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CONTENTS

WE wonder whether the architect who writes to us for advice remembers to send his physician a new fee each time he causes to be re-filled the bottle which contained the elixir compounded after that admirably effective recipe, first written and paid for years ago, and which on each recurrence of the malady is turned to with such confidence. If he has not, as a matter of course, paid these recurrent fees and has never felt that any moral obligation lay upon him to pay them, why should he feel that a duplication of his own fees is reasonable under the circumstances he details? The case upon which he seeks advice is this, and it is a good example of the situations which tempt some practitioners to believe that they have a grievance, and may possibly lead them to test their belief in the courts: It seems that, some years ago, our questioner prepared the plans, working-drawings and specifications of a house for the administrator of a certain estate, the cost of the house being $12,000 and the architect being required to state in writing the lump sum for which he would render the desired service and, at the same time, grant to the administrator the right to use the same drawings in the erection of three additional houses. His "lump sum" proposal, whatever it may have been, was accepted and the four houses were, to the estate's satisfaction, duly erected and paid for. Time lapsed and the administrator, his life's work done, yielded his trust to a new administrator who knew neither the architect nor the character of the bargain made with him by his predecessor. He simply found in the archives of his trust the plans and specifications of the original house and, his books showing that these houses produced satisfactory incomes, at once made contracts for the erection of four other houses identical with the first; but although drawings and specifications, presumably, recorded the name and address of the architect who prepared them he opened no new negotiation with him and certainly did not send him any "lump sum," howsoever small. The architect now asks us whether he has any claim upon the second administrator, and begs us to cite any cases that have a bearing on the matter.

ALTHOUGH we have heard architects debate amongst themselves the possibility of successfully maintaining a suit in equity based upon a claim of this sort, we have never heard of such a suit actually being brought to trial, and doubt whether any leading cases can be found. Although, in this instance, it appears that the original drawings were actually used in building the second lot of houses and this usage of the drawings may seem to be a fraud upon their author, it was not actually needful to use them, since the builder of the second series could easily measure up the original house and use his own figures only in building the new ones, and we fancy that no jury, except one composed of architects, would deny a man the right to use in any manner he chose a structure he had honestly paid for in full, years ago. The matter really comes in the category of that still unsettled question of artistic copyright. But here again, even if our correspondent had copyrighted his design, which he certainly did not do, it would have given him protection for only a short term of years, and it would have been a very easy matter to avoid infringing his copyright while yet reproducing the essentials of his design. Our correspondent will find by referring to the abstract of a paper on "Artistic Copyright" by M. Georges Harmand, reprinted in our issue for May 7, last, that even in the profession the desirability of an architectural copyright is held to be very doubtful, and that, while the profession does hold it unfair that buildings should be duplicated without bringing increase of benefit to the creator of the original, there really seems to be no way of securing such supplementary income, save through the operation of the sense of fair play and equity in the mind of the owner of the building. As such cases do arise now and then, though with no great frequency, we believe, they might be provided for in the schedule of charges — official or private — through a clause to the effect that, should the owner, within a limited term of years, duplicate a structure designed by an architect, an additional fee of —— per cent becomes due to the architect on the completion of the duplicating building, but that the claim of the architect lapses in case of duplication after the original owner has disposed of his property to a third party. Our correspondent's question brings up once more the inadequacy of the method of computing an architect's charges on a percentage basis, and also suggests the advisability of adhering to the schedule and not yielding to the allurements of the "lump sum."

AMONGST the chickens that are being in these days counted in advance by newspaper writers, there seems to be one of such radiant plumage, or down, that it can be seen through the eggshell more distinctly than others, and these enthusiasts are telling their readers what delight is in store for them when the glories of the Prado galleries at Madrid shall have been transported to this country, either as a permanent acquisition of conquest or as a pledge for that indemnity which, in modern parlance, stands for the ransom which the defeated always have had to pay as the penalty of giving any one the trouble to overcome them. It seems to us that no amount of sophistry can make any attempt on the part of the United States to exact as part of Spain's ransom all or any part of the famous Madrid collection of paintings, anything other than an act so barbarian and so vandalistic as to do shame to our civilization, an act justifying foreign historians and moralists in all that has been said in derision of our assertion of the superiority of new world over old world ideas and practices. Few things that Napoleon did excited more indignation against him than the manner in which he looted the art collections of his opponents, for the greater glorification of Paris as an art centre, and the care that was taken when the Allies entered Paris that the stolen artistic spoil should be returned to its original home — although not a little of it was lost *en route* and reached other homes to the profit of titled and official middlemen — showed how valuable and how integrally a part of the educational being of the several States these stolen paintings and sculptures were held to be. Even should Spain herself offer them to us in pawn, it would be in some sense a crime upon art to subject this priceless collection of the works of Murillo, Velasquez and the Italian masters to the risk of damage and loss during transportation and final storage in American galleries, which are more exposed to fire damage than is their present abiding place. In case they should be offered in pledge, it might be well to discover whether all or any of the accepted masterpieces are genuine, or whether these diamonds of art have, at some time in the past, been replaced by the paste diamonds of the clever copyist. There are many private collectors who profess to have genuine masterpieces, and it is not impossible, some of them may be right and now accidentally enjoy the fruits of official corruption in past times.

BUT failing the successful rape of the glorious work of the Spanish masters, what is to be the share of the members of the American artistic world in that general era of prosperity which our political leaders assure us is already begun through and because of this unequal and hardly defensible war? Since there seems little likelihood that any battles are to be fought on our own territory, the country will be spared such another military park as that at Gettysburg, and architects will not be called on to design regimental monuments by wholesale, after the manner of those erected with such lavish hand on that once blood-stained field. Still, as some sick and wounded soldiers will die at home, some architects may be able to earn a ten-per-cent commission by designing for a mourning wife or father a tombstone, to stand as a cold reminder of a useful life needlessly wasted! Work of this kind is often ill-paid even at ten per cent, because of the unpleasant harrowing of one's sensibilities while trying to satisfy the loving ones who still mourn their dead. Fortunately, one can lose sight of individual loss and pain while considering glory and honor in the aggregate, and designers can, with professional satisfaction, pocket all the fees they can secure through being winners in the approaching multitude of competitions for soldiers' and sailors' monuments, memorial town-halls, libraries and so on. Then, too, new hospitals, soldiers' homes, lunatic asylums and poor-houses must be built or enlarged, all to the pecuniary profit of the profession, and we must not forget that the successful army contractors are to be provided with châteaux in the country and mansions in the city. Verily, war as a promoter of prosperity is a great modern discovery! The sculptors and painters, too, may find it distasteful to be called on to produce busts, bas-reliefs and portraits of the fallen, based on the more or less faded and tear-stained photographs that may be brought to them; but it is all in the day's work, and the sculptors, at least, can count on deriving a profit from the public monumental and memorial work that is sure to come. Fortunately, the number of equestrian statues is not likely to be greatly increased, since the Government seems to have found it difficult to transport horses for its cavalry to the East or the West Indies, and that branch of the service has been forced to fight afoot. As to the painters, it seems likely that they will reap the fullest and most long persisting harvest, for in addition to public and private commissions for the great amount of portrait work which they can surely count on, there is the really inexhaustible field of the battle picture. It is more than a quarter of a century since De Neuville and Detaille began to delight picture-lovers with their telling incidents from the Franco-Prussian war, and yet the latter is still producing and selling them, and the walls at each *Salon* are still thickly sprinkled with the work of imitators who find ready sale for their pictures. Inasmuch as the present war is largely a naval war, the painters will find in the deeds of our sailors a new and very tempting field, and we may count on a new list of successful marine painters. It will be very interesting to observe how the artist, on his limited canvas, succeeds in giving the impression that the battle he depicts is really a give-and-take affair. In the old day of sailing ships, an artist could show his ships pounding away yard-arm to yard-arm, and the scene was really animated and exciting; but now that these huge floating gun-platforms engage one another at a distance of six or seven miles, we fear our painters are going to get into trouble with their perspective. It seems possible that the artistic world, finding how greatly its material welfare can be bettered by a little warfare now and then, may hereafter, when out of a job, bring pressure to bear on the politicians and compel them to declare just enough war to keep brush, chisel and T-square in steady work.

WE ask attention for a communication from the Commissioner of Public Records for the Commonwealth of Massachusetts, published in another column, because of its immediate and continuing importance. Although Massachusetts has not suffered in the degree that Western and Southern States have suffered through the destruction of township and court records, it is not so much because of the superiority of the protection afforded by her vault builders as because of the greater efficiency of New England fire-departments. The matter of the proper protection of public records is of such real importance that it will be surprising if a law is not passed by the next legislature empowering the Commissioner to make regular examination of the vaults in use in the State and enabling him to compel the remodelling and rebuilding of any that may be found to be defective in point of capacity or protective qualities. Meanwhile architects in designing new public buildings will serve their clients' interests by giving heed to the Commissioner's warning.

WE confess we are not a little puzzled as to just what are the functions and privileges of the various artistic bodies that have been established with such rapidity in New York of late years. As the membership in several of these societies is largely the same, probably their several efforts do not really overlap one another as, to an outsider, they seem to do. In one particular we believe we are right, when we state that the Municipal Art Society of New York was organized with the purpose of really doing things and not for the purpose of merely advising how things should be done, or criticising them after they had been done. Its latest effort is the promulgation of a programme for an open competition for the designing of a cast-iron drinking-fountain to cost $250, and for the best three designs, selected by an expert jury of fifteen, it will pay prizes aggregating five hundred dollars, and further promises that should a "worthy design" be produced it shall be "warmly recommended" to the City Government for adoption and execution. The competition seeks to satisfy a humantarian demand whose neglect has too long been a disgrace to a metropolitan city and the producer of a worthy design really seems likely to gain something through his success. The committee, foreseeing doubtless that in these dull times their little programme would be very popular and would probably bury their jury of experts under an avalanche of designs, have avoided this difficulty by making one of their conditions the providing of a plastic model at a two-inch scale. This simple and judicious requirement will at once rule out a host of architectural draughtsmen and students who would enter the competition if only drawings were to be required. If the competition results in securing a design as successful as that after which the drinking-fountains at Liège were cast, the Society will deserve applause. The subject for a second competition, to be held at the same time and under the same conditions, is not, we think, equally felicitous; a bronze base for a standard is appropriate enough and not much in the way in the great piazza of St. Mark's where the flow of traffic is somewhat sparse, but it seems hardly wise to suggest placing another obstruction in the small park that surrounds New York's City-hall.

