin. Before a certain hour in the day and after a certain hour in the night the piano must be silent in that musical city. Even during playing hours a fine is imposed for mere banging on the piano. In Paris it is only during the carnival and on fête days that the sound of the French horn is tolerated. At other seasons it is rigorously prohibited by the police. German intolerance of noise is not a recent thing. Wallenstein, who demanded absolute quiet, had 130 houses torn down in Prague and sentries posted all round in the distance, to secure silence. There is a tradition that farther back in time a Bohemian shepherd, seeing the monk Adelbert asleep, blew on his pipe in mischief. The monk called down the curse of deafness on him.

Prehistoric Irrigation in Egypt. — While modern English engineers are steadily carrying out a plan for irrigating Egypt that is to restore prosperity to its sun-parched fields, an English antiquarian has found at Hierakonpolis the records of a primitive system of irrigation that was carried out no less than six thousand years ago. The changeless East has rarely vindicated the repetition of its history in such convincing sort. Before the pyramids of Gizeh were planned, or the mighty steps of Sakkara completed, at the very dawn of those earliest dynasties of primeval monarchs who ruled in the hoary dawn of Egypt's history, the limestone mace-head of King Nar-Mer recorded the turning of the first sod in some primitive scheme of canalization. Even then four distinct types of population can be traced; and on the pivot of an ancient door is carved the bent figure of a bound captive, supporting its weight upon his back, exactly like those Romanesque or early Gothic figures to which Dante compared the suffering souls in his Inferno. Even so long ago, the vase of sculptured diorite shows a skill in working hard material that would be difficult to surpass to-day; and the toilet dish from Denderah, dating about 2440 B. C., is as delicate a bit of workmanship in the same stone as could ever be produced. Professor Petrie found an ordinary coat-button, too, carved roughly in bone, that opens up quite novel problems of attire before the days of "double-breasted vests." The land of slaves and warriors and priests has always been the same in its essentials. The beauty of its art alone has perished. — *St. James's Gazette.*

California Earthquakes. — "*A Catalogue of Earthquakes on the Pacific Coast, 1769 to 1897*," by Dr. E. S. Holden, forms No. 1,087 of "Smithsonian Miscellaneous Collections." In compiling this catalogue, Dr. Holden had in view the determination of the general facts as to distribution of earthquake shocks, as to topographic areas, as to time, intensity, etc., and also the characteristics of particular shocks. The result is a history of earthquakes on the Pacific Coast, the disturbances being arranged chronologically and briefly discussed in an introduction. As many of the earthquakes of California are very local phenomena, which depend upon local causes for their production, no very definite conclusions can be found with reference to them. An arrangement of the shocks according to seasons shows that for California, Oregon and Washington at large shocks occur with about equal frequency in the wet and in the dry seasons. The records indicate, however, that in San Francisco and San José shocks are more frequent in the rainy season than in the dry. Dr. Holden suggests that in any future study of California earthquakes' special regions ought to be selected for examination, with the object of determining the origin of the local shocks. The data he has obtained seem to indicate that the greater number of California earthquakes have been the result of faulting in underlying strata, rather than due to volcanic causes directly. With regard to damage to life and property caused by the earthquakes recorded, it is concluded that the earthquakes of a whole century in California have been less destructive than the tornadoes or floods of a single year in other parts of the States. — *Nature.*

An "Airquake" in Itay. — The earthquake that took place in the Umbrian town of Rieti on the Velino, in Italy, the other day was accompanied by a phenomenon of which the first meagre account of the shock gave no mention. According to a correspondent of the *Osservatore Romano* it was not an earthquake, but an "airquake." The air shook or vibrated like a violently agitated liquid; great rents were made in tall buildings and towers, and walls were thrown to the ground. The earth, however, seemed to be undisturbed, and no shifting of the street pavement was noticed. From the Bishop down to the beggar all seemed frightened. It is said that many felt the air vibrations and were thrown to the ground; while others were almost suffocated. A dense black cloud hung over the town while the phenomenon was passing. The church steeples, the savings bank, the theatre, and no fewer than six palaces were more or less wrecked as well as eighty or one hundred dwellings. Five hundred tents have been sent to the place by the Government. The people, in the meantime, are living in hastily-built huts and in the half-ruined post-office and the churches. Soldiers have been sent from Rome to the scene of the disaster, and they, with the students, are busy policing the ruins and trying to save some of the household goods. King Humbert has sent 35,000 francs from his private purse to relieve the first necessities of the people. At the time of the catastrophe a slight earthquake, like a shudder, was felt in Rome. Even there, too, people say they noticed a peculiar convulsion of the air. — *N. Y. Times.*

