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THE facts that have come out concerning the boiler of the steamer *Adelphi*, which burst at Norwalk a short time ago and killed a dozen passengers or more, enforce the lesson of frequent building accidents, and show us again the precariousness of government inspection. The boiler had been inspected in June and certified as safe. Three months after, it was torn open by a pressure of steam which was less, the engineer declares, than it was allowed to carry. On examination it appears that the boiler was worn and patched and rusted away, into an obviously dangerous condition. A new patch had indeed been put upon it between the inspection and the accident, and still plates were left, it is said, which were worn to the thinness of pasteboard. One naturally asks, How came a government inspector to give a certificate to a boiler which was in a state to require patching in two months, and to burst in a month after that? And what sort of examination did he make? The inspector has been suspended, awaiting an investigation, and pending this we shall not know whether he complied with the letter of his instructions or not. The hydrostatic test prescribed by the regulations has never commanded confidence, for the plain reason that, like any straining test, it may itself permanently injure the structure it tries; but no working substitute has yet been devised for it. It is clear at least that all such tests are likely to be delusive unless they are supplemented by careful subsequent examination. Whether in the case of the *Adelphi* the boiler was tested by pressure or not, an inspection which did not discover that it would not endure two months' wear without repairs must be pronounced worthless. The fall of Mr. Livermore's unfinished dwelling-house on Broadway, New York, a short time before, is an indication among many that building inspections are often no better. A correspondent in another part of this paper suggests, in view of the overloading of buildings and the changes in their uses, that they should be rated and re-rated from time to time, like ships, for the amount of storage they are fit to carry. The suggestion is a useful one, and could doubtless do something to abate the dangers which are incurred through ignorance. Government inspections all tend, however, to one danger: they tempt owners to think that their responsibility is transferred to the government, or at least to act as if it were. Considering their fallible nature, then, it may be questioned whether they do not often do harm rather than good. They are necessary, nevertheless, and the only security is in having it thoroughly understood that they are simply precautionary, and by punishing both owners and inspectors alike with rigor when their carelessness leads to disaster.

THE Grand Jury of New York have, by a unanimous vote, declared that the Metropolitan Elevated Railroad of that city is "a most unfortunate mistake, and is a great calamity,"—"a gross violation of the rights of property-owners and residents in the vicinity of the line." The jury do not indict the road, but they present it before the courts "as a public nuisance in its unparalleled invasion of private rights and of public comfort, safety, and health; and they earnestly request the court to lay this presentment before the Honorable Attorney General of the State, and before the Legislature when it shall assemble, in

order that steps may be taken to redress an outrage which they are confident would never have been sanctioned had its enormity been realized." They do this unanimously, preferring the presentment to the last resort of a criminal indictment, and putting their trust in the courts and the Legislature to vindicate the rights of the people.

WE have no doubt that the Grand Jury are quite justified in their statement, nor that the building of the elevated roads was a mistake which would not have been allowed if its consequences had been realized beforehand; and that the invasion of private rights and the injury to health and comfort are such that, if they are not compensated, to call them an outrage is using language none too strong. Yet the roads are proved to be a great public convenience, and they, or some equivalent for them, must be accepted as a public necessity. The New York Elevated Road is reported to carry an average of nearly sixty thousand passengers daily, and the Metropolitan forty or fifty thousand,—perhaps together a hundred thousand. The *Tribune* says, perhaps a little cynically, "The sense of a selfish public will be that the few must suffer for the good of the many. Rapid transit roads are rendered a necessity by the conformation of New York Island, and no roads are so cheap as those on stilts." None are so cheap to those who build them, certainly, but when account is taken of the amount of property they destroy, and the injury they work to health and comfort, it may turn out, and we are inclined to think it will, that none are on the whole so dear. Here is the secret of the trouble, and the warning to other cities. The roads on stilts were adopted because they could be cheaply constructed, and the travel on them is therefore cheap to those who enjoy it at other people's expense. It is true that the few must sometimes suffer for the good of the many, and Americans are a little prone to the doctrine that a minority has no rights that a majority is bound to respect. Neither the public nor the courts are apt to make much account of the destruction of personal comfort; but to insist that the few must suffer in pocket for the many without compensation, when compensation can be made, is to carry things with a higher hand than we should expect to see allowed. Whether the roads are a mistake or not, it is not likely that the people of New York will consent now to give them up, and therefore it remains to fairly adjust the burden of expense. If the benefits are broad enough to include the whole city, the city may be fairly called upon to compensate the losers, and it may be found that this is the only remedy; but if the benefit is to one class of citizens, it is reasonable that this class should pay the cost. They will be called upon to pay it in the form of fares whenever authority shall compel the roads to compensate the damage they have done,—a thing which the courts will doubtless have abundant opportunity to do.

THERE is still another side to the question of the cost of elevated railways which New York especially illustrates, and which other cities will do well to consider. It is clear that the railways, as they now appear, are the ruin of the streets in which they run. If these are important streets, the loss is by no means limited to the persons whose property is upon them. To divert such streets from their natural uses is to diminish the actual capacity of the city. In a city as narrow as New York the sacrifice of two great longitudinal thoroughfares is a very serious one, not only to those who dwell or own or occupy upon them, but to the whole population, which is restricted in the space available for its business. The use of such thoroughfares as conduits for wayfarers is naturally but a small part of their function, though it may be the key to their other uses. The effect of giving them over to this purpose in such a city is to aggravate the very evils which quick transit is intended to cure, by still further narrowing the area of business and residence, and forcing it out into still more unmanageable length. And of this every inhabitant of the city shares the inconvenience. If this cannot be counteracted, it must be added to the other factors in the cost of the roads. It may be that, when all is accounted for, the value of the communication will justify the whole expenditure, but till this is done it is not safe to decide in their favor. Still less is it safe to assume that they are the necessary resort. The people of London, jealous of the comfort of their city, put their railway under ground; the people of New York, bent on immediate saving, carried theirs through the air. On the whole, the people of London seem to have been more suc-

cessful than those of New York. The London system is much more expensive to construct; the New York system bids fair to be in the long run the costliest method of communication that has ever been devised. The one creates property; the other destroys it. The one limits its discomforts to its passengers, and to the time they are in transit; the other permanently ruins the peace of whole streets full of inhabitants. In New York, however, the choice must probably be accepted as irrevocable, at least for our generation, and since the people have not been forehanded enough to adapt the railways to the thoroughfares, the next thing is to devise ways of adapting the thoroughfares as well as may be to the railways. Other cities will count the cost on all hands before they prefer the example of New York to that of London, or may be fortunate enough to discover some third system which will avoid the faults of both.

THERE is something peculiarly distasteful in the idea of a railroad up Vesuvius. It has come to that, however. A Neapolitan banker has got from his city government the right to run such a road up the mountain, and promises to have it ready for tourists in a few months. He will carry a double track on columns, or trestle-work, the up and down trains being connected by a wire rope passing over a drum, and worked by stationary engines. The trains will be light, consisting of four carriages, with four seats in each, the ascending one, of course, being balanced against the descending one. The sympathetic traveller has become used to railroads up Mount Washington and the Righi, and has consoled himself with the thought that at least by their means these places have become accessible to many appreciative persons to whom a three or four hours' ride or drive was an insurmountable impediment. But the half mile of track up which it is proposed to trundle the Vesuvian tourist will hardly be a real help to any but a few invalids, of whom it is no cynicism to say that they are better off below, and a crowd of lazy visitors, whose numbers the intelligent admirer of the mountain would take a justifiable pleasure in reducing. We may therefore be forgiven the pious hope that the enterprise will prove no more profitable to its projector than it is necessary. It is idle to protest against the tendency to make money by turning all the wonders of nature into raree-shows; yet one might expect the government of a great city to have respect for its most famous treasure. The truth is, there is a real loss in the value to the world of those natural features whose glory is their remoteness and grandeur, when they are made too accessible. The impressiveness of Vesuvius is in the naked and unconquered desolation which even guides and tourists alone cannot obscure. The traveller who breathes the slope on foot, or climbs it slowly on horseback, is forced to feel its grandeur, but they who are dragged up by bucketfuls, along the trestle-work which will soon disfigure the lines of its unequalled slope, to find the edge of its crater marred by a railway station, and its awful eruptions mocked by the puffing of a steam-engine, will have lost the grandeur of an impression which perhaps no other experience of their lives can parallel.

EMPLOYERS of skilled labor who take pains and find means—though it be simply for their own gain—to interest workmen in their work and encourage them to study increase of skill in it, are doing the best possible service to the working classes, and using almost the only influence that is now at hand to counteract the foolish doctrines and dangerous discontent that are conspicuous among them. One encouraging example of this, which we should like to see imitated oftener than we do, is that of a noted firm of jewellers in New York, who have this summer offered a number of prizes among the workmen whom they employ in making silver ware. Prizes were given for both design and workmanship; the workmanship including chasing, engraving, and *repoussé* work. Against the efforts of trades unions to reduce all workmen to a level of wages and performance, and to absorb all their attention in political or social effort, some influence of this kind is necessary to advance their skill or even to keep it from deterioration, to say nothing of keeping up any interest in their work. If manufacturers would combine for this purpose, they might at once improve their own productions and do much to offset the tendency to hostile feeling and divergence of aims between themselves and their employees. A step in the same direction has just been taken by the British Government, which, imitating the action of the French at our Centennial, has sent a select body of skilled workmen to examine and report on the work shown at the French Exhibition of this year. Each

workman is given a free pass to the Exhibition and a sum of money, with the privilege of fares and lodging at a reduced rate, and is expected to spend one or two weeks in examining his own department of the Exhibition.

THE NEW YORK Society of Decorative Art, encouraged by the success of its previous loan exhibition, is preparing another to be opened this fall. The managers have hit upon the useful plan of supplementing the exhibition by a course of lectures on kindred subjects. Professor W. E. Griffis is to lecture on Japanese Art; General di Cesnola, on Ancient Art; Mr. W. C. Prime, on Pottery; Mr. John L. Hayes, on Tapestry; Mr. C. C. Perkins, on American Art in the Future; Mr. Charles Dudley Warner, on Egyptian Art. The lectures will be relied on to second the profits of the exhibition; while they will serve the more permanent use of at once illustrating the articles exhibited, and stimulating the common interest in arts they illustrate. They are arranged in some sort on parallel lines with the subjects of the exhibition; but the wish suggests itself, which always arises when we read the programmes of popular lecture courses, and especially where matters of art are touched upon, that the subjects could be systematically and consecutively arranged. The successive development of styles and the mutual relations of different departments of design are matters in which amateurs of art are commonly very little instructed, while they are very important in its study. Either of them furnishes a connecting thread by which unity may be given to courses of instruction which are too often disconnected, and therefore comparatively fruitless. The necessities of a course which, illustrating a temporary exhibition, must necessarily be in a sort extempore, do not give much opportunity for systematic treatment; but the subject deserves the attention of whoever is concerned with instruction in art in this country.

