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IN the death of M. Viollet-le-Duc, which is just reported, the profession of architecture suffers perhaps the severest loss that has befallen it in modern times. Not that there had not been greater architects, for neither in design nor in construction did he stand among the first, but by his persistent advocacy of rational design, and his convincing analyses of the architecture both of antiquity and of the Middle Ages as the expressions and necessary consequence of certain systems of construction, in distinction from the sentimental or symbolical aspect under which they presented themselves to earlier critics, he has exerted an influence which few in our day have attained in any art. Even the enthusiasm excited by the moving eloquence of Ruskin seems to have been transitory compared with the energetic crusade which has been carried on during the last twenty years against sham and pretence in design of all kinds, for which the works of Viollet-le-Duc have served both as moral inspiration against yielding to the temptations of a vicious style, and material resource for the formation of a better one. His task has been accomplished; the doctrines he inculcated are now accepted as a part of the best professional thought, and to the treasure of examples which he labored so long to collect for us, new treasures are daily added, but the knowledge that the living presence of the teacher is gone forever from among us will cause a sense of personal loss to thousands who have known him only through his writings.

EUGENE EMMANUEL VIOULET-LE-DUC was born January 17, 1814. He studied architecture under Achille Leclerc, and in 1836 went to Italy. After two years among the Roman and Greek remains of Italy and Magna Græcia he returned to France, continuing his researches in the southern provinces of his own country. In 1840 he was appointed to the comparatively humble position of *inspecteur des travaux* under Duban at the Sainte Chapelle. Before this work was finished he was sent to take charge of the restoration of the abbey church of Vezelay, and, in the following year, of the churches of St. Père, Poissy, Montréale, St. Nazaire de Carcassonne, and Semur-en-Auxois, and the hotels-de-ville of St. Antonin and Narbonne. In 1848 he was chosen in competition as adjunct with Lassus to direct the repairs of Notre Dame and the construction of the new sacristy; and this work was followed by the restorations of the fortifications at Carcassonne, the Salle Synodale at Sens, the cathedrals of Amiens and Laon, and the church of Châlons-sur-Marne, and later, the castles of Pierrefonds and Coucy. In 1853 he was made one of the three *inspecteurs des monuments historiques*. He was an officer of the Legion of Honor, and honorary member of both the British and the American Institutes of Architects. On the reorganization, in 1863, of the École des Beaux-Arts, which he had often taken occasion to criticise in his writings for what he considered to be its devotion to irrational and unscientific principles of design, he was appointed professor. This aroused the resentment of the students, and a demonstration took place, which, though it ended in nothing, perhaps led to his retirement not long after. He was afterwards identified with the École Centrale, which gave instruction in architecture in a manner more consonant with his predilections. In 1870-71 he was put in charge of certain of the defences of Paris, with the rank of colonel. Since then he has lived a retired though busy life, much of the time in Switzerland, devoting himself to the writing of essays and newspaper articles, together with more important literary undertakings.

His *magnum opus*, the fruit of immense labor, is the well-known *Dictionnaire Raisoné de l'Architecture Française du XI^e au XVI^e Siècle*, embracing the observations and deductions gathered during the whole period of his active life, from his earliest years to 1868, when the last volume was published, and illustrated by more than three thousand sketches, all drawn on the block by his own hand. This was followed by the *Dictionnaire du Mobilier Français de l'Epoque Carolingienne à la Renaissance*. In 1854 appeared an *Essai sur l'Architecture Militaire du Moyen-âge*, substantially a *résumé* of the observations on the subject scattered through the volumes of the *Dictionnaire*. The *Entretiens sur l'Architecture*, the last volume of which appeared in 1872, comprise a series of discourses, historical and theoretical, and form his last strictly technical work. Since then, his lively and entertaining style has found congenial expression in a number of semi-scientific novelettes, the best of which is the *Histoire d'une Forteresse*, published in 1874. Similar to this are the *Histoire d'une Maison*, and *Histoire de l'Habitation Humaine*, published in 1873 and 1875. A more serious work, the *Habitations Modernes*, written in conjunction with M. Félix Narjoux, has just appeared. The professional journals owe to him many contributions. His *Lettres sur la Sicile* have been reprinted in book form, and a monograph on certain geological features of Switzerland was published not long ago. As an architect, in the sense of designer, Viollet-le-Duc's name does not stand high. His constant employment in other branches of the profession, his temperament, naturally logical and scientific rather than æsthetic, and the deep impression made upon his mind by the constant study of actual examples, all conspired to check what power of original design might have been developed under different auspices; and yet as an artist his reputation was more extended. He received three medals for serious works in water-color, and the sketches with which his works are filled, hasty and mannered as they are, show a vigor of drawing and knowledge of effect which would be even more striking if it were not overshadowed by their extraordinary merit as the best architectural illustrations ever published.