Contrasts in Naples. — One of the strangest contrasts in Naples is to walk from the royal palace, with its fine marble staircase, up the new Corso Rè d'Italia, and to climb into the steep streets around the Church of San Soverino e Sosio. These streets are the dwelling-place of the dyers, and one steps from regal magnificence into a crowd of semi-naked people, who are busily dipping great hanks of cotton or wool into seething caldrons. As elsewhere the work is carried on in the street, and little streams of water — red, yellow, brown and black — pour over the rough stones, and gather in multi-colored pools, while on low benches against the walls women are washing clothes, standing in the dirty, soapy water that splashes over from their tubs. The passers-by walk heedlessly through the dye and soapsuds, while the children find pleasant occupation in throwing mud of every variety of color at anybody who chances to be wearing light-colored garments. It is a veritable feast of color from the merely spectacular point-of-view, but a visit to these streets leaves a bodily as well as a mental impression. Very often in the depths of these sordid alleys one comes across a forgotten old palace, built when carriages were unknown, its great court of honor crowded with booths, its vast halls filled with a heterogeneous collection of men, women and children, fowls, goats, sheep, and occasionally a donkey, all living together in the happiest proximity. The massive old walls are hidden beneath centuries of dirt; the woodwork has, for the most part, disappeared, the rooms that once knew the revels of Angevin nobles now shelter the haphazard existence of *lazzaroni*. — *The Ludgate.*

Ancient Roman Hospital near Zurich. — A very interesting and pleasing discovery is announced from Baden, near Zurich. The learned have been discussing for ages whether anything in the way of hospitals were known to the ancients — it is not to be said that they have been disputing, for there was not material enough hitherto to support a lively argument. One might read the whole volume of Greek and Roman literature, carefully too, without noticing one passage that might be interpreted as an allusion to a hospital. The works of Hippocrates could not fail to speak of them surely, if any existed; but nothing is there beyond a reference to the notes of "cases" observed in the Temple of Æsculapius. So it is generally assumed that there were no hospitals in those days; the Æsclepia were "baths" with massage treatment. Scholars who hold to the other opinion can adduce only hints in its favor. But now we hear that one has actually been discovered at Baden, containing "fourteen rooms, supplied with many kinds of medical, pharmaceutical and surgical apparatus, probes, tubes, pincers, cauterizing instruments, and even a collection of safety-pins for bandaging wounds" — but these things are familiar. "There are also medicine spoons in bone and silver, measuring vessels, jars, and pots for ointment, some still containing traces of the ointment used." The latest date of the coins found appears to be the reign of Hadrian. Probably it was a military hospital, for this was the station of the VII and VIII Legions. But the find is certainly not less interesting on that account, for the army medical service of Rome and Greece is one of the deepest mysteries of archæology. Cæsar refers only once to his regimental surgeons — is there a single distinct allusion elsewhere? We hail with puzzled gratitude the casual remark of Xenophon that the Spartans sent their doctors to the rear when a fight impended — but we look vainly for more information from him or anybody else. — *London Standard.*