THE Women's School of Carving and Modelling, in Boston, is reopened this month, with some advantages over last year, having been taken into the family of the Museum of Fine Arts. It was started a year ago with considerable enthusiasm, and, in spite of the narrowness of the funds which could be collected for its support, had in many respects an encouraging success. There were, says its report, fifteen pupils, to whom instruction was given in modelling in clay, casting and carving in plaster, and carving in wood. It was not possible or desirable in one year's course to carry the instruction very far, but the pupils were advanced from exercises in the use of tools and the cutting of purely geometric forms, through incised ornament, up to modelling and carving simple ornamental designs in relief. Samples of the work of the school are exhibited in the Mechanics' Fair now open in Boston, and show the commendable advance of the pupils in using their tools and processes. It would be out of place to criticise them as actual products, they being placed there, as the report says, "not with the idea of indicating results, but only to show the methods pursued, and the kind of instruction attempted." This is a right idea, which we trust will always prevail; for nothing works such ruin to a school of art as to be invaded by the idea of production or of mercantile success, and to this invasion a school of decorative art is in these days peculiarly exposed. The association with the Museum may be expected to give a valuable stimulus to the school, both by access to its collections and by the working fellowship which it can supply. It is to be hoped that it may find friends who will see that it is not hampered by want of funds; for an experiment of this kind, if it is tried, ought to have the advantage of thorough appliances for its work.

THE EQUILIBRATION OF ARCHES.

A METHOD OF DETERMINING THE LINE OF PRESSURE IN A LOADED SEGMENTAL, SEMI-CIRCULAR, OR SEMI-ELLIPTICAL ARCH.

THE conditions of stability in an arch are these:—

I. The curve of pressure, in that portion of the arch which is above the joint of rupture, must not pass outside of the middle third of the arch-ring.

II. The line of pressure at any joint must not make an angle of more than 30° with a normal to the joint.

III. The mean pressure on any joint must not exceed one twentieth of the ultimate resistance of the material to crushing.

Fig. 1. Draw one half of the arch and load to as large a scale as practicable, not less than one half inch to a foot.

Find the angle of rupture, V , by the following table:—

Let R = radius of extrados.
Let r = radius of intrados.

I. For segmental arches, when r is not less than six tenths of the span, the springing joint is the joint of rupture.

II. For semi-circular arches with horizontal load line:—

$$\text{When } \frac{R}{r} = 1.1 \quad V = 62\frac{1}{2}^\circ.$$

$$\text{When } \frac{R}{r} = 1.12 \text{ to } 1.17 \quad V = 60^\circ.$$

$$\text{When } \frac{R}{r} = 1.18 \text{ to } 1.3 \quad V = 57\frac{1}{2}^\circ.$$

III. For semi-circular arches with load line sloping from an apex above the crown:—

I = the angle between the slope and a vertical.

	I = 60°.	I = 55°.	I = 50°.	I = 45°.
$\frac{R}{r}$	V	V	V	V
1.1	30°	30°	30°	30°
1.15	37½	35	35	32½
1.2	40	40	37½	30½
1.25	42½	42½	42½	40
1.3	47½	45	45	42½

The above table is from Woodbury's "Treatise on the Arch." It may be used for semi-elliptical arches, though probably not quite correctly. The precise determination of the joint of rupture is not important.

The portion of the arch which is below the joint of rupture is to be regarded only as a part of the pier.

Divide that portion of the arch-ring which is above the joint of rupture into three rings of equal depth. Draw ng vertical, and divide the load line ag into any number of equal parts, ab , bc , etc. Draw bi' , cj' , etc., vertical. (The occurrence of m' in the diagram at the intersection of the intrados with the joint of rupture is accidental.) If the density of the load differs from that of the arch, as it usually does, unless both are of brick, reduce ah to $a'h$, so that ah : $a'h$ = weight of a cubic foot of arch: weight of a cubic foot of load. The arch, if of stone, may be taken at 170 pounds to the foot; the load, if of stone, at 150; brick-work at 110. In like manner reduce bi to $b'i$, cj to $c'j$, and so on. Find the centre of gravity of the quadrilateral $a'b'i'h'$ (or $a'b'i'h'$ as the case may be), considering $h'i'$ as a straight line, by the following method:—

To find the c. g. of a triangle, from each of two angles draw a line to the middle point of the side opposite; the intersection of the two lines will give the c. g. To find the c. g. of any quadrilateral, draw diagonals, and from the end of each farthest from their intersection lay off, toward the intersection, its shorter segment; the two points thus found, with the point of intersection, will form a triangle, whose c. g. is that of the quadrilateral. See Fig. 2.

Mark the c. g. thus found C_1 , and in like manner find C_2 , C_3 , C_4 , C_5 , C_6 .

Find the area of each of the quadrilaterals. Assume I , at the upper edge of the middle third of the arch, as the point of application of the horizontal thrust at the crown. (In thin arches and in pointed arches it will be at the lower edge of the middle third.) From I lay off on a vertical, by any convenient scale, Io , to represent the first area $a'b'h'i'$, on the second, pq the third, and so on. Determine the vertical CD , in which lies the centre of gravity of the whole area $a'g'n'm'h'$, thus: From I draw IO , and from t to O , at right angles, and connect Oo , Op , etc. From C_1 , C_2 , etc., drop verticals. Draw uv par-

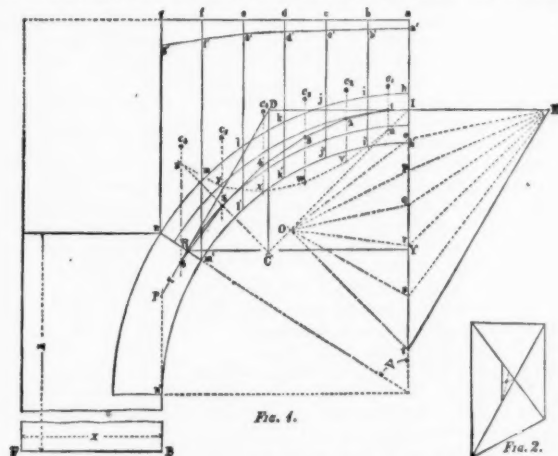


Fig. 1.



Fig. 2.

allel to Oo , vw to Op , wx to Oq , xy to Or , yz to Os , and zC to Ot . Protract Io to C . The required c. g. will be in the vertical drawn through C . The edge of rotation will be at R , the lower edge of the middle third. Draw RY horizontal. Multiply the sum of the areas of all the quadrilaterals by CR , divide the product by IY , and lay off the quotient by the scale of Io , etc., from I to E on a horizontal. Connect Eo , Ep , etc. Protract EI to meet the vertical dropped

from C_1 at 1. Draw 1-2 parallel to Eo , 2-3 to Ep , 3-4 to Eq , 4-5 to Er , 5-6 to Es , 6-7 to Et . Protract $I1$ to D . If the work is correct DR will be parallel to Et , and 6-7 will be a continuation of DR . The points 1, 2, 3, 4, 5, and R are points in the curve of pressure. If 1, 2, 3, 4, and 5 are all within the middle third the arch is safe, provided the other conditions of stability are observed. If the curve runs below the middle third, the arch is too heavily loaded over the crown, or too lightly on the haunches; if above, these conditions are reversed.

The line DR gives the direction of the pressure transmitted from the arch to the pier; and Et gives the value of the pressure, by scale of loads, in terms of area, which, multiplied by the number of pounds in a cubic foot of the arch, will give the pressure in pounds.

To determine the necessary width of the pier which carries the arch, proceed as follows:—

Protract DR to P . Decompose the pressure exerted at R , and now considered as acting at P , into its vertical and horizontal components, by the parallelogram of forces.

Let H = the horizontal component.

Let V = the vertical component.

Let h = the height of the pier assumed.

Let a = PB .

Let w = the weight in pounds of a cubic foot of the pier.

Let x = the required width of pier for bare equilibrium.

The moment of H is balanced by the moment of V plus the moment of the pier; that is, F being the edge of rotation of the pier

$$Ha = Vx + whx^2, \text{ or } Ha = Vx + \frac{whx^2}{2},$$

whence

$$x = \sqrt{\frac{2a}{hw} + \left(\frac{V}{hw}\right)^2} - \frac{V}{hw} = \frac{\sqrt{2Hawh + V^2} - V}{hw}.$$

For stability take $\frac{2}{3}x$, or, if the pier runs up as usual to the load line, $\frac{1}{2}x$.

No account is here taken of the triangle $n'm'n'$, nor of the fact that the specific gravity of that part of the arch which is included in the pier may be greater than that of the pier itself; but these are unimportant, and only add slightly to stability.

CORRESPONDENCE.

LONDON, September 19, 1878.

FOR those who are looking about for modern architecture in and near London, no building is of greater interest than the Natural History Museum at South Kensington, which is now nearing completion. It is by Mr. Waterhouse, and is a fine example of the use of the round arch in the Norman style. The design is imposing, and in simplicity of disposition, and in subordination of detail to masses, it is markedly superior to any of the new public buildings I have seen here. No preoccupation for picturesque effect has broken the grand lines which rule from end to end of the immense pile, while a massive central structure and lofty corner pavilions finely accentuate the whole. The eye at a glance embraces the design, and understands the disposition of the plan. The two lofty stories, with their large bays, indicate exhibition galleries, while the high basement and attic are for lecture-rooms, laboratories, etc. Between the attic windows are statues of animals, and gargoyles of animals seem more appropriate than usual.

The entrance is in the central pavilion,—not yet completed though high above the side galleries,—under a wide round arched portal, deeply recessed with columns, like the finest of the Norman porches. Passing through a shallow vestibule, from which open the exhibition wings on either hand, one stands on the threshold of a noble hall, at whose further end is a monumental staircase, dividing half-way to reach side galleries which lead to the second floor. The bays which separate these galleries from the hall are subdivided with delicate double arches, which look all the lighter because of the massive ones supporting them below. The latter form a series of barrel vaults, like the side chapels in some Romanesque churches, and are to be furnished with specimen cases. The great hall is, in fact, called Index Hall, from its containing index specimens.

The staircase from the galleries below to the floor above is carried in a most graceful and original manner on a vast arch, which, one bay from the entrance wall of the hall, rises in a wide sweep, unbroken by impost; the stairs from either side, uniting, spring from the centre of this vault to the floor beyond. The roof, though pierced largely with skylights, looks too heavy for the light, open iron-work trusses which support it, principally because the heavy window sashes are painted to count with the beams instead of with the ground glass. On whitish panels in the roof are painted specimens of tree branches; while the large end window has a pattern of red leaves upon it,—an appropriate use of stained glass. Behind the great hall is another for the natural history of Great Britain alone, and beyond that from a long vestibule open a series of large and small galleries. Two heavy square towers rise from near the rear galleries, without adding much to the beauty or utility of the design, though one is, I believe, to be used as a smoke shaft.