IT must make American artists envious to see how many of their brethren in Europe grow rich. The census shows, if we are not mistaken, that more money is spent annually in the United States on dogs than on ministers; and the artists must rank, so far as average professional income is concerned, considerably below the ministers. In France, although certain painters, such, particularly, as Meissonnier and Bouguereau, are reported to have accumulated great fortunes, nothing is actually known on the subject; but, in England, the amount of personal property that every man leaves at his death must be certified and recorded. From the records it appears that Sir John Gilbert left personal property to the amount of more than eleven hundred thousand dollars; Lord Leighton left about a quarter of a million; Sir John Millais about half a million; Mr. J. L. Pearson, the architect, about a quarter of a million; and Sir Edward Armitage, who was for many years a very popular painter of historical subjects, more than a million and a half.

THE approaching Public Art Congress in Brussels promises to attract much attention throughout the world. The Belgian Government has formally invited the Government of the United States to send representatives, and it is expected that the invitation will be complied with; and the various Municipal Art Associations, or similar bodies, which are springing up in most of our great cities, would certainly find profit in being represented. Nearly everything relating to public art, from the laying-out of streets to the management of artistic competitions, and the best means of improving the character of posters, is to be discussed, with illustrations, by some of the most noted experts in Europe, and suggestions on these subjects are just the things which we need now in this country.

AN ARCHITECTURAL "SUMMER SCHOOL" ABROAD.[1] — VIII.

Village Street, Audrieu.

WE finally started for Bayeux, with clearing skies, and after a delightful run through wet fields, over the winding country-roads leading to the villages of Norrey, Audrieu, Cristot and Ducy, returned to the main thoroughfare, glad to find smooth surfaces again but regretting the loss of the picturesque scenery of the by-roads.

This part of Normandy is particularly rich in examples of village church architecture and at no time were we out of sight of at least one tall spire. The churches, in the main, are low and without much interior decoration, but that at Norrey is an exception, having, in addition to the old wooden roof over the simple nave that probably belonged to the early church, a richly-decorated apse, peculiar for its wide belt of carved foliage. The outside of this church is quite unusual, for the roofs of the two little apsidal chapels are carried up in high cones on either side of the main apse covering. The tall square tower over the crossing seems to be a copy, on a small scale, of the tower of St. Pierre at Caen, as it has the same grouping of arched openings and similar decorative treatment.

We were very much interested at Norrey in watching the deft fingers of one of the village lace-workers, a woman with coarse features and corpulent body, whom no one would suspect capable of rapid movement or delicate touch, yet whose clever handling of pins and bobbins was remarkable for precision and speed.

After passing through Cristot we came abruptly upon the thatched roofs and village church of Audrieu, a picturesque little place, almost English in appearance. The church is bare and rude in the interior, but has an elaborately carved arch on the west side of each transept and a circular apse projecting from each opposite east side, all clearly of early Norman date. Above the roofs rises an unusually high square tower and octagonal spire.

A little farther on we stopped to sketch the spire of the church at Ducy, a very good example of the small but well-designed spires that abound in this section, and then turned north to meet the national road, hurrying along in order to arrive at Bayeux in time for dinner. Climbing the long paved grade of the Rue St. Martin, a part of the great road from Caen to Cherbourg, we passed the cathedral on our left and soon found the "Hôtel du Luxembourg," where, after cleaning our wheels in the court-yard and then removing all traces of the wet ride from our own persons, we disposed of a very comfortable dinner. The last hours of daylight were spent in tramping about the quiet town.

The morning was spent in and about the great Cathedral of Notre Dame. The interior of this cathedral shows a combination of Norman and thirteenth-century Gothic work that is particularly effective. As one enters through the door under the northwest tower the sturdy circular nave arches with richly diapered spandrels at once attract attention, while beyond and above these arches the lighter and well-balanced lines of the early Gothic choir and clerestory continue the dignified and pleasing proportions. Upon the north side the regularity of the lower nave arches is not unhappily broken by the great pulpit and canopy in carved oak that entirely fills one of the openings.

During the morning we tried to put on paper the simple lines of some of the transept arches, the graceful pointed arch at the beginning of the south aisle particularly attracting us.

The choir has a peculiarly early appearance, for the four piers of the circular end are replaced by four large fluted columns. These Classic columns, however, are backed by the slender vaulting shafts that carry the ribs of the aisle-vaulting, while all the shafts are finished with Gothic capitals of excellent design.

The exterior of the cathedral can only be effectively seen from the rear, and this thirteenth and fourteenth century part of the building in some way suggests Renaissance rather than Gothic design, although there does not appear to be a bit of Renaissance detail in any part. The effect is probably due to the way in which the horizontal lines are emphasized by the decorative cornice arcades, to the squareness of the different features and to the apparent panelling of the buttresses and pinnacles. The exterior is certainly quite different from other French cathedrals of this period, and the transitional appearance is greatly assisted by the delicate detail of the high octagonal tower and dome rising over the crossing of nave and transepts.

Bayeux possesses several good houses of half-timber and stone. The most conspicuous house is, perhaps, No. 43 Rue St. Martin, dating from the fourteenth century, but its general shabbiness does not seem inviting although numerous signs state that breakfast, dinner and comfortable rooms may be obtained at "very moderate prices."

Although the plain fronts of later times prevail, even in the older streets, good overhanging façades in oak with carved brackets and moulded beams may still be found in the Rue Bienvenue, Rue St. Malo and a few streets in the neighborhood of the cathedral. But as we spent so much time at the cathedral, our chances for visiting side-streets were limited by our desire to see the famous Bayeux tapestry before leaving the city. After *déjeûner* we therefore packed our bags and, riding to the Place St. Sauveur, left our wheels among the antique sarcophagi and other interesting fragments collected in the court of the museum, then entered a low small room to see the curious historical pictures worked by the needles of Queen Matilda and the ladies of her court. The yellow cloth, bearing the fifty-eight pictures of the Conquest of England, is stretched over a light wooden frame, with glazed front, and runs back and forth over low tables and around the sides of the room, severely testing the capacity of the small apartment. But although the famous tapestry was, indeed, curious, its art value did not impress our embryo architects as much as did some remarkably careful and minutely detailed pencil-drawings in one corner of the room, — drawings that were full of the light and shade of old lithographs.

On leaving Bayeux by the south side of the Place St. Sauveur we passed a long row of heavily-loaded two-wheeled carts, each carrying a high symetrically packed load of hay and drawn by three sturdy Norman horses, then took the national road, running in almost a straight line to St. Lô.

We had changed our daily programme while at Bayeux, for the slight fatigue of riding proved to be detrimental to afternoon sketching, consequently for the next few days our riding was easily done in the late afternoons, as only a short time was needed to cover the fifteen or twenty miles lying between our stopping-places.

Finding the great road to St. Lô straight and uninteresting, some of us branched off at the meeting-point of seven roads in the Forêt des Biards, a spot appropriately called "l'Embranchement," and after a fine coast down into the valley of the River Drôme visited the village and château of Balleroy. The village is laid out on two main streets at right angles to one another, the broad avenue leading to the château constituting the head of the cruciform plan. The château was erected by Mansart, about 1630, and is regular in plan with pavilions at the corners. But, on account of its large expanse of window-area, the building did not seem particularly attractive and we did not try to pass through the high iron gates separating the roadway from the garden. The deep fosses and stone bridges near the entrance were excellent examples of architectural engineering.

Climbing the steep road, or left arm of the cross, we turned to look back into the beautiful valley, and a little farther on stopped to cool off on the rich green carpet of a wide forest road whose regularly spread trees, meeting overhead, formed a luxuriant green vista stretching away on either side as far as we could see. From our map we found this to be one of the old park roads of the château, a wide forest road that ran two-and-a-half kilometres without a turn or change in direction. For once our bicycles were useless and we all wished for horses, that we might take a gallop between those grand rows of trees.

Village Church, Ducy.

Little was seen after leaving Balleroy for most of the village s

[1] Continued from No. 1141, page 50.

were small, with plain modern churches and uninteresting houses. At Cormolain we stopped at the village church to listen to the peculiar music, evidently just beginning as we arrived. The voices of the closely-packed congregation, accompanied only by the rich tones of a French horn, repeated again and again the long-sustained notes of a quaint and melodious chant. Sometimes in unison, sometimes by voices or horn alone, the simple musical form was given, until we could but think that the peasant voices had caught the mellow serious tones of the horn, — a quality of tone that filled the church and flowed out over the surrounding fields, giving dignity to the little plain building and group of worshipers.

Pushing on over hard hills and rough roads that wound about from village to village we often lost our way, but at last, after many inquiries, rode over the paved streets of St. Lô.

St. Lô is a quaint, picturesque city on the banks of the Vire, with part of its houses in the river valley but the greater number on the sloping sides of the high hill that rises abruptly from the river, bearing on its top the collegiate church and public buildings. The Church of Notre Dame is peculiarly interesting because of its irregularity. It is without transepts, but at the eastern end the choir-aisles are widened, perhaps following the lines of old streets, until quite a broad open space is left in the interior. Back of this space extends the Lady Chapel, in which a new altar has recently been placed. The upper part of the façade is systematically arranged, for the towers of the thirteenth to fifteenth centuries were roofed in the seventeenth century with perforated conical spires of the same design. But in the lower part, especially around the entrance-doors, the arrangement is very irregular, showing a round-arched door to the north aisle, a smaller, but more richly decorated, pointed door to the south aisle, while between these doors is placed a similar but plainer arch, quite off the centre of the nave. On the north corner of the façade two openwork pediments of excellent design still further increase the irregularity.