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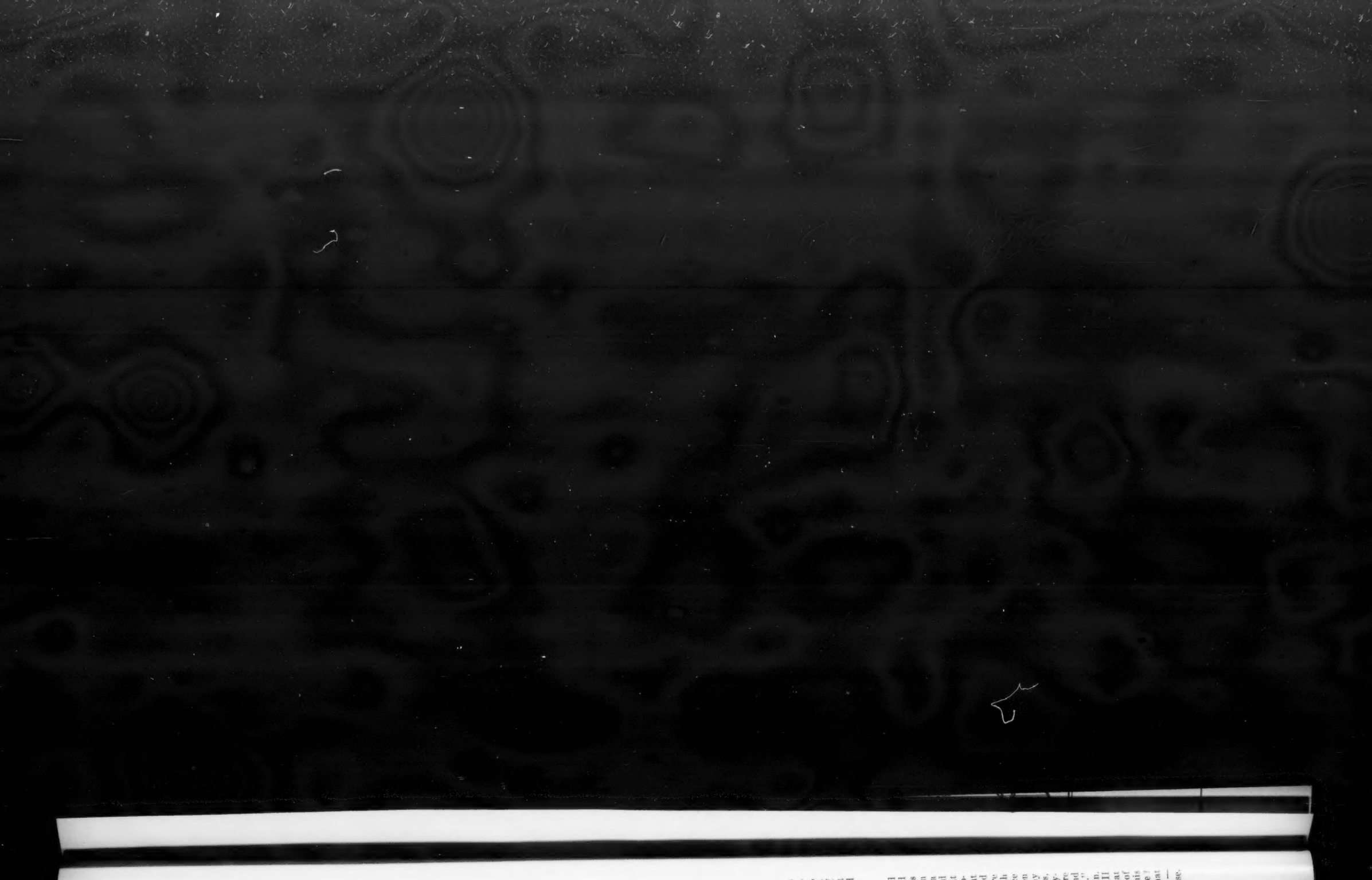