So much for the design and disposition of the building; apart from which it has still a great interest. It appears as if built of a yellowish sandstone, but near examination shows it is entirely of terra-cotta, backed with brick. Therein lies a strong claim to our attention, for it is the most successful application of terra-cotta in England, where

that material has thus far received its greatest development. The slabs vary from one to one half inch in thickness, and are moulded with flanges to be built into the brick-work. The length of them does not exceed eighteen inches, and generally is not more than a foot. A great secret lies in these short lengths, for with them the lines and mouldings can be kept perfectly true. The only place where there is any wavering in the mouldings is outside on the basement,—and that is very slight. Here the slabs were two feet long, so the warning was heeded, and no others were afterwards used of that length. This defect in terra-cotta Mr. Waterhouse has kept clearly in view, designing his mouldings and decorations for the most part in divisions or panels, so that any slight irregularity does not show. The Norman billet and zig-zag mouldings lend themselves easily to this; but more varied means are turned to account, such as the articulations of bamboo; and even those of the spine are formed into an effective moulding; which latter would seem far-fetched in a building devoted to another purpose. A concave moulding around the great staircase-arch is filled with them, and at intervals from this vast spine sprouts a monkey! I expected to see a man triumphantly astride of the keystone, but the designer refused such homage to Mr. Darwin, evidently, for the series of monkeys comes grinning down to the ground again,—which is keenly suggestive. There is true Gothic flavor in this; for if we but knew local mediæval traditions, how full of meaning would be the now senseless grotesques which crop out everywhere in Gothic cathedrals. The stone age precedes that of wood, and the predecessors of Punch's wood-cuts were these quaint satires in lithograph.

Another curious conceit is carried out in the main exhibition galleries. The ceiling of these is supported upon two series of square piers, which two thirds up are decorated with pilasters; just under these, there is a curved Grecian fret. If you notice some wavy lines below, it will flash across you that the fret represents the sea line, and probably not till then will you notice that every three or four of the pier slabs have delicate reliefs of various fishes, and, nearer the bottom, of shells; while on the base itself is carved a band of seaweed. Jules Verne might well be in despair at this walk under the sea, did these reliefs—barely raised from the surface—not look uncommonly like fossil prints, which destroys the sensational effect. Throughout, great art is shown in finding decoration drawn from natural history; and it is to some purpose that the difficulties of terra-cotta have been overcome, for it has permitted an amount of this decoration in panels and diapers which would have been of fabulous cost if done in stone.

On the whole the building seems peculiarly successful, and shows a marked advance since Mr. Waterhouse designed his Manchester Assize Courts, where, though the plan and masses are fine, the same cannot be said of the details. As a practical hint, some difficulty being at first found in cleaning the terra-cotta after it was in place, it was discovered that a little muriatic acid, followed up with water, removed all stains. Gibson and Canning were the contractors for the terra-cotta. The whole cost of the building will be some £400,000, it is thought. Mr. Waterhouse has just finished two large business buildings in red brick with red terra-cotta trimmings. They are both fine, but the last is in the same round arched style as the Museum, and owing to the success of these two buildings, he told me he should probably design for the future in that style, rather than in that of the pointed arch, in which he did his earlier works. In one of the above buildings there is an ingenious ceiling, which is formed entirely of white tiles with colored pattern. The beams are cased in them, and the intervals between filled with square pieces; where the corners of four pieces come together, a joist from the floor above holds them up with a flat cap, and over this is secured a tile rosette, so the ceiling presents as clear a surface as if the tiles had all been bedded in cement. As the walls are of light, enamelled brick, the effect is bright and fresh.

The other great building upon which they are at work here is the New Law Courts, by Mr. Street. These are being slowly pushed through the mass of houses crowding Holborn, and now terminating at Temple Bar. As if to commemorate this triumph—as memorable as unworthy—over the demolition of the most historic of London monuments, a massive tower rises just by its mutilated piles. No more foreboding monument could have been raised to haunt the guilty iconoclasts than this grim tower, which frowns down on the busy street. It is as heavy and windowless as a donjon, and I believe actually is to be used as a reservoir. However, if you do not like that tower you can choose another tower, for though the building is not yet half up, there are three already in the completed part. It is unfair to criticise finally an unfinished work, but the design seems to be so terribly broken up in a frantic struggle after the picturesque, that I fear the last trace of unity will disappear with the scaffolding—for that binds together in some measure the parts. Throughout there seems a wanton elimination of axes. Windows and divisions are hopelessly uneven, and by no chance is there correspondence or repetition of parts. The front, upon Holborn, is of a gray stone, which heightens the dryness of the architecture, already cold in the side and rear façade, where the stone trimmings are warmed with brick. This dryness is increased by a great deal of diaper ornamentation, too deeply carved, which gives a cast-iron look. The building has disappointed the profession generally.

Far more successful, in quite a different style of Gothic, is the American Episcopal church, at Rome, which Mr. Street designed.

"St. Paul's within the Walls," situated in the new Via Nazionale, was the first Protestant church built in Rome, for it was begun just after the entrance of Victor Emmanuel. Although it has been open for worship some time, it is not entirely finished, as it was wisely begun on a scale which would leave it in the future open to memorial gifts and bequests. It was intended to be, and is, a fitting monument—the only one we have in Europe—of American religious zeal and liberality. In spite of their "Church and State" which the English proverbially carry everywhere with them, their churches in Rome are insignificant chapels beside our basilica, which with apse and side aisles measures 138 feet by 62 feet in width, and is 59 feet to the top of the open timber roof. It is in the early Gothic style of Northern Italy, built with travertine bands,—a style in which all who have read Mr. Street's work on the Gothic of Northern Italy will acknowledge him a master. From the apse itself, 20 feet deep, a choir projects 22 feet into the nave, and at its corners are two beautiful ambones with colored marble colonnettes, in the style of those of the twelfth century. The fine marbles, so common in Rome, are turned to the best account, and the effect will be extremely rich when the conque of the apse is filled with the projected blazonry of mosaics. Some capitals and other carving are unfinished, awaiting funds. The stained glass shows the best work of Clayton and Bell. A full peal of chimes has been given and is about to be hung in the tower, which, in spite of Rome's three hundred and sixty-five churches, adds a conspicuous and beautiful feature to the city. Its design was suggested by the graceful ninth century campanile of Sta. Pudenziana, and it rises directly from one side of the nave gable towards the street. Although it is to be regretted that so successful an American monument should not have been designed by a countryman, all who are familiar with its history know that no small share of its success is due to the intelligent energy of its rector, the Rev. R. J. Nevin, D. D., who, as Mr. Street could pay but three or four flying visits to Rome during its erection, ably presided over everything which was done; and though a Swiss archbishop regulated the accounts of the contractor, and was clerk of the works, Dr. Nevin really had the chief responsibility, and decided many of the difficult questions.

R.

THE CHICAGO ACADEMY OF DESIGN — LECTURES ON ARCHITECTURE — THE EXPOSITION.

CHICAGO, October.

The Chicago Academy of Design, an organization ten years old or so, which has passed through many trying periods and numerous reorganizations, has recently added a course in architecture to the art studies pursued in its schools. This is one of the results of the last reorganization, which took place during the spring of the present year, infusing a new life into its torpid and neglected body. The academy, unlike that of New York, is a mixed body of artists and amateurs. It has been found that the artists here are as yet too weak to maintain an organization of their own. It differs also from that referred to, in that it is unable to afford free instruction in art. But, with small fees for tuition, its classes in all departments are well filled, and the students are enthusiastic.

For the present nothing further than a course of lectures in the architectural department will be attempted. The lecturer for this season is Mr. W. L. B. Jenney, practising architect, of this city. The lectures will be free to students in the other departments, and will be open to the public for the moderate fee of one dollar for the course of five lectures, and twenty-five cents for single admissions. The first lecture will be delivered on October 3 at the rooms of the academy, corner of State and Monroe Streets.

The announcement says that "the subject of the lectures will be the history of the different styles of architecture that have arisen, flourished, and passed away, from the earliest period of which we have any knowledge,—the savage tribes, Egypt, Assyria, Greece, Rome, and the Middle Ages." A knowledge of the architecture of a country at any epoch is a knowledge of the people, of the religion, and of the government of that country at that epoch, and is of interest to the traveller, to the student of history, and to all persons of liberal education, as well as to those practising architecture as a profession. It is to these classes that these lectures are directed, and the lecturer promises to avoid technicalities and the dry details of construction, and will illustrate, as far as possible, with off-hand crayon sketches.

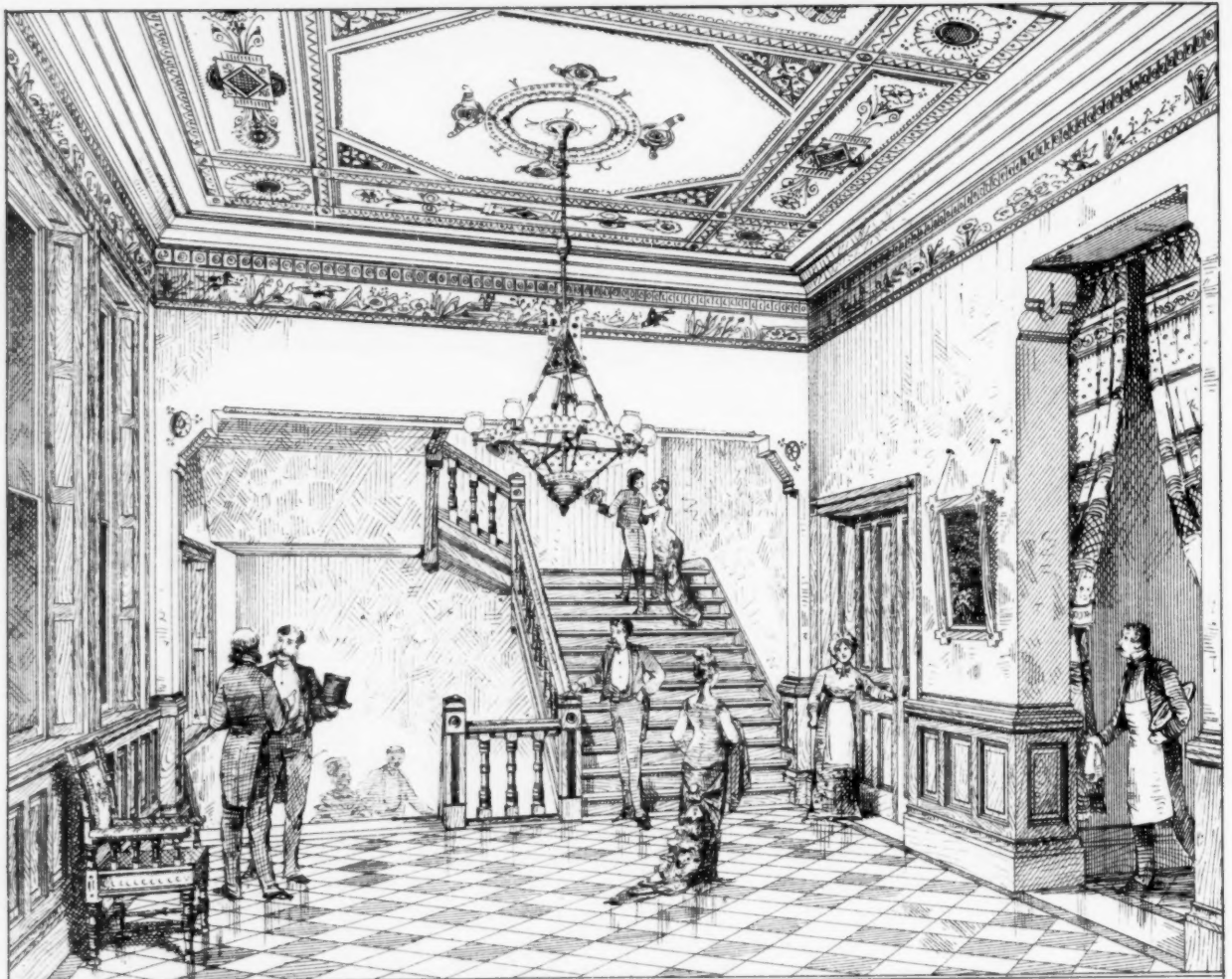
The following is a list of the subjects to be treated:—

- I. October 3. The Savage Tribes and Egypt.
- II. October 10. Assyria and Judea.
- III. October 17. Greece and Rome.
- IV. October 24. Mediæval Period—France.
- V. October 31. Mediæval Period—England.