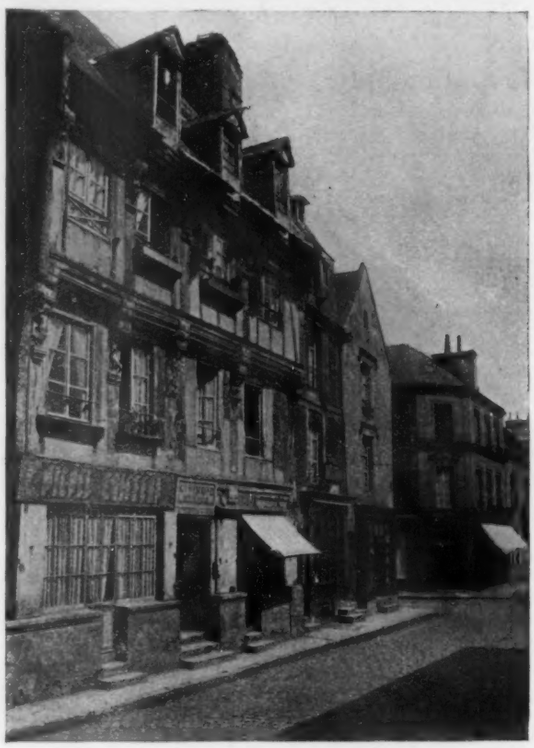
Against the wall of the north side an outdoor pulpit is hung, with canopy overhead, and door and steps leading back through the wall into the church. The little fragment is quite good in detail although the decay of the soft stone has caused the loss of its strongest lines.

The open square in front of the church is enclosed on two sides by the buildings of the Hôtel de Ville and the Préfecture, but the third side terminates abruptly in a steep precipice guarded by a parapet-wall that overlooks the lower town and river valley far below.

As the court-yard of the "Cheval Blanc" was not particularly clean or sweet-smelling, and we needed more room for Fourth of July enthusiasm, we adjourned after dinner to this breezy cliff promenade,

Old House, 43 Rue St. Martin, Bayeux.

and hanging our heels over the parapet-wall watched the twilight deepen, then sang patriotic songs by the light of a small bonfire of straw and leaves and tried to think that we were helping America celebrate her noisy day. When at last our twenty-two men formed into line and marched down over the cobble-stones to the tune of "Schneider's Band" we expected momentarily to be called to order, but no obstruction appeared, although a crowd quickly collected in the Rue Torteron outside the hotel gates to hear our parting chorus, given with the Rembrandt effects of a score of smoking candles.



Old House in the Rue Bienvenue, Bayeux.

On the whole, however, St. Lô showed such evidences of lack of proper sanitary arrangements that we were glad to leave its not too clean streets and be out in the fresh fields again.

Continuing almost due west on the wide national road leading to Coutances we branched off to the north to visit the little town of Marigny, then, as no villages occurred on the straight route, turned to the south to include Cametours, Savigny and Belval. That was indeed a zigzag route — up and down hills and across streams and brooks, in fact, a cross-country run, that gave us many an exciting coast and hard climb before we caught sight of Coutances's church towers.

We found Coutances delightfully clean and wholesome in appearance. Bayeux seemed dead, St. Lô busy and dirty, but Coutances, with its large houses and clean streets, built on top of the great granite hill and surrounded by boulevards and open parks, seemed to be a good place to live in.

E. B. Homer.

[To be continued.]

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

DISCUSSION.

Mr. GEORGE B. FRANCIS: I have been very much interested in listening to this paper, but in two or three respects my experience fails to coincide with the author's views. First, as to the point of "no set." With pile-hammers of 1,500 to 2,000 pounds I have always found a "set" of 6, 8, 10 or 20 inches in 100 or more blows. In a great many instances we crushed the pile long before the point of no penetration is reached. I cannot see how these men, with hammers of 1,500 or 2,000 pounds, failed to get more set. My experience is that we should get about a foot of set on solid rock with this number of blows.

Very few of the authorities quoted say anything about crushing timber, and it is a very easy matter to crush it, especially if it is spruce or any timber except white oak.

Another point is that care enough is not used in writing about the safe load in tons per pile. One can read the articles of some of these writers for a long time without gaining the least idea of what kind of a pile is being talked of when the tons per pile are mentioned. Whether a pile is good for six tons or thirty tons depends upon the size, length, kind of timber and ground, and no off-hand unqualified statement should be made as to the general safe loads per pile.

The following notes are based wholly on my own experience, and it is with some diffidence that I pretend to say much, knowing full well that there are many others who have had a longer and better experience than myself: —

[1] A paper by Horace J. Howe, member Boston Society of Civil Engineers, and read before the society, March 30, 1898. Continued from No. 1175, page 7.

The timbers that seem most suitable for piling in the territory in which I have been working are spruce, yellow pine, several varieties of white or other oak, and, in Oregon and California, fir. In diameter, spruce piles generally vary from 10 to 12 inches at the butt, and from 5 to 8 inches at the tip; and they can be obtained in any lengths up to 50 feet at reasonable rates.

Yellow-pine piles vary from 12 to 20 inches in diameter at the butt and from 6 to 8 inches at the tip, and can be obtained in lengths up to 80 feet. Oak piles generally vary from 12 to 15 inches at the butt and from 6 to 8 inches at the tip, and can be obtained in varying lengths up to about 55 feet. Piles from the Oregon fir vary from 16 to 26 inches at the butt and from 8 to 12 inches at the tip, and can be obtained in lengths up to 175 feet.

In this vicinity [Boston] spruce piles from 30 to 45 feet long cost from $3 to $5 in place. Yellow-pine piles as long as 70 feet cost nearer $15 each for the piles themselves, and $2 or more each for the driving. Oak piles from 40 to 50 feet long cost from $8 to $10 each in place.

Piles are used for a large number of purposes. The conditions in each case are usually different, and what will be a good specification for one place will not do at all for another place.

Piles are most commonly used as bearing piles, wharf piles, trestle piles, fender piles, batter piles, guide piles for ferry-slips and as sheet-piling for coffer-dam purposes.

The ground conditions met with vary extremely. In some instances it is necessary that the pile shall act as a column descending through soft material to a very hard bottom. In other instances no reasonable length of pile will reach a hard bottom, and it is necessary to depend upon the friction of the ground upon the sides of the pile. These latter conditions predominate. Once in a while it is found necessary to shoe the points of the piles with metal; but, as a rule, if the ground is hard enough to require such treatment, it is also hard enough to support an ordinary structure without piles. In the case of a column, it is necessary to specify a pile which will be of large diameter at the tip. In the case of friction bearing this is less necessary. Sometimes piles in friction ground are placed too close together, so that the value of the friction is lost; but it is desirable to place them close enough to consolidate the softer material between them. In some trestle structures it is preferable to use oak piles; in others spruce piles. In the case of bearing piles for buildings, it is, of course, necessary to their preservation that they should be below the ground-water level.

Of the large variety of pile-driving machines employed, some are for use upon the water, others on the land and others for cars for transportation upon railroads. In Boston the style known as "The Boston Roller Machine" is generally used; in other cities the swivel machine is frequently seen. The engine should have two drums, one for the purpose of hoisting the pile and the other for hoisting the hammer; and it should by all means have friction-drums. The hammer is sometimes a heavy piece of oak, and at other times a long, slim piece of wood, for the purpose of driving piles in a trench, with the driving machine upon the surface of the ground. In Boston a few years ago a common hammer weighed from 1,500 to 1,800 pounds. At present they vary from 2,000 to 2,500 pounds. In the vicinity of New York hammers weighing 4,000 pounds predominate. In other parts of the country hammers as heavy as 7,000 pounds are used. In Chicago steam-hammers are largely used, but they are not seen very frequently in the East. The hammer-line is sometimes attached direct to the hammer and at other times to an automatic clutch, which is detached from the hammer when the blow is struck. The former arrangement is vastly preferable for rapid and economical driving. As a rule, engineers' specifications require too much resistance before a pile is considered to be sufficiently well driven. My own experience is that with spruce piles, when the penetration is less than about 1 or 1½ inch per blow, there is very serious danger of permanently crippling the pile, and that, although slighter penetrations are prescribed, the custom is to accept a penetration of 2 to 3 inches on the average. Very frequently a penetration of 8 inches or a foot is obtained at the last blow, and if the pile is allowed to stand for twenty-four hours only a fraction of an inch can be obtained under the same conditions.

In order to determine the proper lengths of piles, there are various methods of endeavoring to ascertain the character of the material through which they are expected to be driven. Sounding-rods are sometimes forced into the ground, borings are sometimes made and test piles are driven. I consider the latter method preferable, if only one method is used, but should desire borings in addition if possible.

I consider the *Engineering News* formula the best formula for ascertaining the approximate supporting power of a pile. This is based upon the fall of the hammer free from the hammer-line, which, as above stated, is not customary; and allowance must be made for the friction of the rope while the hammer is descending.

Piles are shod with cast-iron shoes, sheet-iron points, steel points with welded straps and various other appliances. All these are generally unsatisfactory, the blow of the hammer being, in most instances, sufficient to very quickly detach any shoe. It is better in such instances to do without the pile altogether.

It is not wise to trust in the slightest to the value of pile foundations as a lateral support; in almost every instance where this is done the engineer will come to grief. The supporting power may be first-class, but the value for a side push is practically nothing.