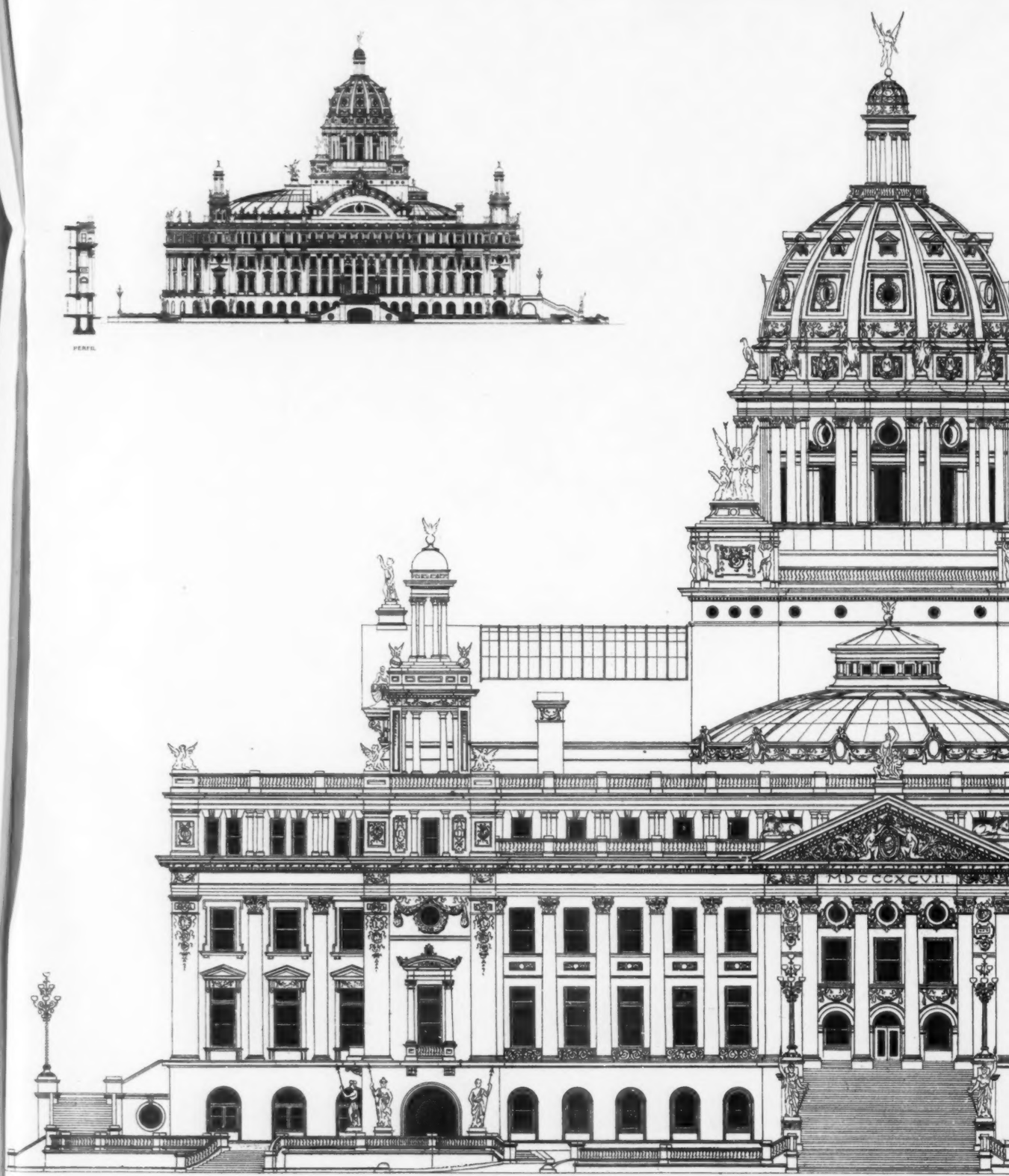

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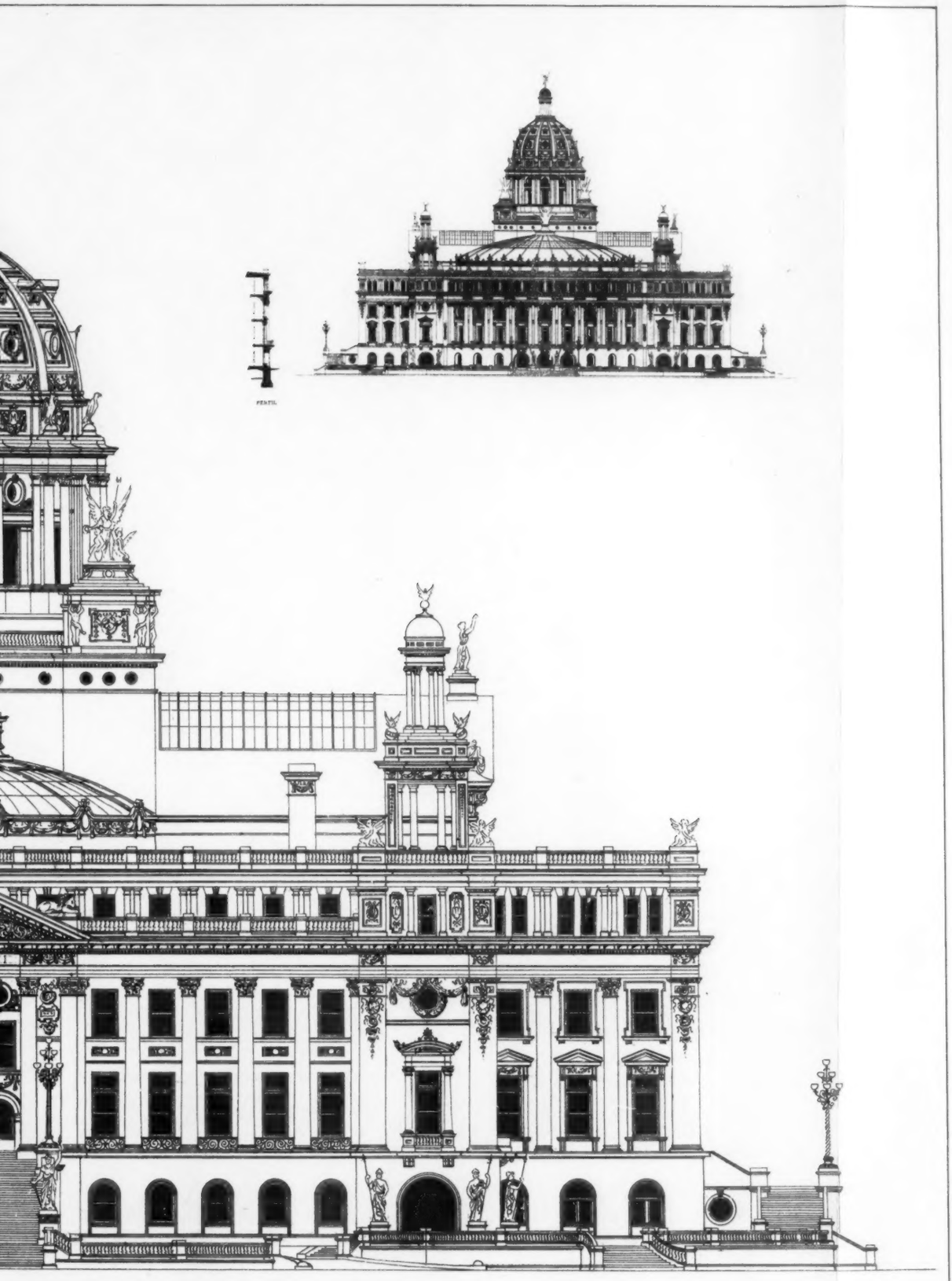