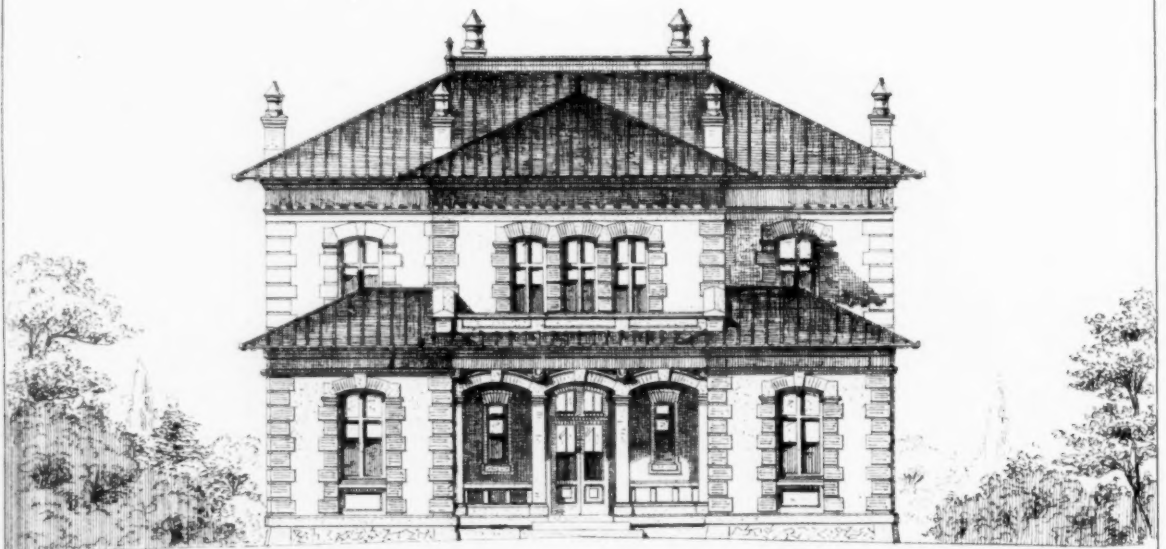
Each annual subscriber and life-member of the academy will receive two tickets to the course.

It is also announced that upon the conclusion of these lectures, Thursday, November 7, an additional evening will be given to the architecture of Paris, to be illustrated by stereopticon views. Following Mr. Jenney's course other lectures on the fine arts are promised.

The annual Inter-State Exposition is now open in this city. The fine art exhibition is always an attractive feature of these annual displays of industry and art. The art galleries are in a separate

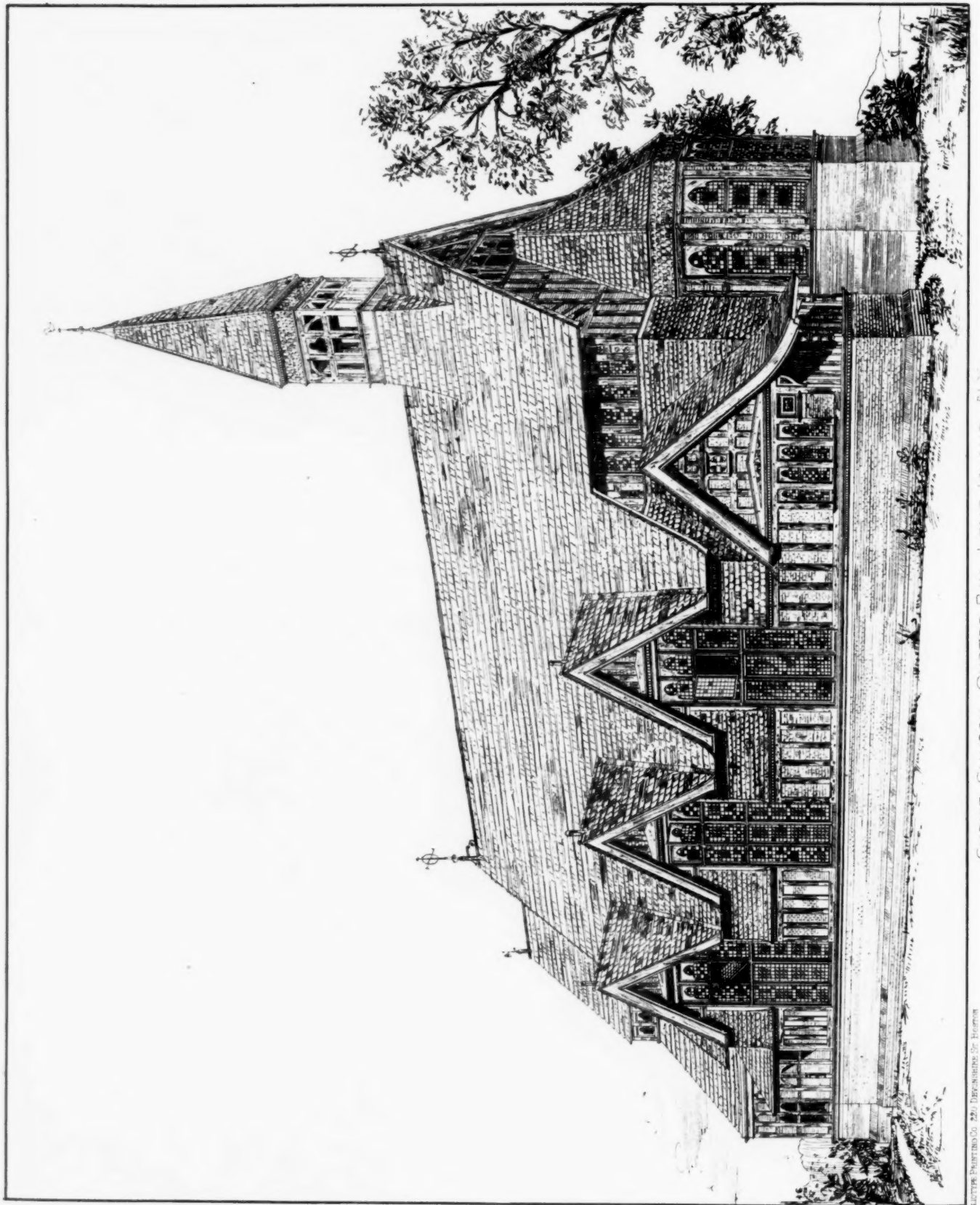


RECEPTION HALL & STAIRCASE * ALLEMANIA CLUB HOUSE * CINCINNATI * J.W.McLaughlin, Arch't.



STREET FRONT

HOUSE-AT-CHATEAU-LONDON-FRANCE — E. LETANG-ARCHT BOSTON



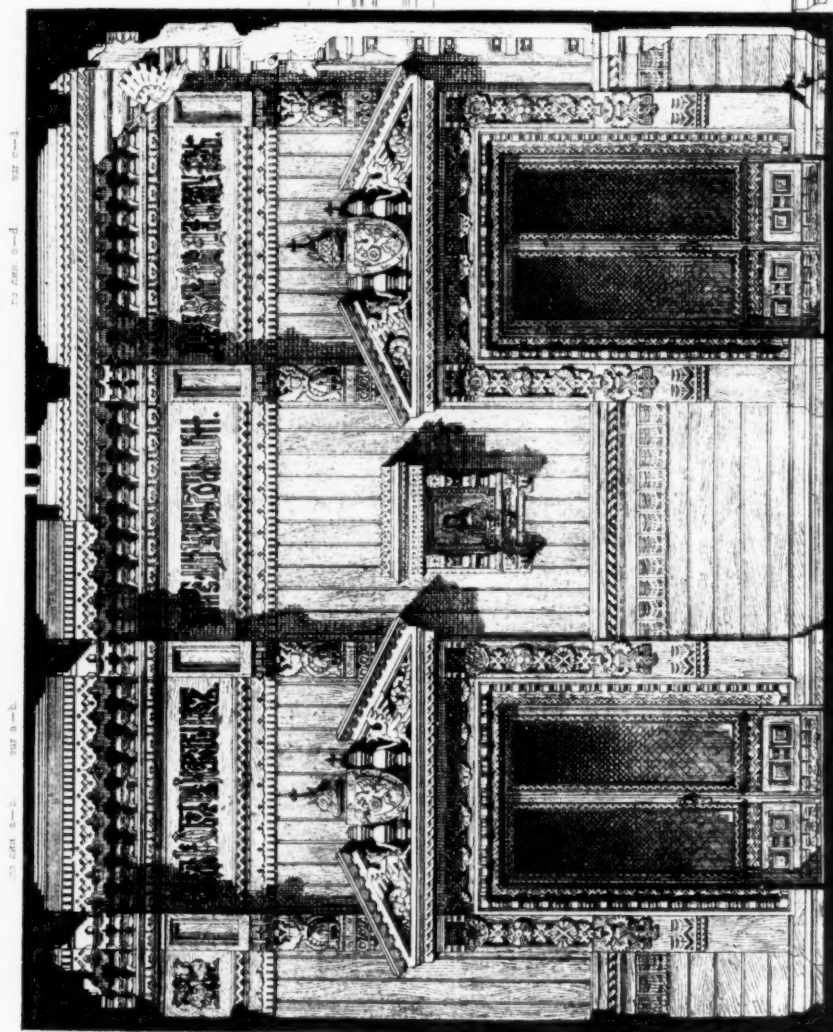
CHRIST CHURCH, OYSTER BAY, LONG ISLAND, N.Y.

Engraved by H. K. Brown, New York.

ДВОРЕЦЪ ЕГО ИМПЕРАТОРСКАГО ВЪСОЧЕСТВА ГОСУДАРЯ ВЕЛИКАГО КНЯЗЯ ВЛАДИМИРА АЛЕКСАНДРОВИЧА.
 PALAIS DE SON ALTESSE IMPÉRIALE LE GRAND DUC WLADIMIR ALEXANDROWITCH
 БОЛЬШАЯ СТОЛОВАЯ. GRAND SALLE A MANGER.

ПОПЕРЕЧНЫЙ РАЗРѢЗЪ.

COUPE TRANSVERSALE.