Experience has satisfied me that piles should not be cut off with an axe after being driven. The best thing is an ordinary cross-cut saw, upon two straight-edge guides attached to the piles, whenever the cutting can be done in the open air. The next best thing is a circular saw upon a rigid support. If a circular saw is used from the leaders of a water pile-driver the result will be most unsatisfactory, without the closest kind of a watch; even with the cutting 2 feet under water, the grade of cut-off will vary at least 1 inch, after watching the work very carefully. In deep water the grade will vary several inches after doing the best that can be done.

Both square caps, drift-bolted to the heads of piles, and clamp caps, clamped to the heads of piles, are used for capping. The latter should be avoided if possible. In the case of pile foundations for retaining-walls, where the capping comes below water-level, it is better not to try to bring the piles into line and cap them, but to sink a solid platform, made of at least three courses of timber. In this case the platform will rest upon all piles and upon the entire head of each pile. These courses of timber may vary in thickness to suit the circumstances.

For retaining-walls and sea-walls, as well as for bridge abutments, it is absolutely necessary that there should be an ample quantity of rip-rap, or bracing of some sort, against the heads of the piles, to resist lateral pressure. Usually insufficient rip-rap is placed, and a movement takes place, greatly disfiguring the walls.

In the case of pile trestles, first-class sway-bracing is absolutely necessary. In some of the older work in New England it was customary to omit the sway-bracing and to put in, between the bents, what is known as lateral bracing, just under the floor, similar to the lateral bracing in the panels of an ordinary bridge. The sway-bracing will not only accomplish the same result but immensely stiffen the work.

Where exposed to the ravages of sea-worms, it is necessary to protect piles by creosoting them, or by covering them with some substance to shut out the worms. This is sometimes done with ordinary vitrified pipe, slipped over the heads of the piles, the intervening space being filled with cement-mortar. In some instances the piles are coppered. I know of one place where the piles were driven full of small shingle or lath nails, driven so close together that it was impossible for the worms to get in between the nails.

I do not believe in sharpening the points of piles before driving, but think pains should be taken to have the tips cut square to the axis of the pile. I have frequently seen piles cut off to grade before adjacent piles are driven, and afterwards, when driving the latter, have seen the piles rise from 2 to 3 inches, showing that the ground between the piles is thoroughly compacted, and that there is no room for it to move except in a vertical direction, which is the line of least resistance.

The proper load for piles is frequently discussed, and sometimes without any reference to the kind of pile or the conditions at hand. If a large oak pile is used, perhaps it would be safe to assume that it will carry 15 or 16 tons — perhaps sometimes as high as 20 tons; but if small piles are used it is sometimes wise to restrict the load to as little as 6 tons. A hard-and-fast rule should not be laid down.

In calculating the load on piles used under railroad-bridge abutments there is much divergence of views. Some calculate the dead load of the masonry that is to be carried, while others include the train loads and the weight of the bridges. In pier work, buried underground, it is hardly ever considered that the pier takes a considerable load from the surrounding earth. All these matters must be carefully thought of before assuming the proper load for the piles.

Once in a while it becomes necessary to use what is known as a follower, but I have never yet seen a follower that gave very satisfactory results. I always avoid them wherever possible.

Some specifications require that the bark shall be stripped from the piles. Except in a few instances, I do not think this is of much consequence one way or the other. It is better, if possible, to avoid the expense.

The following instances of pile-driving, in work with which I have been connected, may be of interest: —

In Portland, Oregon, it was necessary at one time to build trestle approaches on each bank of the Willimette River, for the purpose of transferring cars from the railroad to the ferry-boat. The range of high and low water in this instance was about 30 feet. The trestle inclines had to be built to cover this range. They were built at a time when the water was about at a mid stage. The slope of the banks toward the channel was about 45°, and consisted of hard-pan, or cemented gravel. It was not possible, with the time and facilities at hand, to build masonry upon this hard-pan. The trestle inclines were necessarily pile structures, and it was impossible to drive the piles upon one side of the river into the cemented gravel or hard-pan. Cast-iron pot shoes were made, weighing some 200 pounds each, if I remember rightly. These were fastened to the points of the piles, and in the bottom of the shoe there was placed a steel spike about 2 inches in diameter and 2 feet long. The only part of this pile that was expected we could get into the ground was the steel spike; and, as soon as the steel spike was in the hard-pan, it was necessary to fasten the pile temporarily, so that it would remain in position before the pile-driver let go of it. These inclines were thus built and served their purpose for several years. The foregoing is a condition not usually met with.

At the Thames River Bridge, in New London, one of the piers, supported by piles, settled. The weight per pile was about 19 tons. These were spruce piles of ordinary lengths, driven into mud, sand and gravel, and, according to the inspector's books, were driven to "absolute resistance." The pier, however, settled about 15 inches, piles and all, and was stopped only by transferring some of the load to additional piles driven around the pier, reducing the load per pile to about 13 tons.

On the Jersey Junction Railroad, at Newark Avenue, Jersey City, as engineer in charge, I had occasion to drive some piles into the surface of the street to support temporarily a large water-pipe, afterwards excavating the street for the passage of a railroad beneath it. The piles were well driven, and supposed to be in good shape. The supports for the water-pipe were placed, and the street was dug out. It was found that about half of these piles were ruined in the driving; some were broken off square and the butt driven down alongside of the tips. One pile in particular encountered a large flat rock about 16 feet under ground, but the pile was supposed to have been driven properly. When this rock was reached it was found that the fibres of this pile were anywhere within 15 feet of it, off in a horizontal direction.

Another instance of a similar character occurred at Atwell's Avenue railroad bridge, Providence, where a number of spruce piles were driven into ordinary sand, to carry a temporary bridge while excavation should be made for the passage of the railroad beneath. The result was similar to that in the Newark Avenue incident.

At another point in Providence where piles were driven for temporary support for railroad tracks over a sewer trench, it was found impossible to drive black-oak piles with any satisfaction. The sticks were so irregular in shape and so covered with knots that the ordinary machine would not drive them into the ground. Spruce piles were substituted, and carefully selected for their straightness and smoothness, and these were driven where it was impossible to drive the oak piles.

It is quite probable that if we could excavate around all the piles that have been driven in Boston within the last two years we should be utterly surprised at the appearance of the sticks. I doubt not that many of them would be found to be broken, crushed and far different from what is usually expected.

Upon the Ulster division of the West Shore Railroad we had a specification which called for something like ½-inch penetration at the last blow. Piles were driven under this specification, and the penetration was nearer a foot at the last blow. The next day the pile-driving machine was placed over the piles, and the penetration on the first one or two blows was within the limit of the specifications; consequently the contractor held that the pile-driving was within the limits of the specifications, and he was sustained.

At another point, called "Crumb Elbow," I had occasion to take some rod soundings to ascertain the proper length of piles to order for a trestle across a mud cove. We had eight men in the party, but, owing to the stiff nature of the mud, which was really clay, we were unable to penetrate with the sounding rod exceeding 7 feet with our utmost endeavors, and concluded to send the pile-driver and drive test piles. In the same spot we found no difficulty in driving 70-foot piles into this clay. Ever since that experience I have not had much faith in rod soundings.

Upon one piece of work, where a steam hammer was used, we found that the heads of the piles were not quite large enough and that they worked up into a ring, through which the plunger of the hammer descended. To avoid difficulty the workmen cut off small planks and laid them on the head of the pile, and went on with the work; but it was soon discovered that these small blocks of wood were ground up under the blow of the hammer and driven right into the middle of the head of the pile, frequently splitting the pile for some distance down. This practice had to be abandoned.

As piles are usually delivered upon the work, the heads are bevelled just as they come from the forest. I have noticed that, to avoid too much sawing, contractors will sometimes cut off just a little of the head and hammer about one-quarter of the area of the whole pile, sometimes forcing this small area right down into the head of the pile, splitting the pile as above described.

In the foundations of the Providence passenger-station, and the accompanying bridges, we used about 17,000 piles. This is a friction ground, and the piles were of spruce, averaging about 45 feet in length. At the river bridge we drove a large number of batter piles, and after many trials concluded that we could not drive batter piles with a greater inclination than 3 inches per foot out of the vertical with any satisfaction. Some of these piles were driven with a steam-hammer and some in the ordinary way.

At the Harbor Junction pier of the New Haven road, in Providence harbor, we placed a foundation for a coal-pocket upon yellow-pine piles about 70 feet in length, which piles settled with the weight only of a 4,000-pound hammer about 30 feet into the mud for a start, and the remaining distance 4 and 5 feet at a blow, the hammer falling a very moderate distance; as I remember it, not much more than 6 feet. Trying these piles the following day proved that the penetration was within the ordinary limits, and the coal-pockets were built upon them; and they have never given any trouble.

At the Wilkesbarre pier, at Providence harbor, where another coal-pocket was constructed, we felt safe in cutting the piles off at half-tide, believing that they were protected against decay by the constant wetting of the rise and fall of the tide. At this same place there was timber that had been in use twenty years, with no evidence of decay when placed at the same height. The range of the tide at this place is about 5 feet.

At the new Southern Station in Boston there will be used about 44,000 spruce piles for bearing piles, and about 5,000 sheet piles. This is a friction ground, and piles are ordinary spruce material, ranging from 25 to 45 feet in length. In this instance we loaded three piles, for a test, with 60 tons of pig-iron, amounting to about 20 tons per pile, with no resulting settlement. I have a photograph here of the piles with their load of pig-iron; should have put on more, but we got the iron so high we were afraid it would fall over. The specified loading was 10 tons per pile. In this work there has been some night-work on pile-driving, but my advice is to avoid it if possible: it is dangerous work.

I have had a great deal of trouble in forcing foremen to keep the machines and leaders plumb. It makes an immense difference in driving the pile, and we have had to be continually after them to plumb up the leaders.

Hardly a day passes but some one rushes into the office and states that in a certain place we are driving the piles too deep; that we have got through a hard stratum into a poor stratum, forgetting that, in friction ground, what we are after is a good deal of friction.