IN a project which has in one form or other been long before the people of Paris, and has of late been the subject of discussion both in the municipal council and in the ministry of the fine arts, — the project for establishing a national opera, that is, a popular one, — M. Viollet-le-Duc has taken a warm interest, as he has in every question of opening art to the active influences of the day. He has lately presented a report or memorial on this subject to the municipal council. He argued for a stage which shall give adequate representations of the best works without the costly mounting of the fashionable opera or other theatres, and a low admission price. This, he thought, would divert many people from their attendance on the *café* concerts and the lower theatres; and he argued that the public, which would be contented with good works well executed, would not be exacting of splendor in the *mise en scène*. This will seem not impossible to the visitor who remembers the crowds that have for years attended the excellent but unpretentious Pasdeloup concerts, and who recollects that at the theatre of the Odéon in the Latin Quarter, which may, we suppose, be called *par excellence* a popular theatre, certain days in the week have always been set aside for the performance of serious and standard works, making it the only theatre in Paris, except the Français, where one could always find chances to hear the best French plays. His latest published writings are a series of papers printed in *L'Art*, on Decoration applied to Buildings, a subject which he has studied by the lessons of earlier and more homogeneous examples than those of to-day. In these papers, of which the last, apparently, was printed hardly a month before his death, he writes with all his accustomed keenness of analysis and breadth of view, and he does not fail to lift his voice as usual against the academic exclusiveness and conservatism which it was one of the habits of his life to attack, nor to bear his testimony against their influence, which he had once in vain attempted to combat, upon the École des Beaux-Arts. He closes with this characteristic paragraph: "My conclusions shall not be lengthy. There are but two modes of existence for art: hieraticism and liberty. Hieraticism tends fatally towards irremediable decadence. Liberty may have its excesses, its moments of splendor and of eclipse; but however low it may fall it always springs up again with new youth and vigor."

WE have received a small *brochure*, which may be considered the prospectus of a private course of instruction in civil and mechanical engineering projected by Mr. William Watson, sometime professor in the Massachusetts Institute of Technology. The plan of instruction proposed in the brochure is to exchange the system of teaching by text-books, usual in American technical schools, for familiar lectures and the discipline of problems, or *projets*, as they are called in the French schools, combined with study in what the pamphlet calls a studio and *atelier*, which will be supplied with examples and models of appliances and constructions of engineering, both civil and mechanical. The method of instruction thus foreshadowed will be new in this country, although it is founded on the practice of the most successful continental schools. It ought to have special advantages in leading the engineering student directly to the study of the sort of problems which he will face in actual practice, under the inspiration of the best examples and under the immediate supervision of an instructor. The apparatus for teaching, which Professor Watson has collected and which the pamphlet enumerates, is extensive, and includes much that has not been introduced in this country, much, in fact, that is not accessible for the use of most schools, containing unpublished courses of the lectures delivered in the French schools; collections of the projects used in them; models, books, and illustrations of various kinds collected by the projector while studying the European systems of instruction, or while acting as U. S. Commissioner or member of the jury at the Austrian and French Exhibitions. The course of instruction promised includes the usual subjects, — descriptive geometry, stereotomy, the principles of mechanism and of constructive engineering. With these are included, of course, draughtsmanship, to which is added practice in modelling; and special stress is laid on the use of the new methods of graphical statics. Examples are given of the kind of problems to be studied in connection with the courses, *e. g.*, the iron roof of a railroad station, a travelling crane, the improvement of an inland and a tidal river. These methods of education are those that have been best approved by experience: we shall be glad to see them introduced in this country with adequate appliances and under skilled instruction.