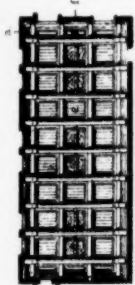


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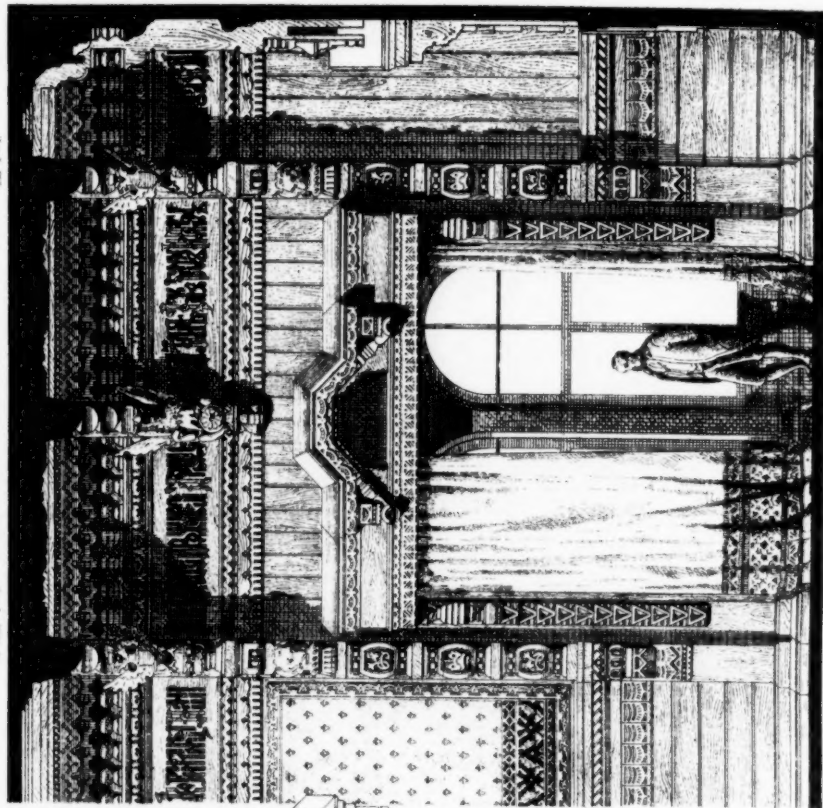
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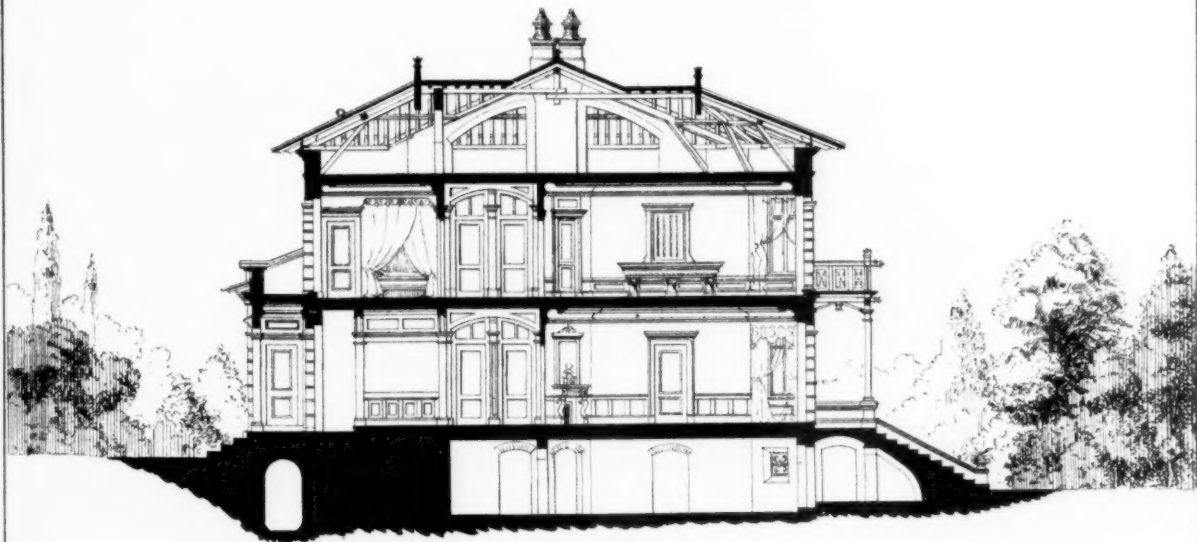
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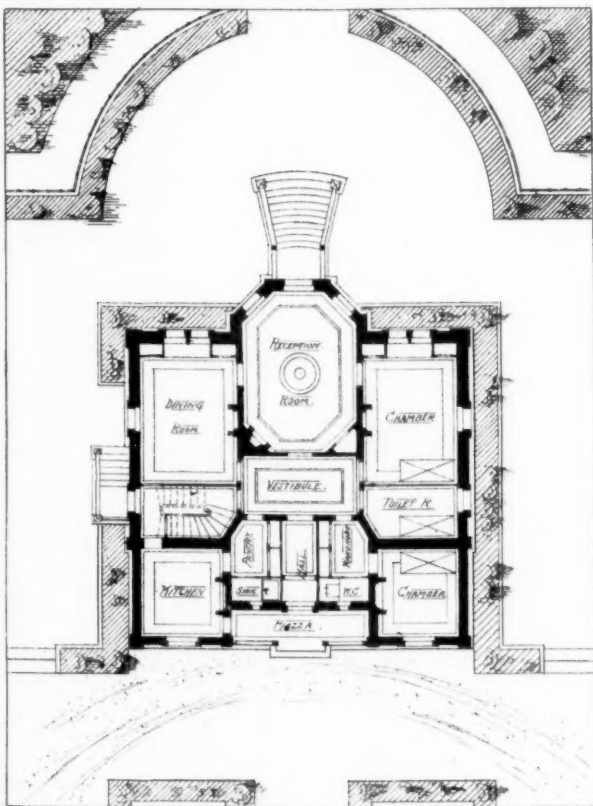


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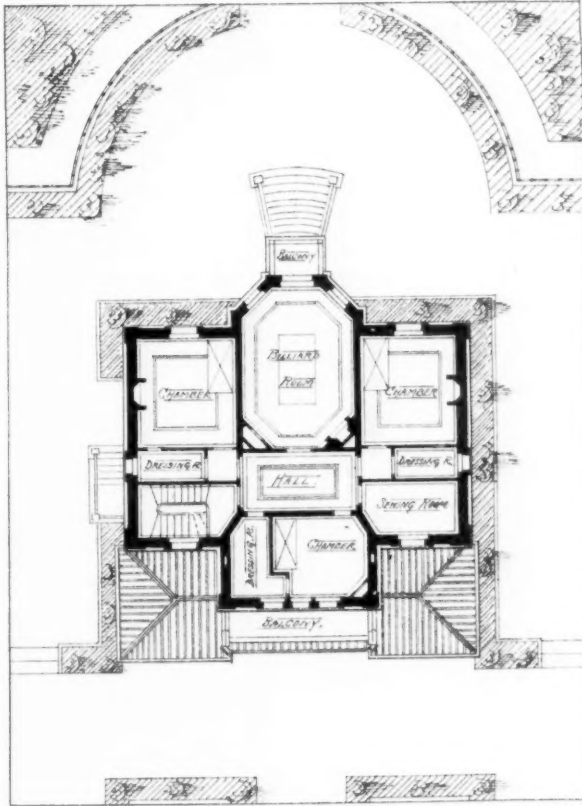
Wm. A. Richardson Del.

HOUSE-AT-CHATEAU-LONDON-FRANCE

E. LETANG-ARCHT. BOSTON



PLAN FIRST FLOOR



PLAN SECOND FLOOR

building, which might be called an "annex," to follow the present fashion in nomenclature. There are six rooms, which together equal in capacity the galleries of the Academy of Design in New York. One room contains paintings by local artists, and water-colors mostly sent by Eastern artists. The second room contains a loan collection of paintings, and is probably the best exhibit ever made in this city. The best contemporaneous French artists and a few of the best Americans are represented. It can safely be said that there is not a bad picture in the room. Most prominent is Cabanel's "Phædra and Œnone," loaned by L. Z. Leiter, of this city. This is the first Cabanel, other than a few portraits, that has been exhibited in Chicago. The Exposition Company has recently purchased a very full collection of casts of well-known pieces of ancient sculpture, including some Assyrian bas-reliefs. It also has some examples of Renaissance carving. These fill two rooms. The Parthenon sculptures are admirably placed. Representative pediments have been constructed to show the position occupied by the originals, and the frieze bas-reliefs may be seen consecutively and in good light. As a popular educator this collection is of incalculable value, as it is seen by an average of ten thousand people daily. In one room is an exhibition of artistic photography. The pictures are all treated as works of art, hung by the committee and catalogued. No photographers' signs or advertisements are allowed.

The exhibit of Chicago's art manufacturers is not so good or extensive as in former years. The exhibits of artistic carpets, curtains, and tapestries by Field, Leiter & Co. are remarkable. These are mainly importations. Many duplicates of the finest contributions of the Glasgow looms to the Paris Exposition may be seen, and among them is a set of the Whistler curtains of peacock pattern.

The Minton tile exhibition of Charles L. Page is an attractive and artistic contribution, and in modern art pottery Burley and Tyrrell show some of the finest pieces that have been produced.

The interest of the masses of the people in matters of art is evinced by the fact that most of the visitors to the exhibition go directly to the art rooms on entering. The rooms are crowded from morning to night, so that at times it is impossible to gain admission to them.

THE ILLUSTRATIONS.

CHURCH AT OYSTER BAY, L. I. MESSRS. POTTER & ROBERTSON, ARCHITECTS.

DINING HALL IN THE PALACE OF THE GRAND DUKE, WLADIMIR ALEXANDROWITCH.

THIS illustration, a very characteristic example of interior finishing in the Russian style, is copied from the Russian building journal, the *Zodchey*.

HOUSE AT CHATEAU-LONDON. MR. E. LETANG, ARCHITECT.

The villa was erected some four years ago at Château-London, near Paris, at a cost of about ten thousand dollars (\$10,000). The garden front looks towards extensive vineyards, and beyond and about a hundred feet below upon a very pretty little stream. There are many trees upon the place, and a fine growth of shrubbery. The materials of construction are brick for angle quoins, a light brown stone for cornices and basement, with plaster filled in between. The floors are of iron construction, deafened by means of plaster filling. Partitions of brick, having arches sprung from them to stiffen chimneys, help to support the roof.

RECEPTION HALL AND STAIRCASE IN THE ALLEMANIA CLUB HOUSE, CINCINNATI. MR. J. W. M'LAUGHLIN, ARCHITECT.

We printed last week a perspective exterior of this club house, with a short description.

THE RATING OF BUILDINGS.