From my experience, I feel justified in saying that no hard-and-fast rules can properly be laid down for procedure, but that each new job requires a study of its conditions, and a ruling to suit those conditions.

[To be concluded.]

WATER-SUPPLY FROM SAND DUNES IN THE NETHERLANDS.

UNDER date of April 18, 1898, U. S. Consul G. J. Corey, of Amsterdam, transmits memoranda regarding the water-supply of that city, as collected from the sand dunes bordering the sea.

The dunes consist of sand blown up from the seashore. Their basis consists of sand, also, although this is mixed with peat at some points, and at the sea-level layers of compressed peat are frequently found. It is noticeable that these peat layers are never found on the sides of the dunes next the sea.

The rainfall in the dunes percolates through the sand and flows landward and seaward. The surface is therefore a cone whose apex is the summit of the dune, which, sloping both ways, forms a continuous watershed. In the dunes near Haarlem, where they have a width of about 4 kilometres (nearly 2½ miles), the summits are 20 to 23 feet above sea-level.

Not only is the dune water fresh above sea-level, but it is perfectly fresh to a depth of 20 metres (66.6 feet) below sea-level. This fresh water being found at such depth under the dunes, while the water at the same depth, in the immediate neighborhood, is salt, goes to prove that either the subsoil must be based on fresh water, the hydraulic pressure of the dune water preventing sea impregnation, or that the water, originally salt, has become freshened by this dune-water pressure. In any case, this dune water is a vast reservoir of fresh water.

The quantity of rain-water percolating through these dunes, and contributing to the ground-water streams, is estimated at 0.30 metre (1.191 inches) per annum. From a range of dunes 2½ miles in width the quantity of water thus percolating is estimated at 240,000,000 gallons per kilometre (0.62137 mile) in length of dunes. This quantity, however, cannot be drawn off, as a certain amount must be permitted to flow inward and outward to counteract the pressure of the salt-water from the sea and the land.

For the Amsterdam water-works the water is collected in open canals, which are never excavated below sea-level. For The Hague water-works it is collected in stoneware pipes, in a bed of shells, laid at a depth of 13 feet below sea-level. In Haarlem, on the other hand, the water will be collected in wells of 50 to 66 feet below sea-level (these works are not yet completed).

The water contains much iron in solution, and for this reason, as well as for other reasons, it is filtered at the three places mentioned before being pumped into the mains. When the water is collected in wells or in pipes, it must be aërated before being filtered.

The question of securing a permanent supply of fresh water from below sea-level is not, it appears to me, infallibly settled. Cases which have come within my personal cognizance would seem to cast a doubt upon this low supply. I have known wells 10 to 40 metres (32.8 feet to 131.2 feet) to supply perfectly fresh water for a time; but after a certain period of pumping, the water became so salt as to render it unfit for use. Whether these cases are exceptions remains to be proven by time, the deep drainage system having been in operation only a comparatively short period.

A Warning for Bell-owners. — An exciting incident in a belfry took place recently while the bell-ringers were chiming from the Curfew Tower of Windsor Castle the last joyous peal in honor of the Duke of York's birthday. The axle on which the big tenor bell swung suddenly broke, and the huge mass of metal fell to the strong old beams below, where it remained. The ringers, at the time of the occurrence, were, happily, in the lower chamber. The bell was cast early in the sixteenth century, and weighs about thirty-six hundredweight. — *Boston Transcript.*

BOOKS AND PAPERS

THE discussion which was recently aroused in the Royal Institute of British Architects by the report of the holder of the Godwin Bursary anent the differences between American and English methods is recalled by a perusal of a recent work[1] upon the subject of heating and ventilation, which, viewed from the American standpoint, would seem to be impracticable and inefficient where it claims to be most practicable, for the reason that it is entirely a study of the subject from an English standpoint. The severe conditions which we are obliged to meet in this country do not exist in Europe. Consequently, the problem of the heating engineer is very much simplified for our foreign cousins, and the book in question, dealing entirely with English practice, has an incomplete air which obscures its real worth. The fundamental facts of the science are set forth in very appreciable and systematic shape, and, though admittedly a reprint or revision of an earlier work, can be read in a general sense with a great deal of profit. It is only in the practical application of the theories that it falls far short of being valuable on our side of the water. As a treatise on the theory of the science it is of very tangible value.

THE American natural cements have found an eloquent friend in Mr. Cummings, who, in an interesting and valuable book,[2] has sounded the praises that they merit, and described the virtues which they unquestionably possess, and which have been too much overshadowed of late by the claims of the artificial cements.

American engineers and architects of experience, familiar with the uncertainties of the Portlands, have long shown what their clients consider a strange indifference to high tensile tests, in preferring, for work where very great strength is not required, the best native cements, which could be relied upon to stay where they were put, to refrain from swelling or cracking, and to go on quietly increasing in strength and hardness from year to year, without fear of sudden disintegration; and this work gives the reasons for their preference.

Perhaps naturally, Mr. Cummings dwells upon defects in artificial cements which may be, and are, in the best brands, avoided; but, although the first-class Portland cements are, in the hands of men who know how to judge and use them, now excellent and reliable materials, the picture which Mr. Cummings draws of the plastered, slag-mixed, quick-setting varieties, as compared with the uniform and easily-managed natural cements, is not without truth.

It should be said, however, that the manufacture of natural cements in this country has been very greatly improved within the past twenty years, and, by better burning and grinding, and more careful mixing, the product is now, in average quality, far superior to the brands which were regarded, twenty years ago, as the best in the market. The steps by which this development has been secured, and the details of the present manufacture of native cements, are well described in the book, and a valuable, and most timely, discussion of the important question of testing will attract the professional reader.

Looking at Mr. Cummings's work as an account of the American manufacture of natural cements, we are a little disposed to regret that the historical part of his description should have been so brief. While the better-known varieties, such as the Rosendale, Akron and Louisville, are treated of at some length, certain sorts, which have had a fleeting reputation, and, in many cases, possessed special interest, are not mentioned. For example, many architects will remember the substance called, if we are not mistaken, the "Diamond lime," which was made by burning a beautiful pink marble. The product of the burning was a black lime, almost as dark as cola, which slaked with great fury, forming a blackish paste. It was claimed that this paste would set under water; but its behavior in slaking did not indicate the possession of any hydraulic qualities, and, as the color made the material totally unsuitable for plastering or most sorts of masonwork, it never came into extensive use, so far as we know.

Another variety of lime, much used in New York twenty or twenty-five years ago, was the "ground lime," which was employed for brick and stone work, in distinction from plastering, for which "lump lime," was unsuited. The ground lime was, we believe, imagined to have something of the hydraulic quality of the Aberhaw or lias limes of England, but it has long been superseded by mixtures of lump-lime paste and Rosendale cement, and is remembered only as a curiosity which, nevertheless, has a certain historical interest. Still a third native cement, which should not be lost sight of, is the magnesia cement used, years ago, by the Union Stone Company, of Massachusetts, in making emery-wheels. Reid, if we are not mistaken, says that pure carbonate of magnesia forms, when burned, the strongest cement known, whether natural or artificial.

The Union Stone Company is said to have owned a quarry of magnesite, which it calcined for its own use; but whether this, or any similar cement, is now made, and if so, what is its quality, we do not know. There has been, of late years, a serious prejudice against magnesia as a component of Portland cements. Mr. Cummings considers this prejudice unfounded, and gives reasons for his opinion; but he does not mention the cements of pure magnesia, the investigation of which would be of great value.

Some time, perhaps, another expert will take up these branches of the subject, about which there is still much to be learned and said. So far as the outside world is concerned, the thing for which the public now waits most anxiously is, we imagine, a strong, and not too costly, white cement, either natural or artificial. White Portland cement was advertised years ago in Germany, and is said to have been made in this country; but none of it has come into general use, and the artificial-stone industry still awaits a material which would be of incalculable value to it.

[1] "*Hood on Warming Buildings.*" A practical treatise upon warming buildings by hot water and upon heat and heating appliances in general, with an enquiry respecting ventilation, the cause and action of draughts in chimneys or flues, and the laws relating to combustion. By Chas. Hood, F. R. S., F. R. A. S., etc. Rewritten by Frederick Dye, author of Hot-water Supply. London: E. & F. N. Spon, Limited, 125 Strand. New York: Spon & Chamberlain, 12 Cortlandt St. 1897.

[2] "*American Cements.*" By Uriah Cummings. Boston: Rogers & Manson, 1898.

THE ILLUSTRATIONS

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

GALLERY IN THE REPRESENTATIVES' CHAMBER: NEW YORK STATE CAPITOL, ALBANY, N. Y. MR. LEOPOLD EIDLITZ, ARCHITECT, NEW YORK, N. Y.

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

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THE CATHEDRAL, BAYEUX, FRANCE.

THE CHURCH OF NOTRE DAME, ST. LÔ, FRANCE.

SEE "An Architectural 'Summer School' Abroad" elsewhere in this issue.

[The following named illustrations may be found by reference to our advertising pages.]

EQUESTRIAN STATUES: TWO PLATES.

AT the time of bringing to a period the imperfect but, perhaps, too voluminous series of papers dealing with "Equestrian Monuments," we said that it seemed best to stop even though we had on hand much further material in various stages of preparation. Coming across some of these prepared but unused cuts the other day, it occurred to us that they might be used in this way to some advantage without boring our readers with the history of each subject shown.

[Additional Illustrations in the International Edition.]

DETAIL OF THE HOUSE STAIRCASE: NEW YORK STATE CAPITOL, ALBANY, N. Y. MR. LEOPOLD EIDLITZ, ARCHITECT, NEW YORK, N. Y.

[Gelatine Print.]

THE HOUSE READING-ROOM: LIBRARY OF CONGRESS, WASHINGTON, D. C. ARCHITECTS, MESSRS. SMITHMEYER & PELZ; P. J. PELZ; E. P. CASEY.