It is a painful and wearying duty to chronicle week after week the fatal disasters that are due to the bad construction of buildings; but our habits of building are in some particulars so disastrous that public attention cannot be too persistently called to their consequences. The latest case we have heard of was the burning of a small tenement-house in South Boston, Mass., a few days ago, by which five persons were killed and several others greatly injured. It was a common kind of occurrence, — its significance is in its commonness, in fact. A fire at the foot of the staircase was discovered from without at midnight. When the alarm was given the egress of the lodgers on the upper floors was already cut off. The firemen, arriving with their ladders, found that those who were not burned alive had been either killed or maimed by jumping from the windows, or the roof, no one, we believe, escaping without injury. Fortunately, the house being a small one, there were only three families in the upper stories, and therefore not a great many people to burn. When we consider how the larger tenement-houses are built and occupied, the wonder grows that such occurrences are not more frequent and more disastrous. The weakest point is always the staircase, since it is not only the way of escape, but the speediest means of spreading the fire. The incendiaries at all events have found out this vulnerable point; and it is to one of them that the disaster at South Boston is ascribed.

OUR hotels, it must be confessed, are not much better provided in this respect than our tenement-houses. When the Tremont Temple in Boston was burned a controversy was provoked between the *Fireman's Journal* and the proprietor of the Parker House, which adjoined the Temple, by some reflections of the paper on the risk to the guests at the hotel. The *Journal*, while allowing that the Parker House was as safe as other hotels, reasonably condemned the manner in which all hotels are built as unsafe. Its remedy — and it is the remedy which we are apt to hear first invoked, whenever a tenement-house or hotel or factory burns — was fire-escapes and balconies. Fire-escapes are no doubt valuable auxiliaries to staircases in case of fire, when they are not otherwise objectionable, and important palliatives of danger in buildings whose stairways are insecure and cannot

or will not be improved by their owners. For many existing and faulty buildings they may be the only palliative which can be imposed. But we have small respect for them as substitutes for proper stairways, or for the wisdom of persons who will build staircases that invite fire, and then look to fire-escapes to do duty for them when they burn. The fire-escapes seem to us a very questionable addition to hotels, where their chief use would be, we fear, to afford an apparatus for playing bo-peep with thieves, and where the chief security is to be looked for in constant patrolling, and in proper planning and construction. In these last respects old buildings are often incurable, to be sure, but new ones may be provided for by law, and should be, now that public attention has been so often called to their danger. It is pretty safe to say, without computation, that the money which it would cost to properly equip any large tenement-house or hotel with fire-escapes would meet the additional cost of enough fire-proof staircases to do much better service. It is important, therefore, not to let the proposed palliation divert attention from the radical fault, which we ought to remedy. Already the agitation of the tenement-house problem has advanced us so far that all the plans for improved buildings of this class that are brought forward are provided with fire-proof stairs; and it ought to be forbidden henceforth to build in our large cities any hotels or tenement-houses that are not provided with a sufficient number of staircases that will not burn, enclosed in brick wells that will not communicate fire. Then let fire-escapes be added, when there is occasion for them, and where they will not invite as much danger as they parry. When this kind of construction becomes the rule, as it is in more carefully regulated towns than ours, the danger of casualties will be enormously diminished, and the "fire-bug" will be checkmated, at least in his most diabolical trick of kindling his fire at the bottom of the stairs.