AMONG the natural results of the present state of the business community is a large increase in the number of buildings that are subjected to a change of use. This is especially the case with buildings put up as manufactories, and for trade purposes. Dwelling-houses, as a class, seldom change their purpose, but with buildings put up for business uses the case is different. When the occupants of such a building change, the next use of that building will probably change also to whatever business it is supposed will pay, or happens to be seeking a domicile. The result is an unusually large number of cases where the building is not fitted for its present use. These things were illustrated with emphasis by an accident in New York, not long ago, whereby one man lost his life, and others were more or less injured. In this case the building was originally put up for and used as a machine shop, for light work, the making of sewing machines. It was of brick with iron columns, and the floors were brick arches on iron beams; the whole only about twenty years old, and, if kept to its normal use, apparently good for another score. But in its original use the weight was naturally heaviest on the lowest floors; there would be the heaviest machinery, and there the heaviest accumulations of stock. Even there the weight upon any one square yard of floor would seldom amount to one half of a ton, and never average that over eight or ten contiguous square yards; while in the upper stories a load of six hundred pounds would probably be the maximum upon any one square yard, and less than half that an average load. But the sewing machine company grew, and, leaving their building as the soldier crab does his shell,

moved to more commodious quarters, and a cabinet maker occupied the building. Of course a building strong enough for a machine shop and iron work was expected to be strong enough for cabinet making and light wood work; but what was the fact?

The accident was a break in the sixth floor; this floor was constructed of brick arches upon iron beams; these beams were about five feet from centres, and rested upon girders sixteen feet from centre to centre; the girders rested upon the cap of columns twenty feet from centres, and were secured to the heads of the columns by bolts passing through lugs on each side of the web of the girder, through which the bolts also passed; there were three or four of these bolts about seven eighths of an inch in diameter at each end of the girder, and it is to be noted that when the girder fell the lugs upon the head of the columns and the bolts stood, tearing out the web of the girder like pie-crust. The girder which broke was of cast iron, with wrought tie; the cast iron was in form like a plain I-beam sixteen inches deep, six inches across the top flanges, three inches across the bottom flanges. At each end of the girder, and upon its lower flange, were lugs, forming sockets for the two-inch wrought iron tie-rod. The upper member of this girder had about ten square inches of cross section, this was under compression; the lower part of the cast iron had about seven square inches of cross section which was practically useless, as being about the neutral axis; while the real lower chord, the tie-rod, had about three square inches of section, which was under tension. Upon this girder rested the weight of three hundred and twenty square feet, or about thirty-five square yards, of the floor mentioned, with whatever load might be placed upon it, or hung under it.

This girder should have an ultimate supporting strength of about eighteen tons, and the tie-rod would be the weakest point. Out of this eighteen tons should be taken the weight of the floor, including the girder itself, in all about seven tons, leaving less than twelve tons as the carrying capacity of the floor; and this reduced by a factor of safety of two¹ would leave only six tons as a reasonable load on the thirty-five yards of floor, or about three hundred and fifty pounds per square yard, equal to forty pounds per square foot. This is supposing the tie-rod to be, as it would with material of uniform quality, the weakest point; and the fact that breakage actually occurred by the crushing and crumbling of the upper member, while the tie-rod was uninjured, only shows that the quality of the cast iron was below the average; in fact, a soft metal, as was remarked upon the spot, better fit for sewing-machines than for building purposes. But it is seen that in no case would this floor be safe for more than forty pounds per square foot. It was loaded with stock. How much cannot now be proven; but, judging from the rest of that floor, as well as the rest of the building, it is fair to say that it was a common thing to pile bureau backs or drawer bottoms in close-packed piles six feet high, which would weigh near one hundred and eighty pounds per foot; and black-walnut stock was piled on these upper floors in close packs six and seven feet high, by eight or more wide, by twelve to twenty feet long, equal to three hundred pounds per foot or twenty-seven hundred pounds per yard, showing that the furniture-maker needed in his upper floors three or four times the strength that the sewing-machine company required in their lower ones.

In the above case some of the floors, as, for instance, the one immediately below the falling girder, were of stronger build; besides, at that particular point this next floor was not so heavily overloaded, being occupied by the cabinet-makers' benches and men at work. Had the same break occurred at some points a few feet from there, it would probably have gone on to the cellar.

This is an example of the changes and risks often incurred in the uses of a building, even if supposed to be strong enough for a manufactory under the building law.

This matter of change seems to need some more competent supervision than the guess-work of the ordinary mechanic; something more nearly akin to the maritime rules, where a ship is inspected when built, and classed for a certain number of years in one grade, and then again inspected and rated for the next term in such grade as she seems fit for. And the class of cargo permitted in each grade is specified: thus, a ship built for carrying heavy blocks of marble from Italy, while she holds that rating, may take almost any freight, but after that will be rated for light and dry freights, and still later for only lumber and non-perishable matters; while one built for light freight and passenger service will not be insured at all, nor, in fact, allowed to carry marble blocks, nor even pig-iron in large quantity, without especial inspection. In these cases the matter is not left to the judgment of the captain; but the ship's rating is expressed upon her papers and in the published list, to be seen and read of all men. Something similar seems to be needed in regard to buildings. Suppose that a commission of competent architects were created, whose duty, like Lloyds' inspectors, should be to rate the building for a given term of years and for a given service, with regular inspection and rating at the end of the term, and who should be made aware of all changes in the building during the term, and have power to change the rating accordingly. Let the rating show the maximum load to be permitted on each floor, and the number of years it should be permitted; and then make the occupant who overloads his floor responsible for all damages, including a deodand for personal injury resulting therefrom, and the result would be well for all. It may be thought that this would be an infringement of the rights of the

¹ A dangerously small factor. — EDS. AMERICAN ARCHITECT.

owners; but public safety overrides private rights. Nor are ship-owners desirous to evade the Lloyds' rule. Until every man is competent to judge the strength of a building in all its parts, and until every man has sense enough to calculate the weight of his material and tools, some one who has this judgment and ability should be employed; and if the individual will not employ them, the public must.

It may be said that the ship carries the property of various parties who cannot be expected to examine and judge for themselves, and who, without the authorized rating, would be at the mercy of any captain either ignorant or unprincipled enough to take the advantage of them, and thus much property would be lost. But in regard to the manufactories, they are at this moment filled with men, women, and children who are at the mercy of ignorant and unprincipled employers; and the comparison lies fairly between the importance of saving property and of saving human life.

VIVARTAZ.

FRENCH PAINTING OF TO-DAY.

WE translate from *L'Artiste* parts of a long notice of paintings at the Exhibition, which gives a lively sense of some of the French artists' present tendencies:—

Mme. Marie Collart has a third medal. This is honorable for those who have a second. I have no hesitation in declaring that men of feeling will take pleasure in looking at Mme. Collart's orchards when some of the medalled pictures of the Exhibition of 1878 are no longer valued except as curiosities. Very curious, in truth, is the machinery of Messrs. Mackart, Matejko, Padilla, Siemiradski. But all their art goes into their stage properties. No one personage in these huge canvases has ever found himself face to face with life, has ever loved or felt an impulse of emotion. I have nothing in common with this artificial humanity which does not speak my language and lives in a world which is not mine. It is written in an archaeological jargon, diffuse and pedantic, which has no more possible relation to the truth of any epoch than the archaism of Alma Tadema. Thanks to this accommodating tendency, painting is sliding farther and farther down the declivity of dead things, substituting for the true and just representation of man, and the medium in which he lives, the findings of unwholesome exhumations,—costumes, furniture, and gimcracks. Hence a harlequin art, which includes only an active and adroit minority, well skilled in handling the wardrobe of the ancients, and whose great cleverness consists in only painting enigmas of which no one can get hold. Pure charlatanism.

But the great subject of art in all well-balanced periods is man. He fills the whole breadth of the stage with his aspirations and his pains. Yet I look in vain for this eternal manhood in the work of most contemporary artists. I find, it is true, a certain special manufacture, substantially abstract and conventional, which has an anatomical correspondence with a human being, and that only. Academical instruction has made it a sort of human currency, which is accepted as good money, and circulates freely at exhibitions. But this disjointed manikin is never got out of the realm of mechanism. He moves about automatically among factitious surroundings; he has but a small number of gestures and attitudes, which are adopted pretty indifferently for all situations.

Here is an actual occurrence: A worthy tradesman one day borrowed my catalogue of the *Salon*. He, too, wanted to get an idea of the condition of the arts. He went back and forth half a day in the *Salon*. He was interested chiefly in the great mechanisms. Historical painting attracted him prodigiously, and, naturally, before each great canvas he opened his book and read the title.

No. 928. This represented a personage in a pit, under a red and black effect of light. The man had a great beard, and lifted his eyes to heaven with an expression of ecstasy. The worthy man read in his book, *St. Lawrence the Martyr*. "Ah," said he, "it's before he was roasted." He stepped up to the picture and looked long at the face of the Saint, and said: "After all, it must have been afterwards, or else while it was doing."

He passed to No. 1056. On a bed in confusion was stretched out the half-nude body of a young woman. A certain stiffness characterized her limbs, and her eyes were fast closed. It suggested a person in catalepsy. A torch threw red gleams upon the bed and reddened the paleness of the flesh next it. The tradesman read, *The Death of Catherine de Medici*. He gave a start. "What!" said he, "did she die with so little clothes on as that?" A queen, too!" And after a moment's reflection he added, "Perhaps they are going to lay her out." He stopped before No. 311, and saw a gray-haired man holding his head between his hands. He seemed buried in the reading of a folio which was spread upon the table. The man was shown in full face. His eyebrows were contracted, his expression intense and tragic. My friend read, *The Last Day of a Condemned Felon*. He was greatly moved. How real that was; he could imagine himself in the sufferer's place. Doubtless he was seeking a last consolation in the reading of the gospel.

A little farther he saw some priests standing up, their arms raised before an altar. One of them, who wore a mitre, was stretching out his hands toward a man and woman that lay prostrate, their faces in the dust. He opened his catalogue, not understanding, and read, *The Nuptial Benediction*.

"Exactly," he exclaimed; "they are great personages; the pope

is marrying them; but what the devil do the priests and choir hold up their arms for? However, I suppose it's part of the ceremony." And he went away, convinced and content.

"Unluckily," said I to him when he brought me the book, "you made a mistake. This catalogue"—

"Well, what?"

"Is last year's," and I put into his hands the catalogue which he ought to have taken.

He shook his head. "It is impossible," said he. "The pictures correspond exactly to the titles in the catalogue."

He turned over the pages and fell upon No. 928. He read, *The Miner's Prayer*. He started. "What! this monk, this St. Lawrence, a miner?"

No. 1056, which he had taken for *The Death of Catherine de Medici*, had for its title *The Sleep of Innocence*. That which he had taken for *The Last Day of a Condemned Felon* was *A Philosopher studying a Problem*. Finally, *The Nuptial Benediction* was called in the catalogue *An Anathema*.

The good man was overwhelmed. I said to him, "You are experiencing the art of our day. The subject is no matter what. It is for the catalogue to tell you what you are to see and understand. You think you see a corpse. Not at all; it is a sleeping woman. A philosopher wears the head of a criminal; a pope cursing resembles a pope blessing, and so on. This comes from the fact that there is a limited number of conventional forms which are the general property of artists. They belong to everybody and serve all purposes. They are like the lasts of the village shoemaker."