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COMMUNICATIONS

[*The editors cannot pay attention to demands of correspondents who forget to give their names and addresses as guaranty of good faith; nor do they hold themselves responsible for opinions expressed by their correspondents.*]

VAULT-ROOM FOR PUBLIC RECORDS.

Boston, Mass., July 15, 1893.

To the Editors of the American Architect: —

Dear Sirs, — I would ask the use of your columns in the interest of the public records.

It is a matter of great regret to find how little attention the architects have given to providing sufficient vault room in the buildings intended for use of public officers who must keep records. Town buildings provided with rooms for the various departments are found with but one vault, usually for the use of the town-clerk, and that one of a capacity soon to be outgrown. For this the architects are not wholly to blame, for the town officers, as a rule, have cared little for the records, and their estimate of needed vault-room is based upon the comparatively few books in current use.

But the architects in many cases have shown great ignorance in the construction of vaults, locating them in dark, out-of-the-way places, which seemed unfit for other use, and building them without the slightest thought of ventilation. Many are built in cellars, the word vault having apparently been used in its sense of a tomb. The consequence is that many of the vaults, some in the finest buildings, are worthless, and as unfit for a record as a refrigerator would be, and books placed in them have dropped out of their covers in a few months.

Vaults should be constructed with double walls, with an air-space between, and ventilation into the air-space from within and without should be provided. Many simple devices can be used for this purpose.

The single vault in the small towns should have a floor-space of at least forty square feet. (Part of the shelving must have a depth of eighteen inches to accommodate the "valuation" books.) The vaults should increase in number and size according to the population of the town.

I should be glad to confer with architects or builders proposing to draw plans for town buildings. Robert T. Swan, *Commissioner.*

NOTES AND CLIPPINGS

Pneumatic Postal Tubes. — On this side of the Atlantic the pneumatic dispatch system has only been made use of for conveying very small packages, usually telegraphic messages, the largest tube in London being but 3 inches in diameter. It is true that a much larger tube was once laid in the Euston-road, but it never came into practical use. In America, on the other hand, the same method has been applied to conveying the mails to and from central and district offices, and also to connect the former with the principal railway stations. The pioneer line as adapted for mail matter was installed at Philadelphia in the winter of 1892–93, the tube in this case being 6 1-8 inches in diameter. It was originally intended to use wrought-iron pipes, but these proved ultimately unsuitable, and accordingly cast-iron water-pipes, bored out to 6 1-8 inches in diameter, were substituted. Special machines were improvised to do the work, and proved very satisfactory, no less than 6,000 feet being bored in the space of six weeks. The joints are made with lead, and caulked with oakum in the usual manner. The bends are made of solid drawn-brass tubing bent to the desired radius. The compressor, in this case, was of 30 horse-power, and delivered the air at a pressure of 6 pounds per square inch. The practice is to keep a constant flow of air through the line, the carriers being inserted through a small air-lock of simple construction. The velocity attained by the carrier is very great, so that in withdrawing it, at either a terminal or intermediate station, use is made of air-cushions to bring the carrier gently to rest. Since the Philadelphia lines were opened others have been completed at New York and Boston, the tubes in these cases being 8 1-8 inches in diameter. They are of cast-iron, with spigot and socket ends, and cast in 12-foot lengths. A large plant for boring them to size has been laid down at the works of the Batcheller Pneumatic Tube Company, Philadelphia, where there are twenty-four special boring machines at work. The tubes are bored in the vertical position, the operation being effected at one cut. The diameter as cast is 8 inches, and the finished size 8 1-8 inches. The tube forms its own guide for the tool, a certain amount of flexibility in the boring head arrangements being provided to this end, as absolute straightness is not essential in the finished tube. The sockets and spigots are also machined. After finishing each tube is gauged, the toleration allowed being about 1-100 inch. The carriers consist of thin steel cylinders 24 inches long and 7 inches in diameter. They are prepared with cotton rings, and weigh 30 pounds when filled with mail matter. The principal line at present at work is that between the main Post-office, New York, and the Grand Central Railroad Depot, and it includes three intermediate stations. These latter are fitted with automatic selecting devices by means of which a carrier intended for any particular station is automatically delivered there. The selection is effected by the diameter of a flat circular metal disc placed in front of the carrier. This completes an electric current as it approaches the station to which it should be delivered, and the current then operates a pneumatic relay, switching the carrier into the receiver. A great saving of time is effected by the adoption of this system of handling mail matter. The mail-bags can be kept open at the offices until but three or four minutes before the time fixed for the departure of the trains, and the saving in the case of the incoming mails is even greater. — *Engineering.*

The New Street between the Strand and Holborn. — At last, after nine years of agitation, London is seemingly on the way to get its big street cut through from Holborn to the Strand. The pressing necessity for such a thoroughfare has dimly troubled three or four generations of Londoners, and it was one of the first subjects the new County Council took up. But all previous attempts to secure Parliament's assent failed, because the Council coupled the principle of betterment with the project. This idea of making the landlords, who are to be enriched by the improvement, pay some share of its cost, has now been abandoned, and so the new bill had no difficulty in passing. To outsiders, however, the main interest lies in the fact that of the total estimated cost of three and a half million dollars, one and a half is to be devoted to rehousing the working population turned out of their homes. These are 3,000 in number, and their vocations are such that they cannot be transplanted to cheap and remote suburbs. The Council intends to rehouse them within a mile of their present quarters, and the cost of doing this will be for each artisan and his family seven thousand dollars. Of course, the highest rent he will be able to pay from his wages will represent a heavy interest loss on this capital, but nobody appears to protest on this ground. It raises indirectly, however, the whole formidable problem of warehouse and commercial areas continually expanding in the centres of great cities and driving the populations away to outer slum rings. There is a considerable following in the Council for the principle of the community reserving a portion of all these high-priced areas, and by comprehensive building schemes to secure that they do not become uninhabited. Tentative small experiments in this direction have been made for years, but nothing at all on this scale. — *N. Y. Times.*

Sawdust, Smoke and Frost. — The following letter, from Mr. T. M. Richards of Boca Ratone, Fla., to Mr. James E. Ingraham, Land Commissioner of the Florida East-Coast Railway, will prove of interest to fruit-growers throughout the State: Referring to our conversation concerning protection against frost for vegetables and pineapples, I would suggest the plan commonly in use, and very successfully so, in parts of Carolina and Virginia, as follows: In the fall, some weeks before danger of cold, one should procure a supply of pine sawdust from the mills. Around each field of not more than four acres' area (and two acres is better), the sawdust should be deposited in conical piles, fifty feet apart, and two bushels of sawdust in each heap. These heaps should be placed all the way around each lot, as the wind may shift to any quarter. When the thermometer shows danger of frost, at three o'clock in the morning let men take cans of common kerosene and go to each alternate heap, make a little opening in the top of the heap, pour in one or two tablespoonfuls of kerosene, and set it on fire. It will not blaze much, but by giving a little time for the oil to spread before firing, the sawdust will smoulder and burn slowly until it is all consumed, all the while smoking forth volumes of thick smoke, which will protect the plants from the direct rays of the sun, and prevent them from scalding until frost is slowly drawn out. Last winter's freeze in many instances demonstrated that the sun was responsible for the damage in nearly every case. Wherever there was shade through the forenoon no plants were injured. This is also the case among the orange groves in the interior. This plan has proved extremely successful where tried. — *Jacksonville (Fla.) Times-Union.*

Moving the Church of St. John of Jerusalem, London. — An extraordinary feat in church removal will soon be witnessed in London. Hidden away in the quiet recess of Great Ormond Street, Bloomsbury, is an unpretentious building externally, which in reality is one of the most beautiful Roman Catholic churches in the metropolis. The extension of the Hospital for Sick Children, close by, hampered the authorities of the smaller institutions in a scheme of enlargement they had devised, and they accordingly agreed to sell their whole property to the other hospital and erect a new building for themselves in St. John's Wood. This involved the demolition or removal of the Church of St. John of Jerusalem, and the question, after careful consideration by Cardinal Vaughn, was referred for final decision to the Pope, who has now authorized the church to be taken down stone by stone and re-erected beside the new hospital in the district mentioned. The beautiful altar and magnificent carving which the church contains will be transferred bodily, so that on its new site the building, externally and internally, will have exactly the same appearance as it has at present. — *London Telegraph.*

Dangerous Incandescent Lamps. — We have more than once commented in these columns upon the not too well-known fact that electric glow-lamps are sufficiently hot to char and fire an inflammable substance with which they may be placed in contact. There is a prevalent idea that such lamps give off no heat; but this is far from being correct; indeed, in Germany so many fires have occurred in shop-windows from placing goods in touch with these lamps that the police have issued a notice containing certain precautions which should be observed. All such lamps, they suggest, should be furnished with globes, shades, or wire guards, so that the lamps cannot themselves come into contact with goods, and in every case the covering should be so arranged that that there is free access of air. In the case of arc-lamps, which will occasionally drop sparks of white-hot carbon, it is recommended that each lamp should be provided with a metal ash-tray. Lastly, all wires carried within shop-windows should be most carefully insulated. — *Chambers Journal.*