APPROPOS of articles on the Venus of Milo which have appeared lately in the *Atlantic Monthly* and the *Art Amateur*, we have in the last named journal a letter from Mr. Philip Gay, which describes with interesting minuteness the manner in which the statue was hidden away by the curators of the Museum in the Louvre, as is commonly known, during the sieges of Paris in 1870. The Venus, laid in an iron coffin, was carried out by night and immured in a subterranean chamber at the end of a corridor in the Prefecture. A wall was built to enclose her, and finished with all the factitious look of age that it was possible to give it. In front of this a second chamber was walled off, being filled with a valuable deposit of state papers, which also needed a place of safety, and which were immured in their turn. It was shrewdly assumed that if the outer hiding-place were discovered the finding of an important deposit of documents would satisfy the discoverer, and that he would look no further, but leave the yet more precious deposit of sculpture undisturbed. In point of fact the Venus lay securely until the troubles of the Commune were over, and it was safe to restore the treasures of the Louvre to their places in the galleries. It will be remembered that to this removal we owe the correction of the attitude of the goddess, as far as her body is concerned. The statue was made in two or three pieces, which separated when it was taken down; when she was replaced it was noticed that to suit the taste of her first restorers the upper part of her body had been tilted forward by inserting wooden wedges into the joints in the back of the figure. The story of the concealment is pleasant testimony to the intelligence as well as the zeal of the custodians. It is unlucky that the publication of the device will make it more difficult to succeed in it when the need occurs again. But the trick may be forgotten in the lapse of a generation, as many things are forgotten.

URBAN HOUSING.¹ V.

In this plan for a bachelor apartment-house in New York, on a twenty-five by one hundred feet lot, not on a corner, a lot chosen because of the kind most common in New York, the architect has aimed —

First. To avoid inside and windowless rooms.

Second. To avoid windows opening on close courts, air-shafts or wells of light, or other objectionable or insufficient air and light spaces.

Third. To avoid inability to get a thorough draught of air through each dwelling in hot weather, or when needed for ventilation.

Fourth. To avoid (while securing the benefits of shallow houses as regards ventilation) wasting space in over-large yards, or neces-

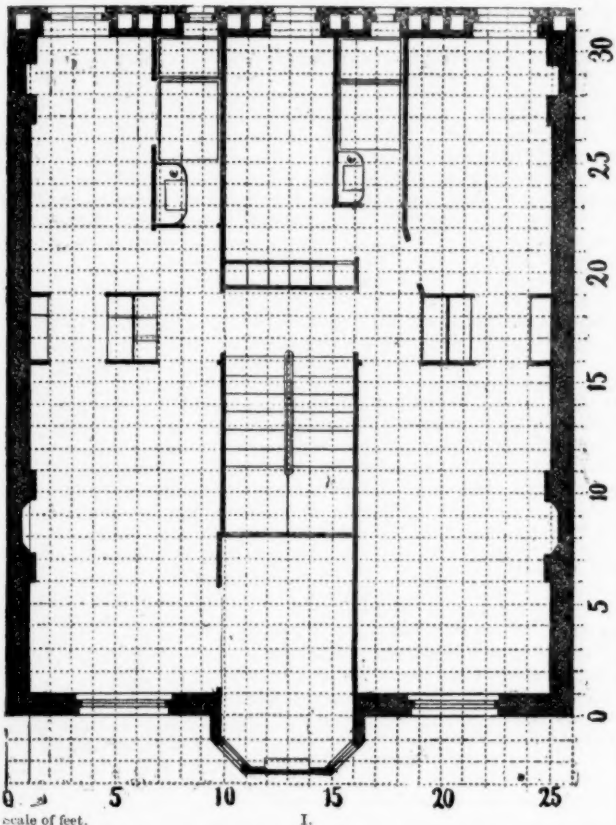
¹ The paper on New York Yards (Vol. V., Nos. 178 and 179) forms part of this series.

situating the opening of new streets or lanes, and thus to avoid not only the difficulty of introducing lanes in the city, as now laid out and partly built up, but also to avoid all questions as to the policing of such lanes, the difficulty of keeping them neat, and whatever drawback there is to the renting of apartments in houses fronting on them.

Fifth. To avoid, as far as practicable, things to be used in common, the need of a janitor, and whatever may detract from the independence of tenants or may add to the expense of living in the house; yet, at the same time, to avoid anything mean or unusual in the finish or appearance of the house, and whatever may unfit it, or seem to unfit it, in any way, for occupancy by persons of the highest social position.