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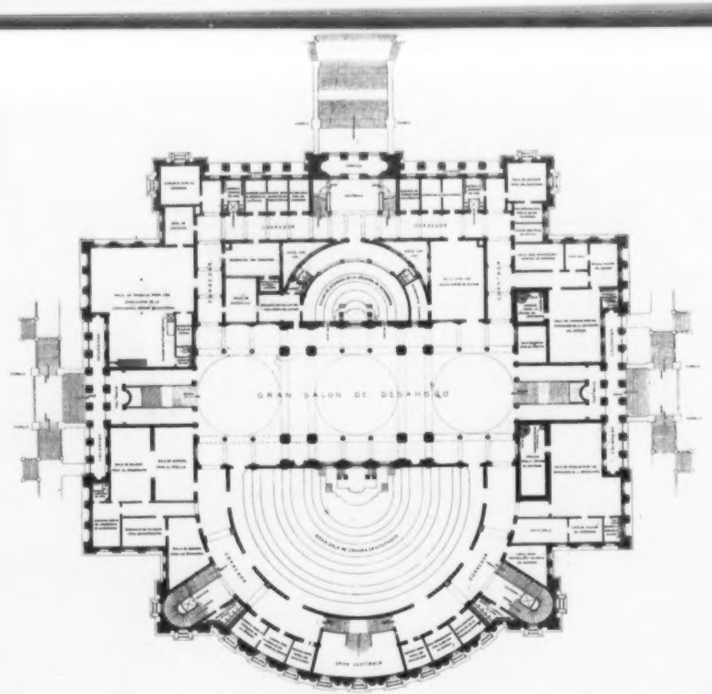