AERIAL ECHOES.¹

BY PROF. JOSEPH HENRY.

DURING the year 1877, and also in 1876, a series of experiments was made on the aerial echo, in which I was assisted in the first series by General Woodruff, engineer of the third lighthouse district, and in the second series by Edward Woodruff, assistant engineer of the same district. These experiments were made principally at Block Island, but also at Little Gull Island. Especial attention has been given to this phenomenon, which consists in a distinct echo from the verge of the horizon in the direction of the prolongation of the axis of the trumpet of the siren, because the study of it has been considered to offer the easiest access to the solution of the question as to the cause of all the abnormal phenomena of sound, and also because it is in itself an object of much scientific interest.

In my previous notice of this phenomenon, in the report of the Lighthouse Board for 1874, I suggested that it might be due to the reflection from the crests of the waves of the ocean; but as the phenomenon has been observed during all conditions of the surface of the water, this explanation is not tenable.

Another hypothesis has been suggested, that it is due to a flocculent condition of the atmosphere, or to an acoustic invisible cloud, of a density in different parts differing from that of the general atmosphere at the time. To test this hypothesis experimentally the large trumpet of the siren was gradually elevated from its usual horizontal position to a vertical one. In conception, this experiment appears very simple, but, on account of the great weight of the trumpet, it required the labor of several men for two days to complete the arrangements necessary to the desired end. The trumpet, in its vertical position, was sounded at intervals for two days, but in no instant was an echo heard from the zenith, but one was in every case produced from the entire horizon. The echo appeared to be somewhat louder from the land portion of the circle of the horizon than from that of the water. On restoring the trumpet to its horizontal position, the echo gradually increased on the side of the water, until the horizontal position was reached, when the echo, as usual, appeared to proceed from an angle of about twenty degrees of the horizon, the middle of which was in the prolongation of the axis of the trumpet. A similar experiment was made with one of the trumpets of the two sirens at Little Gull Island. In this case the trumpet was sounded in a vertical position every day for a week with the same result. On one occasion it happened that a small cloud passed directly over the island on which the lighthouse is erected, and threw down on it a few drops of rain. At the moment of the passage of this cloud the trumpet was sounded, but no echo was produced.

From these experiments it is evident that the phenomenon is in some way connected with the horizon, and that during the continuance of the experiment of sounding the trumpets while directed toward the zenith, no acoustic cloud capable of producing reflection of sound existed in the atmosphere above them.

Another method of investigating this phenomenon occurred to me, which consisted in observing the effects produced on the ears of the observer by approaching the origin of the echo. For this purpose, during the sounding at the usual interval of twenty seconds of the large trumpet at Block Island, observations were made from a steamer, which proceeded from the station into the region of the echo, and in the line of the prolongation of the axis of the trumpet, with the following results:—

1. As the steamer advanced, and the distance from the trumpet was increased, the loudness of the echo diminished, contrary to the effect of an echo from a plane surface, since in the latter case the

¹ From the Report of the Lighthouse Board, 1877.

echo would have increased in loudness as the reflecting surface was approached, because the whole distance traveled by the sound-wave to and from the reflector would have been lessened. The effect, however, is in accordance with the supposition that the echo is a multiple sound, the several parts of which proceed from different points at different distances of the space in front of the trumpet, and that as the steamer advances toward the verge of the horizon, it leaves behind it a number of the points from which the louder ones proceed, and thus the effect upon the ear is diminished as the distance from the trumpet is increased.

2. The duration of the echo was manifestly increased, in one instance, from five seconds, as heard at the mouth of the trumpet, to twenty seconds.

This would also indicate that the echo is a multiple reaction of varying intensities from different points, and that at the place of the steamer the fainter ones from a greater distance would be heard, which would be inaudible near the trumpet.

3. The arc of the horizon from which the echo appeared to come was also increased, in some cases, to more than three times that subtended by the echo at the place of the trumpet. This fact again indicates that the echo consists of multiple sounds from various points at or near the surface of the sea, the angle which the aggregate of these points subtend necessarily becoming greater as the steamer advances.

But perhaps the most important facts in regard to the echo are those derived from the series of observations made in regard to it by Mr. Henry W. Clark, the intelligent keeper of the principal lighthouse station on Block Island, and by Joseph Whaley, keeper of the Point Judith Lighthouse. Mr. Clark was furnished with a time-maker to observe the duration of the echo, and both were directed to sound the trumpets every Monday morning for half an hour, noting the temperature, the height of the barometer, the state of the weather as to clearness or fog, the direction and intensity of the wind, and the surface of the ocean.

From the observations made at these two points, for more than two years at one station and over a year at the other, the echo may be considered as produced constantly under all conditions of weather, even during dense fogs, since at Block Island it was heard 106 times out of 113, and at Point Judith 50 times out of 57, and on the occasions when it was not heard the wind was blowing a gale, making a noise sufficiently intense to drown the sound of the echo. These results appear to be sufficient to disprove the hypothesis that the phenomenon is produced by an acoustic cloud accidentally situated in the prolongation of the axis of the trumpet. It must be due to something more permanent in its effects than that from a portion of air differing from that of the general atmosphere in temperature or density, since such a condition cannot exist in a dense fog embracing all the region of the locality of the phenomenon. Indeed, it is difficult to conceive how the results can be produced, even in a single instance, from a flocculent portion of atmosphere in the prolongation of the axis of the trumpet, since a series of patches of clouds of different temperature and densities would tend to absorb or stifle by repeated reflections a sound coming from their interior, rather than to transmit it to the ear of the observer.

The question, therefore, remains to be answered: What is the cause of the aerial echo? As I have stated, it must in some way be connected with the horizon. The only explanation which suggests itself to me at present is, that the spread of the sound which fills the whole atmosphere from the zenith to the horizon with sound-waves may continue their curvilinear direction until they strike the surface of the water at such an angle and direction as to be reflected back to the ear of the observer. In this case the echo would be heard from a perfectly flat surface of water, and as different sound-rays would reach the water at different distances and from different azimuths, they would produce the prolonged character of the echo and its angular extent along the horizon.

While we do not advance this hypothesis as a final solution of the question, we shall provisionally adopt it as a means of suggesting further experiments in regard to this perplexing question at another season.

BURIALS AT ANCIENT ROME.

THERE were burial clubs at Rome at an early time, and the Christians availed themselves of the same means to bury their dead as their pagan predecessors; the transition was gradual, and in some cases there are pagan sarcophagi and inscriptions still remaining in the Christian Catacombs. There is no need of the theory that they were merely carried there as old marble, to be used again. The subsoil of the Campagna consists of successive layers of tufa of different degrees of hardness. Roads had been made in the beds of softer materials to get out sand, and these subterranean roads formed convenient modes of access to the Catacombs, which were generally made in the harder bed of tufa under that level. The churches outside the walls, grand basilicas as some of them now are, were originally chapels at the entrances of the Catacombs, of which St. Agnes is the best example. The Catacombs are not under Rome itself, but two or three miles from it. In an ancient city no one was allowed, except in very rare cases, to be buried within the walls, a wise practice to which we are returning. The paintings of the second and third centuries are quite simple; e.g., the cultivation

of the vine in the Catacomb of Prætextatus; of the four seasons in that of S. Nereus. There are no religious subjects before the time of Constantine: the earliest are those of the Good Shepherd and certain well-known Scriptural types. The history of Jonah is common in the fifth century; figures of saints or martyrs appear in the sixth century, and are common in the eighth. The inscriptions are the earliest and most genuine things left; few of the dated ones are before the third century; the larger proportion are of the fourth and fifth, with a few of the sixth and even later, for the family burial-places continued to be in use as long as they were accessible. Unfortunately, most of the inscriptions have been removed to the museums or monasteries, and sometimes there is no record to say from what place they came. A picture in Dr. Northcote's "Visit," page 3, gives a good idea of the subterranean galleries. They are about eight feet high and three wide, and their walls on either side are pierced with a number of horizontal shelves, one above the other, like the shelves of a bookcase. Each shelf once contained a dead body, and they had been shut up by long tiles or slabs of marble, securely fastened by cement, and inscribed perhaps with the name of the deceased or with some Christian emblem. In page 5 there is a plan of the labyrinth of lanes in part of the Catacomb of St. Agnes. In St. Callistus, on the Via Appia, we can descend by a succession of staircases to five different galleries of these lanes, the fifth being only just above the level to which water rises. Many of the original catacombs were family burying-places secured under the Roman law which allowed tombs and burial-places to be exempted from the rules of succession: "heredem non sequitur" was the principle in such cases. Hence, when a family became Christian, it could easily open its burial-place to other Christians, "ad religionem pertinentes meum" (Northcote, p. 19). The finest inscriptions belong to the time of Pope Damasus, the contemporary of St. Jerome: they are exquisitely engraved in marble. The fatal year 410, in which Alaric took Rome, brought the original use of the Catacombs in great measure to an end. Speaking generally, they ceased to be places of burial, and were thenceforth mainly places of pilgrimage, and were "restored" for that purpose. Vigilius, in 550, restored some of Damasus' inscriptions which had been broken; but art had perished and the workmen were unskilful and ignorant. The inscriptions are perhaps the most valuable of the remains. The paintings link on to the paintings of the age of Roman art, when "the walls of apartments were covered with arabesques, and the roofs were often in the form of arbors hung with garlands, interspersed with fluttering winged forms." Dr. Northcote gives two of the Christian paintings on the roof of St. Domitilla and that of Prætextatus (pp. 67, 69). As Roman art perishes, the paintings become stiff and bad. But the inscriptions are not dependent for their permanent value on the state of art; it is their meaning that is important. De Rossi has studied more than fifteen thousand Christian inscriptions that have come down to us from the first six centuries, but this only represents a part of what once existed. Alaric and Attila may be responsible for part of the loss, but friends are more destructive than enemies, and the marble tombstones were used largely from the eleventh to the fifteenth century, not only in Rome, but even in distant places, for the pavement of churches. Tombstones are perishing among ourselves every year by the hundred; the restorations going on are most destructive, and a copy of the inscriptions is hardly ever taken. We can see by Weever and others who made collections of inscriptions how many of our tombs have perished within the last century or so. The Greek language is common in the earliest inscriptions of the Catacombs, the primitive Roman Church being composed mainly of Greeks and Hellenizing Jews. The Christian literature of early Rome is almost wholly Greek, and the Latin Christian literature comes from Africa. About fifteen hundred of the inscriptions are dated. There is but one dated inscription of the first century, two of the second, two dozen of the third, about five hundred of the fourth and fifth; the rest belong to the sixth. But of the undated inscriptions it is probable that a considerable number belong to the second and third centuries. Each age has its fashion in the wording of such inscriptions, each country its peculiarity. De Rossi's long experience has enabled him to lay down rules on this subject, which are even more necessary than in the case of pagan inscriptions. The three names are not recorded in the old Roman fashion after the third century: even the mention of two names becomes rare; new Christian names come in, such as Adeodatus, Quodvult-deus, and so on, which almost remind us of the Puritan style. — *The Academy*.

AMERICAN INSTITUTE OF ARCHITECTS.

NEW YORK CHAPTER.