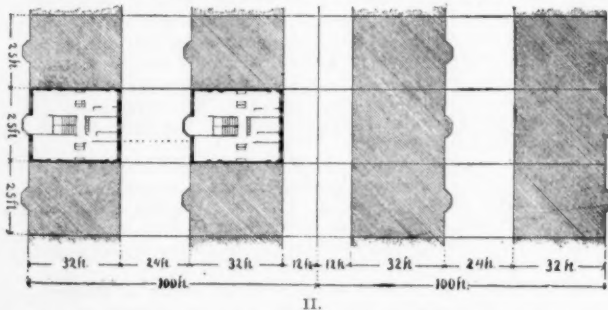
In these plans the publicity and embarrassment of entering apartments from galleries is avoided, as well as the semi-publicity of corridors, together with their liability to espionage, noise, difficulty of policing and keeping clean, and the absence of a proper thorough draught through them and through the rooms entered from them. The only corridor is a glazed passage, such as is common in office buildings, which is used to connect, on the entrance floor, the front and rear buildings into which the house is divided.

There are two apartments on the entrance floor, and four apart-



ments on each of the floors above, two being in the front building (see Diagram I.) and two in the rear building.

Each apartment consists of vestibule or ante-room, sitting-room, bed-room, bath-room (with water-closet, bath arranged as on a yacht, laundry tub, and sink), kitchen, private lift from basement to roof, private well lighted and finished off basement-room or cellar, private coal vault, and private clothes-drying yard or roof garden. The rooms are small, but such as the smaller private parlors of many hotels through the country, the hall bedrooms of many houses in New York and elsewhere, and the kitchens of many French apart-



ments show will suffice for the needs of a large number of persons who, being without family, still wish the privacy of a separate home, but without the expense of a larger home than they need. Servants

need not be dispensed with, but, as is common with bachelors' chambers, are expected to sleep out. Janitors can be employed if preferred. The stairs are easy, of one size and finish from basement to roof, and well lighted and ventilated.

A light, well-railed bridge connects the roofs of the front and rear buildings, to serve as a fire-escape.

A court or yard, of the full width of the lot and twenty-four feet deep (see Diagram II.), separates the front and rear buildings. There is a similar court of half the depth behind the rear building. A careful examination will show scarcely an apartment-house in New York or Boston that does not lack some of the safeguards of health in regard to ample air-spaces, and the opening of all rooms by windows on them, embodied in this plan. The bearing of this plan on the problem presented by those offering prizes in the recent competitions in tenement-house plans is recommended to the attention of those interested in that subject.

If larger apartments and a variety in the number, size, and distribution of their rooms be desired, should they be obtained by having, for instance, one apartment in place of the two shown on the plan, in the width of a twenty-five feet lot, or by using the front and rear buildings of the plan on wider lots (such as property in New York, although obliged to retain the standard depth, is often found divided into), the main merits of the plan can still be retained and its excellence for deep lots availed of.

The benefits of the plan to which attention has so far been called will be secured should it be carried out on a single lot only. This calls for no great outlay of capital, whether that of several persons combined or of a single individual. The whole increased cost of dividing a building, as shown, into front and rear buildings, and so securing the benefits of light and air and thorough draught in every room, and so too higher rents, need not exceed five to seven hundred dollars. The chances are that the yards or air-spaces shown in the plan, like the yards of houses in general, will not for many years be shut in by adjoining houses built up in the rear, or perhaps on the sides. So long as this remains the case all such defects as are inherent in courts, even as large as these, will be avoided; for, being open at the sides and in the rear, they will be courts only in name. But if, further, the lot in the rear should be similarly built on, that would secure permanently (as shown by Diagram II.), between the two rear buildings, a court or yard like that between the front and rear buildings, which, whether it remained open at the sides or not, would still have twenty-four feet as its smallest dimension; and if, in addition, the adjoining lots be similarly built on, that would further give permanently (as also shown by Diagram II.) what would be, in effect, rows of shallow houses (thirty-two feet deep each), yet all entered from the main street, but separated by continuous air-spaces, like streets twenty-four feet wide. Such street-like air-spaces would approach in width some fashionable streets in London, and would exceed the width of many business and other streets in that city, the healthiest, according to statistics, in the world. The results to be obtained by carrying out this plan, or one embodying its leading features, both on a single lot and on a number of adjoining lots, are recommended to the attention of all interested in the evils of New York flats and tenement-houses, and in the evils brought about everywhere by over-deep lots, and who seek how best to lessen or avoid them.