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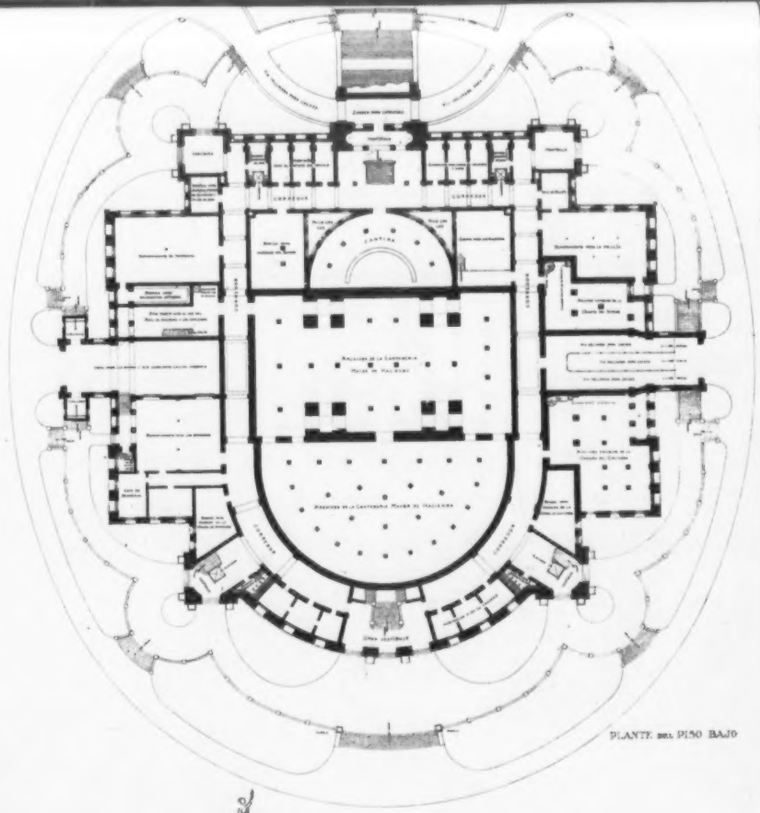

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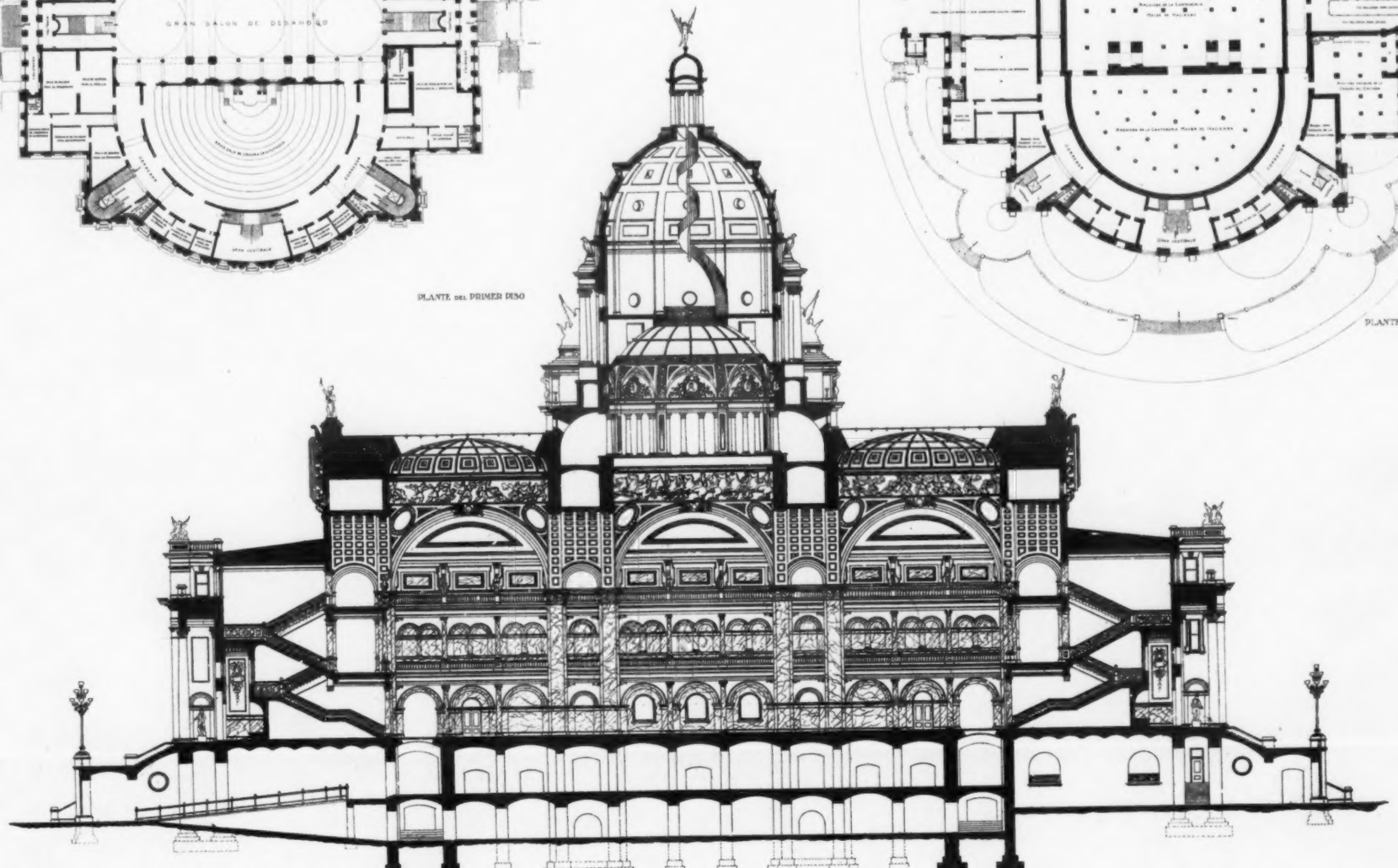