THE first meeting of the season of 1878-1879 was held on the 1st instant, President R. G. Hatfield in the chair. The reports of the officers were received and filed; on the election for the coming official year, R. G. Hatfield was reelected president; E. M. Littell and G. B. Post, vice-presidents; A. J. Bloor, secretary; and Henry Fernbach, treasurer. The standing committees on admissions, on library and publication, on education, and on examinations, were re-elected. Messrs. Littell, Bloor, and Le Brun were appointed a committee to report suitable action on the death of Mr. Richard Upjohn, at the next meeting of the Chapter. Mr. Robertson, of Potter & Robertson, was appointed to represent the Chapter, and act in con-

nection with Mr. Cady of the Board of Trustees of the Institute, in preparing for the Twelfth Annual Convention, to be held in New York, and to open on Wednesday, November 13.

NOTES AND CLIPPINGS.

TRENCHES IN STREETS.—The Commissioner of Public Works in New York has issued the following notice:—

DEPARTMENT OF PUBLIC WORKS,
COMMISSIONER'S OFFICE, ROOM 19, CITY HALL,
NEW YORK, September 16, 1878.

TO THE PUBLIC.

The rough condition of most of our streets is due in a great measure to the many excavations made by plumbers, builders, and gas companies, for the purpose of connecting houses with sewers, water-pipes, and gas-pipes, the pavements over which are not properly replaced. These excavations in the three hundred and twenty-eight miles of paved streets are so numerous that the Department finds it impossible, with its small force of inspectors, to watch each one, and compel a compliance with the ordinances and regulations, which require that the trench be filled with earth or sand in layers not more than six inches thick, compactly rammed, and the pavement perfectly relaid, and kept in good condition for six months.

All persons are therefore requested to report to the Department every case of failure to comply with these requirements which may come to their notice, giving the location and, if possible, the nature of the excavation and the names of the offending parties. This will greatly aid the efforts of the Department to improve the condition of the pavements, and will confer a public benefit.

ALLAN CAMPBELL,
Commissioner of Public Works.

MOROCCO AT THE EXPOSITION.—The court of Morocco at the Paris Exposition has an indescribable air of romance about it. It is hung with mats and scarfs of gay, warm colors, and displays an endless variety of attractive knick-knacks, delicately embroidered silk kerchiefs, cigar and cigarette cases and holders, brilliantly illuminated bracelets and necklaces made of an aromatic composition, fantastically embroidered slippers, delicate pastilles, and an astonishing variety of gilt and tinsel ornaments. Everything seems to send forth the most delicious odor. The air is heavy with Eastern perfumes and spices. Olive wood souvenirs in the shape of canes, paper cutters, paper weights, and sleeve buttons are spread temptingly before you. Strange-looking musical instruments, war trumpets, balafans (a very primitive sort of piano), spears, guns, and queer-looking dirks and battle-axes appear. Then the tall, handsome Moors, with "liquid eyes" and languishing manners, looking like the stage Othellos in their picturesque red turbans and flowing many-colored robes, standing in the tent and around the court, add greatly to the romantic scene.

BRITISH SCHOOLS OF ART.—The progress of elementary instruction in art in the British schools is indicated by a late report. The total number of persons taught drawing, painting, and modelling through the agency of the art and science department was, in 1875, 448,689; in 1876, 530,412; and last year, 610,620. The number of students taught in art classes was 29,579; and 549,010 children were taught drawing in elementary day schools, against 460,961 in 1876. During the period of 1873-77 the number of institutions in which instruction is given in drawing or in higher art, with the aid of the department and subject to its inspection, has nearly doubled. The number of persons taught and of exercises and works examined has more than doubled during the same period; while the total amount of the aid given by the department in the form of payments on the results of this instruction, as tested by examinations, has risen from £31,918, in 1873, to £49,960, in 1877, or nearly sixty per cent. The lectures delivered in the Lecture Theatre of the South Kensington Museum were attended by 8,481 persons; the evening lectures to workmen at the Royal School of Mines by 1,227 persons; and 172 science teachers attended the special course of lectures provided for their instruction in the new science schools at South Kensington. The various courses of lectures delivered in connection with the department in Dublin were attended by about 4,300 persons. The total number of persons, therefore, who received direct instruction as students, or by means of lectures in connection with the science and art department, in 1877, is 681,367, showing an increase, as compared with the number in the previous year, of 81,199, or more than 13½ per cent. The attendance at the art and educational libraries at South Kensington continues to increase.

MANUFACTURE OF RAILROAD IRON.—The Director of the Bureau of Statistics furnishes the following: During the last four years we have been building railroads at the rate of 2224 miles per year. The importation of railroad bars, both iron and steel, fell from 595,321 tons in 1871 to 12 tons in 1877; but the production of iron and steel bars in the United States increased from 2,958,141 tons during the five years from 1867 to 1871 to 4,056,340 tons during the five years from 1873 to 1877, an increase of 37 per cent. The supply of iron and steel railroad bars necessary to meet the demand of our seventy-nine thousand miles of railroad already in operation, for renewals of track and for the extension of track facilities, in order to meet the necessary requirements of traffic, is now about three times as large as the supply required for track-laying on new roads. This production of bars to supply railroads in operation has, in fact, mainly sustained the iron and steel rail interests of the country in their present state of efficiency.

TOMPKINS SQUARE, NEW YORK.—The work of altering the Tompkins Square Parade Ground into a lawn and shrub park has been commenced. Three gangs of workmen, of twenty-five each, are now removing the loam and top dressing from the trench formerly used as a redoubt, which is situated in the southeast corner of the park. The loam is being taken out and will be used as a sub-soil in laying out the lawns in the centre of the park, which is now covered with solid concrete. The mound on the southwest side, formerly used by the regiments as a fort, is to be removed, and the earth and grass which now cover the top and sides will be utilized in filling and levelling the redoubts, etc.

FRENCH AND ENGLISH COMPETITION.—In 1874 a law was passed in France somewhat like the English factory acts, under the provisions of which no children under twelve years of age can be employed in mills and workshops. This law, however, is not very efficiently administered, and is, indeed, little heeded by the manufacturers. The hours of labor in England are 56½ per week, against 72 in France. The French manufacturers thus have an advantage of 27½ per cent, without reckoning the benefit they gain owing to holidays being less numerous in France, and from Sunday work. The wages of the work people employed in the woollen manufactures in France are on the average at least 25 per cent lower than those paid in the United Kingdom. It will thus be seen that as regards the relative cost of labor in the two countries the French have an advantage of 27½ per cent in time worked, and 25 per cent in money paid for wages, or together 52½ per cent. But as a larger number of hands is employed in France than in England for a similar amount of work, and as it is undeniable that English work-people as a rule can produce more than the French, it is estimated that these two advantages on the part of British labor reduce the gain of the French manufacturer in time and wages by one half, or, say, 26 per cent. According to this estimate, labor in France costs one fourth less than in England. The proportion of the cost of labor to the cost of materials varies considerably in different articles; but, to show the effect of the additional cost the English manufacturer has to bear, it may be stated that if the total cost of labor for producing an article of fabric is one fourth of the total cost, the French manufacturer would gain 6½ per cent; if one third of the total cost, 8½ per cent; and if one half of the whole cost, 12½ per cent. The French manufacturer can, therefore, produce more cheaply than his English competitor. It is generally admitted that in many classes of goods the French already excel us, and that the French industry is yearly making more progress than the English. In France, too, strikes in the woollen and other industries of this kind are almost unknown. — *Pall Mall Budget*.

THE DARIEN CANAL PROJECT.—The friends of the Nicaraguan interocean project are getting uneasy lest England and France may secure control of the route, and the government of Nicaragua is growing restless under the long delay of the United States government in deciding what it intends to do in the matter. The strength of opposition to that project in this country comes from the Panama Railroad Company. This corporation succeeded in defeating the proposed canal during General Grant's administration, and is on the lookout and ready to oppose any revival of the subject. An attempt will be made at the next session of Congress to interest that body in the work. If a failure follows it will be dropped so far as this country is concerned, and the execution of the work be left to the European governments. — *Washington Star*.

A FLORIDA SHIP CANAL.—The people of Florida propose to build, or more probably to get the general government to build, a ship canal across their State from Matanzas Inlet on the Atlantic to Fort Wool or Clay Landing on the Suwanee River, in order to shorten the passage from New York to New Orleans. It would have, it is said, an excellent harbor at each end of the canal, and no obstructions at either end. There would not have to be more than seventy-five miles of canal cut on this route, and then it would reclaim at least 1,000,000 acres of the best lands in the State. This land, when reclaimed, would be worth the price of cutting the canal, and the whole route would be well supplied with natural feeders.

"The distance from New York to New Orleans by this route would be much less than by any route farther South. It would be from 1,000 to 1,200 miles less than the route now sailed, which would make a difference of from 2,000 to 2,400 miles saved on the round trip, and would save yearly \$5,000,000 in the way of shipwrecks, and \$3,000,000 annually in the way of extra insurance, over \$40,000,000 in freight, and several millions every year in the way of grain and meat which go to waste every year in the great Mississippi valley for the want of a cheap transportation to the seaboard. The canal, when built, would bring in a revenue of at least \$8,000,000 or \$10,000,000 annually in the way of tolls, especially when the Darien Canal is completed, as it would throw a vast amount of shipping from California, Japan, and China through the Gulf of Mexico, and through the Florida Ship Canal, to New York and Liverpool and other ports."

THE TREASURES OF CYRUS.—A peasant at Michakoff, on the Dniester, is said to have just found, buried in the ground, a treasure supposed to be that of King Cyrus, conqueror of Croesus. It consists of a crown, goblets, clasps ornamented with dragons' heads, sceptres, etc., all of gold, and representing, in weight of that metal only, a sum of 250,000 francs. They have been examined by the archaeologist Praglowski, who declares them to be of Persian origin. He supposes them to have belonged to King Cyrus, and to have been buried there by his attendants on his defeat in the battle of Massagetes, in which, according to some writers, he lost his life.

CLOISTER OF ST. PAUL'S.—In excavating in St. Paul's Churchyard, London, the foundation of the cloister and chapter house of the old cathedral have been discovered, the marble carvings of the fourteenth century being in excellent preservation.

DR. SCHLIEMANN IN ITHACA.—Dr. Schliemann is said to have obtained permission from the Greek Government to begin excavating at Ithaca.

A FORTUNATE ARCHITECT.—William H. Hume, an architect and builder in New York, who was severely injured in February, 1867, by the fall of an awning at One Hundred and Twenty-fifth Street and Fourth Avenue, New York, sued the city to recover \$15,000 damages. The case has been to the Court of Appeals, which renders judgment in Mr. Hume's favor. The judgment, with costs, amounts to nearly \$24,000, and was yesterday entered in the New York County Clerk's office.

AN INTERNATIONAL PARK AT NIAGARA.—Lord Dufferin has proposed to the governor of New York that that State and the Dominion of Canada shall unite in buying up whatever rights as against the public may have been acquired by corporations or individuals in the land around the Falls of Niagara, and shall hold the falls and adjacent land as a public park wholly natural and unsophisticated.