This plan, made with reference to the intention but not the letter of existing legal enactments, is only one way of dealing with certain great and small evils to which, one after another, attention has been drawn during a long study of the subject of urban housing. Therefore it is of less importance to call attention to the plan than to call the attention of all interested in the wide and important general subject of dwellings in cities to the evils which it aims to avoid. Yet the more those evils are studied, the more will this plan be valued as a study in the distribution of areas, so as to get by the least expenditure the highest return in rents and in sanitary excellence. For as the public attention is being more and more turned to sanitary excellence, so will higher rents be more and more paid for what gives the best assurance of commanding it. — Edward T. Potter.

THE SEWERAGE OF THE SMALLER TOWNS.¹ I.

I PROPOSE to consider the subject of the sanitary drainage of the smaller towns, which, whether they have city charters or not, are, in their physical characteristics, more like villages than like the larger cities.

It seems to me that the difference of conditions between large and small towns, so far as relates to the removal of their waste matters, has not been sufficiently considered in arranging plans for their drainage; our best drainage engineers have gained their experience and have formulated their practice in connection with works in large, populous, and prosperous towns, where much of the area is covered with buildings and with pavements, where the frontage of private property is short, and where the cost of extensive works may easily be borne. When such engineers are appealed to to furnish plans for the sewerage of the smaller places now under consideration, they quite naturally apply to the work the skill, experience, and judgment which they have acquired in their larger practice. As a result, the projects for the sewerage of these country towns are either not carried out be-

¹ A paper by Colonel G. E. Waring, Jr., read at the Social Science Convention lately held at Saratoga.

cause of the great expense that the work would entail, or, among other disadvantages, they are carried out at a cost which leads to the long-continued embarrassment of the community.

All things considered, it is safe to say that the question of the cost of these sewerage operations is hardly less important than that of their sanitary efficiency. It is extremely important, not only that the work be well and properly done, but also that it be done in such a manner as to interfere as little as possible with the financial prosperity of the community. Inordinate outlay in one direction implies restricted outlay in others. Sewers which are so costly as to embarrass the municipal government entail a restriction of necessary expenses in other directions which have a more or less direct influence upon other aspects of the sanitary question.

In order to judge what is the best course to be pursued in arranging for the drainage of a town of limited population, limited wealth, and relatively large area, it is important to consider carefully the different offices which sewers are intended to perform, and the relative importance of these offices.

Public drainage works generally have for their object the removal of storm-water, of excessive soil-moisture, and other foul liquid wastes proceeding from private houses and from factories, slaughter-houses, etc.

It is no part of my present purpose to discuss the question as to the relations of these different elements of work in a large city. In considering the case of a small town, their relative importance covers the very basis of all our calculations. Certainly, no town, with wide, unpaved streets, with considerable land about most of its houses, and with a population of limited wealth, would think of constructing an expensive system of large sewers for the sake of getting rid of the storm-water which falls upon its surface. Such storm-water often produces inconvenience, and on rare occasions it does damage to public and private property; but, so far as my observation goes, there is not a small town in the country where this inconvenience might not be avoided, and this occasional injury remedied, for very much less than the interest upon the original cost of a comprehensive system of large sewers.

Large sewers which are made of brick, or of pipes with imperfectly cemented joints, serve an excellent office as a means for the outlet of soil-moisture. That is, they make excellent under-drains. Occasionally, but not always, while they serve as under-drains in wet weather, they leak out contaminating sewage into the soil in dry weather. Considered with reference to their action in removing soil-moisture, they are extremely costly. The work which they perform in this way might be secured for an infinitely smaller outlay by an independent system of soil-drains. Then, too, in many cases, if not in the majority of cases, the soil is naturally of such a character as to render their action in this regard unnecessary. In these instances the constant effect of their porosity or leakage would be an injurious one.