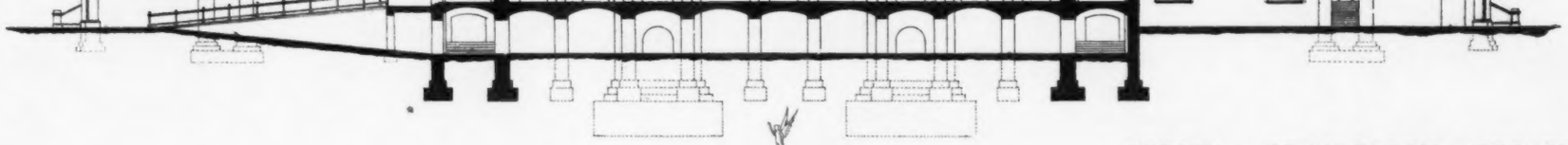

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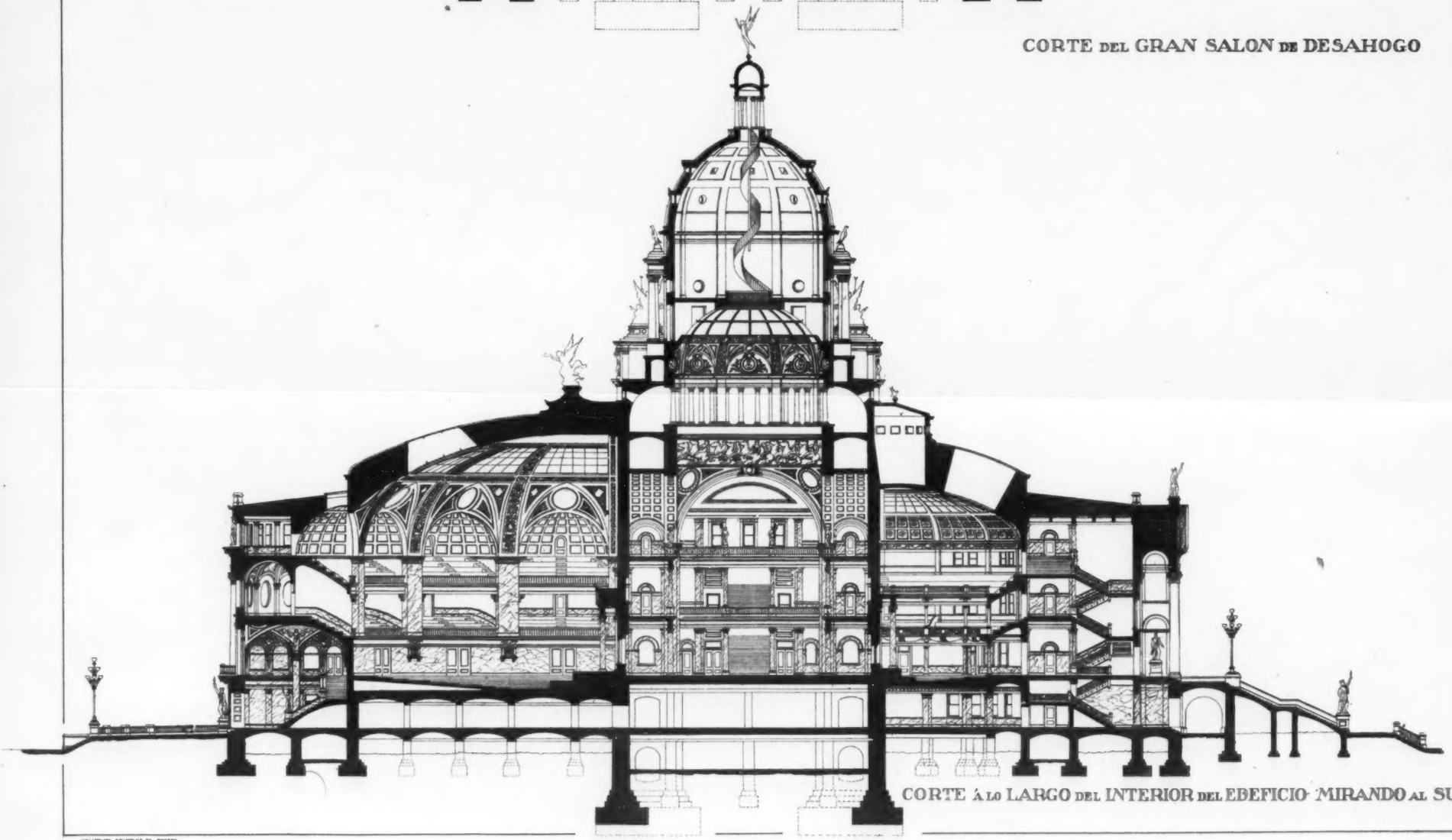