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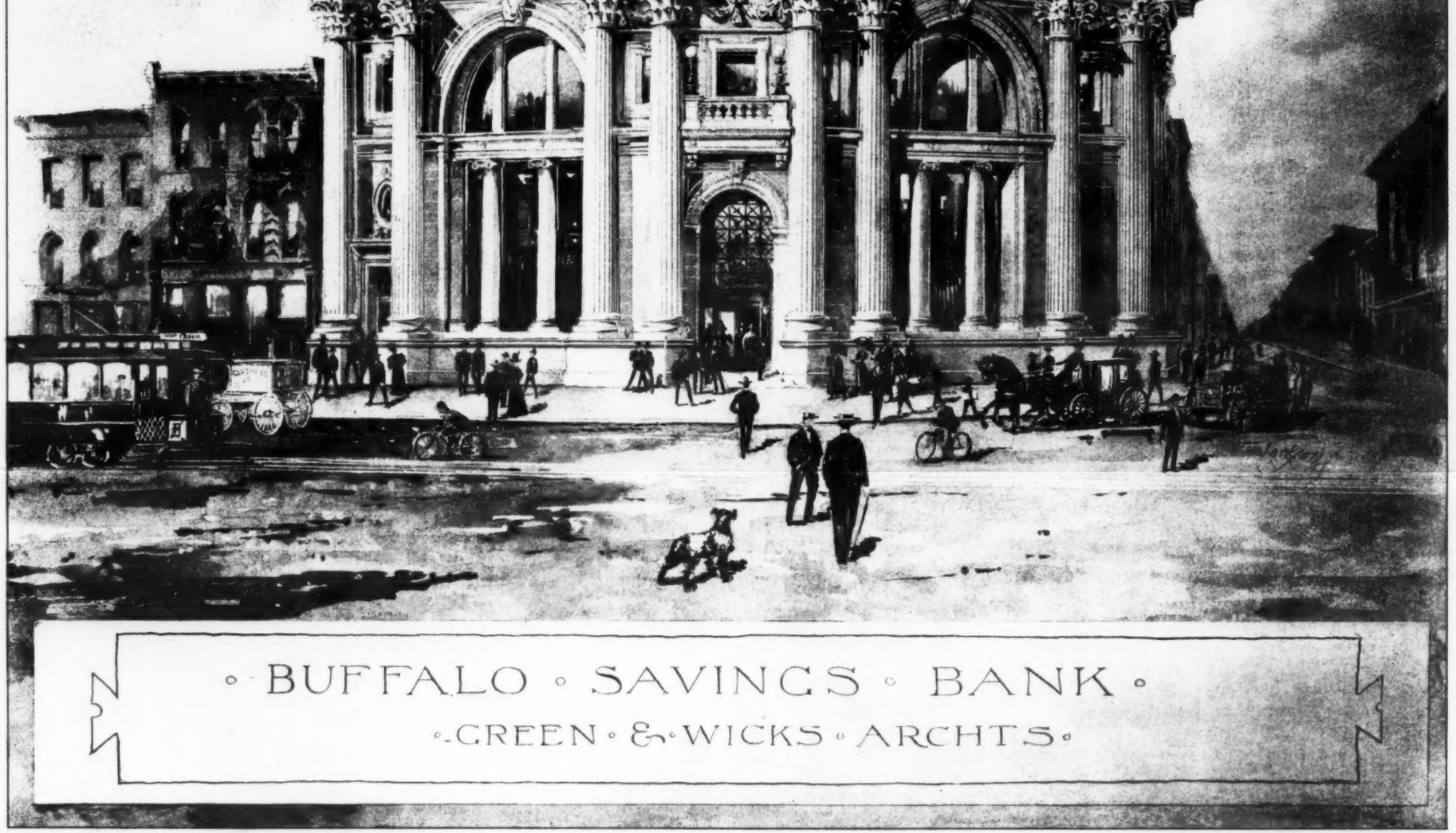

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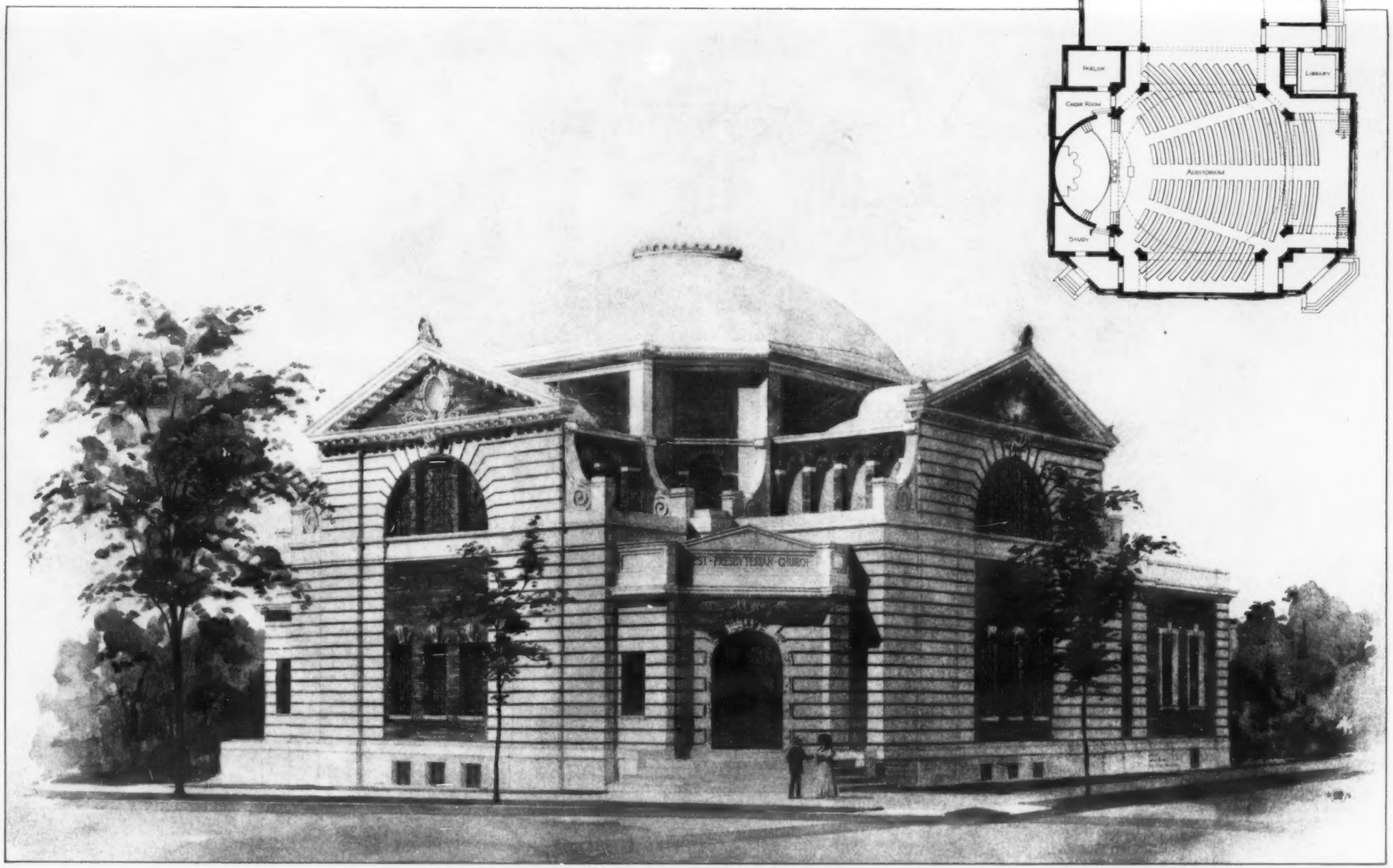

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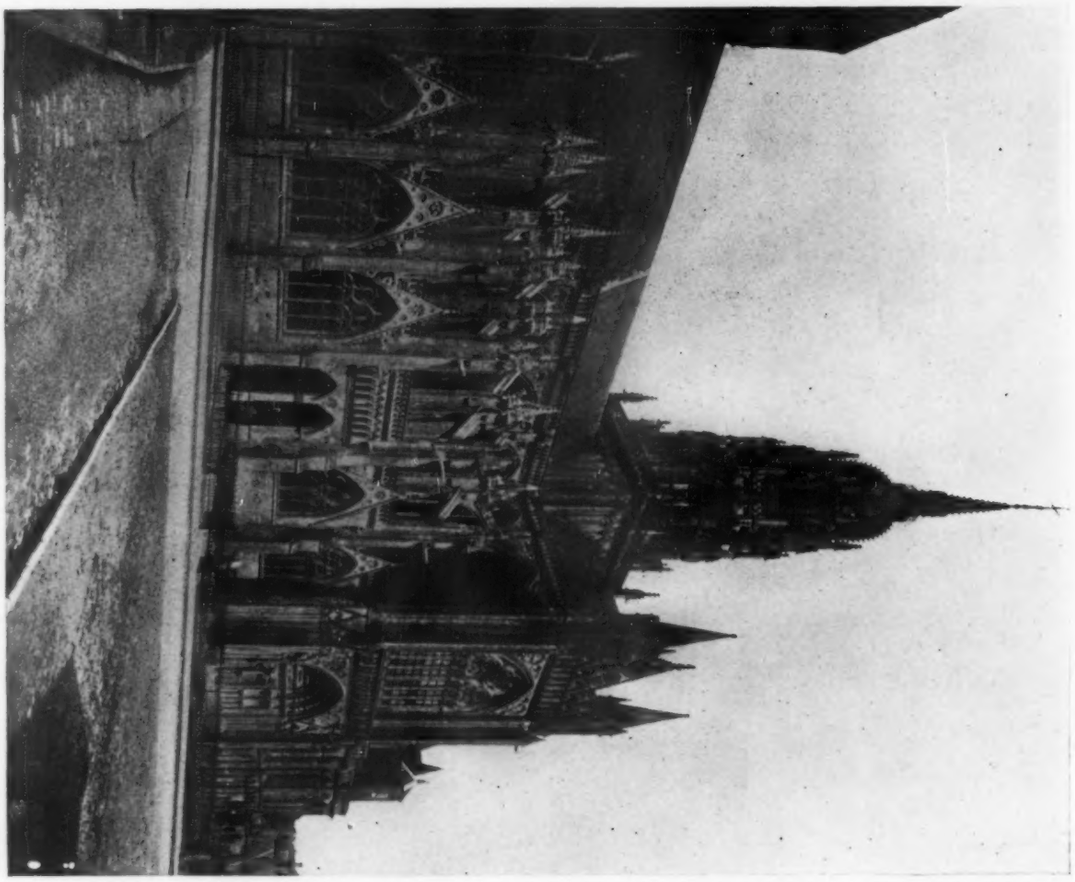

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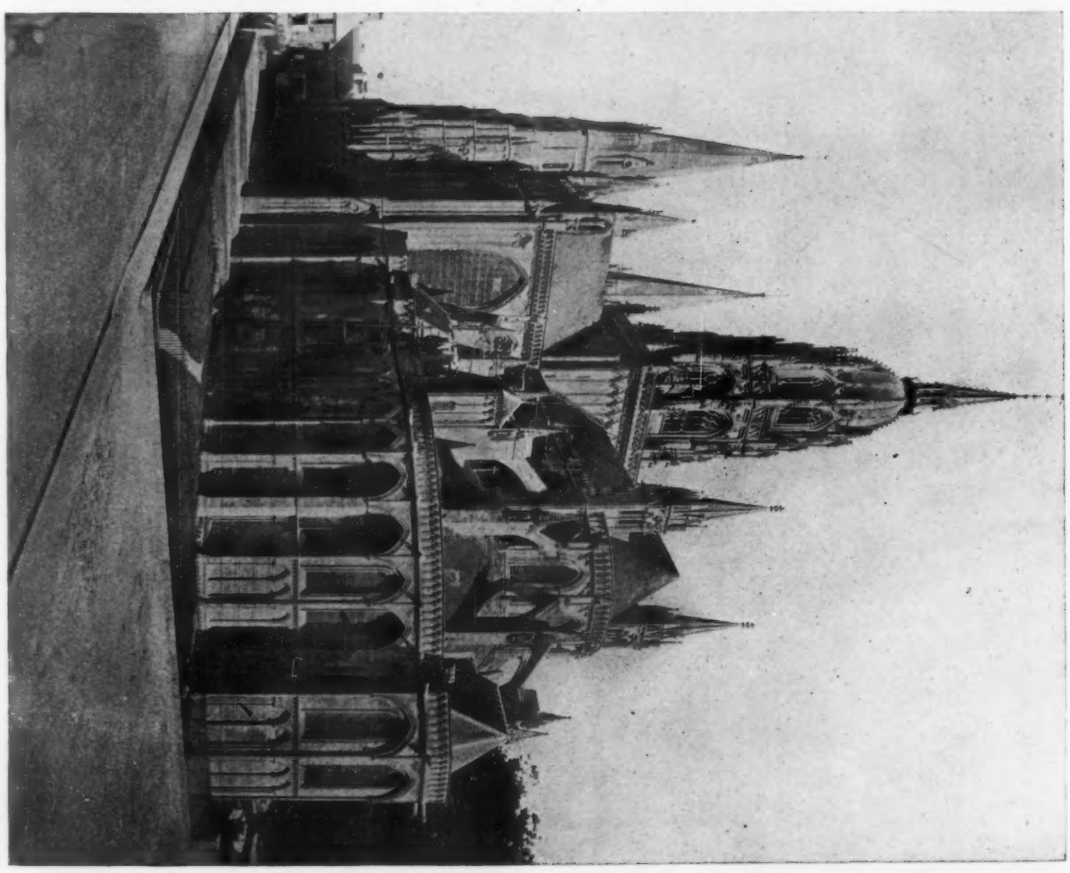

From the East.

The Cathedral, Bayeux, Calvados, France.

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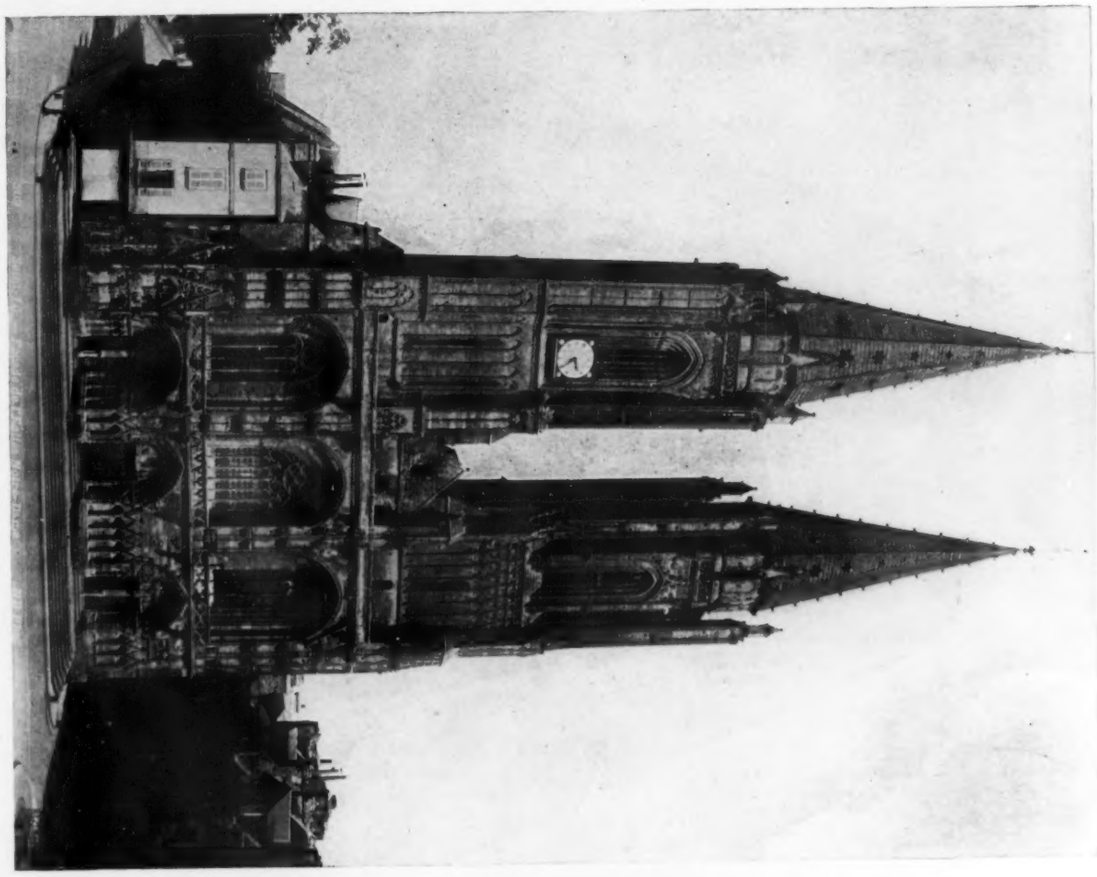

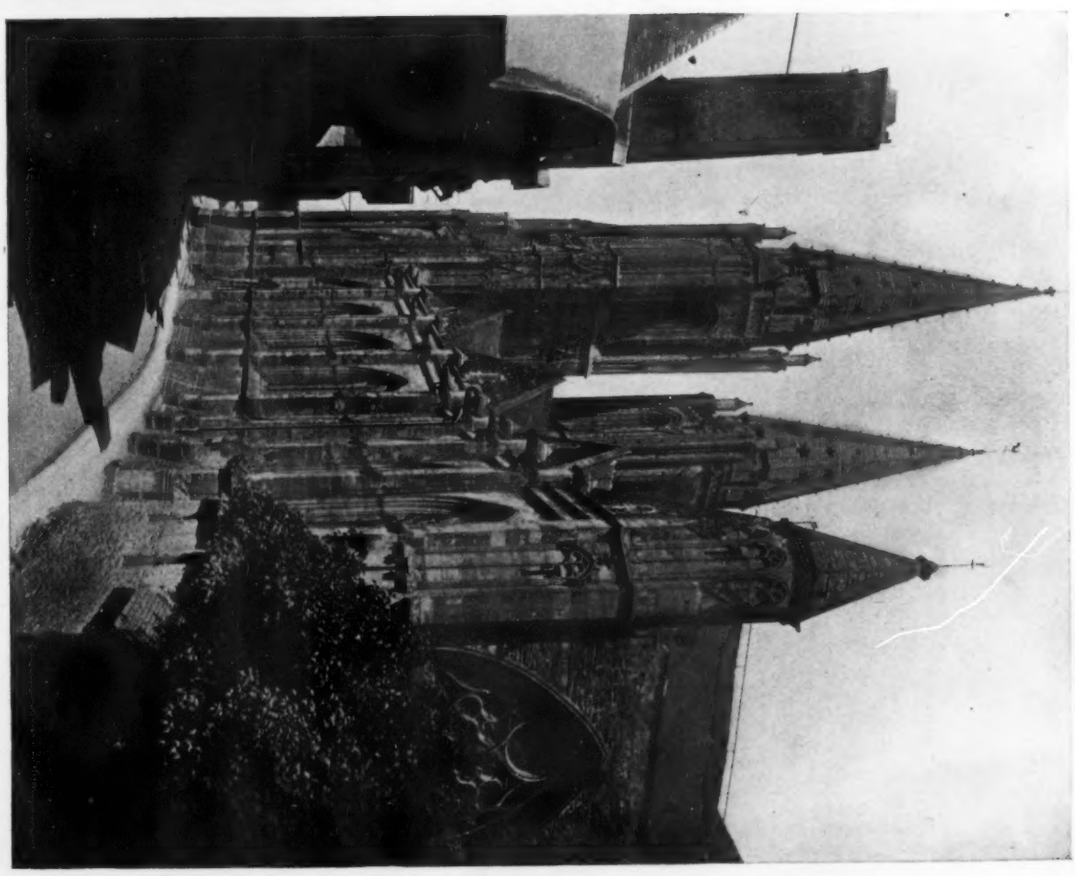

THE CHURCH OF NOTRE DAME, ST. LO, MANCHE, FRANCE.