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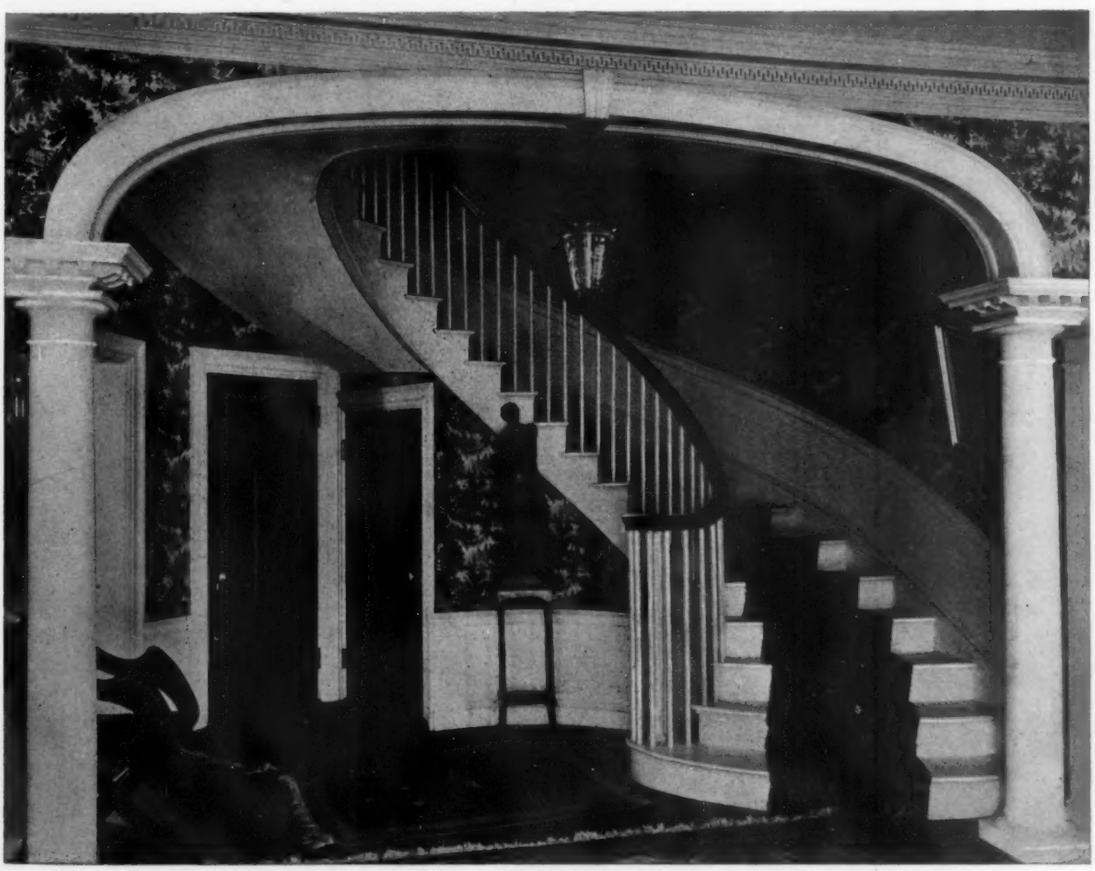

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