Of the three offices of a system of sewers, the removal of domestic and manufacturing waste is not only by far the most important consideration, but it is, in many small communities, the only one which is worthy of a moment's consideration. A town of twenty thousand inhabitants does not contemplate the construction of a system of sewers to get rid of its rain-water or to get rid of its soil-water, but because it finds itself harassed on every side by the accumulation of foul organic matters, whose decomposition produces an immediately deleterious effect upon the health of the population, and a shameful and annoying nuisance. I shall assume, for the purposes of this discussion, that this latter consideration is the *only* one which need enter into the argument; that it is simply a question of removing household waste, the outflow of factories, chemical works, dye-houses, etc., and all other liquid or semi-liquid matters of which the organic constituents may undergo offensive and dangerous decomposition if retained within the limits of the town, — and a question of the efficiency and economy of doing this by the use of large sewers or of small sewers.

In my studies and observations on this subject I have been very slow to withdraw from the conviction, universal some years ago, and still adhered to by many among the more experienced men of the profession, that the most efficient drainage of a town is to be secured by the use of sewers constructed and arranged to receive all or nearly all of the rainfall. While I do not, even now, altogether abandon this conviction with reference to large cities, I believe that I have sound reasons for the faith to which I have slowly come, that in the case of the smaller towns the separate removal of the foul drainage only is as much better than the former practice as it is cheaper. I will take, as an illustration of my meaning, the case of a town in New England with a population of about twenty thousand, for which a plan has recently been prepared that contemplates the admission of storm-water to the sewers. The arguments used by the engineer in his report to the authorities are based upon a comprehensive review of the best that has been written on that side of the subject. His smaller branch sewers, even those extending into short streets with very few houses, are twelve inches in diameter. The collecting sewers are considerably larger, and the main outlet, which is of great length, is more than five feet in diameter. It is not necessary to consider in this connection the utility and importance of the larger sewers, but the arguments concerning the twelve-inch pipes are instructive. With reference to the cleansing capacity of the flow and the calculations of grade and size, we are repeatedly told that the

assumed velocity, upon which thorough flushing must depend, is based upon an amount of discharge that will cause the sewer to run *half full*. The rate given is three feet per second. Now a twelve-inch sewer, running half full and having a fall of one in three hundred (needed for a velocity of three feet per second), would discharge nearly half a million gallons per day. I assume that the outflow of the average of houses in such towns does not exceed thirty-three and one third gallons per day per head of population. It would therefore require a population of about sixteen thousand to fill a sewer of this size, and lying on this inclination, half full, supposing the flow to be uniform day and night. If we assume that one quarter of the daily flow is discharged in three hours, — between eight and eleven in the morning, — the sewage of about eight thousand persons would fill the sewer half full at least once a day, and this would suffice for flushing purposes. Eight thousand persons would probably occupy over sixteen hundred houses, and, theoretically, it would require this number of houses to furnish sewage enough to keep the twelve-inch pipe in good condition. As in the case in hand, there is probably no instance where a population of five hundred is to be served by a twelve-inch pipe, we must assume that it was contemplated to depend entirely upon the rainfall to keep the sewers properly flushed. Did rain fall in sufficient quantity and at sufficiently frequent intervals to secure this result, this part of the difficulty would be overcome. But often many weeks elapse during which no storm-water whatever enters the sewers. This is, too, generally at the season when decomposition is the most active, and when its effect upon the atmosphere is the most injurious.

It is very well understood that sewage matters, if removed within twelve or even twenty-four hours after production, generate little, if any, injurious gas, and that if they lie longer than this they become increasingly dangerous and offensive. Therefore, in the present example, the sewers being all of a size which the household flow is by no means adequate to cleanse, and the rain-water cleansing being very intermittent, we should have, practically, throughout the whole year, an accumulation of decomposing organic matter within the sewers, which every consideration should lead us to avoid.

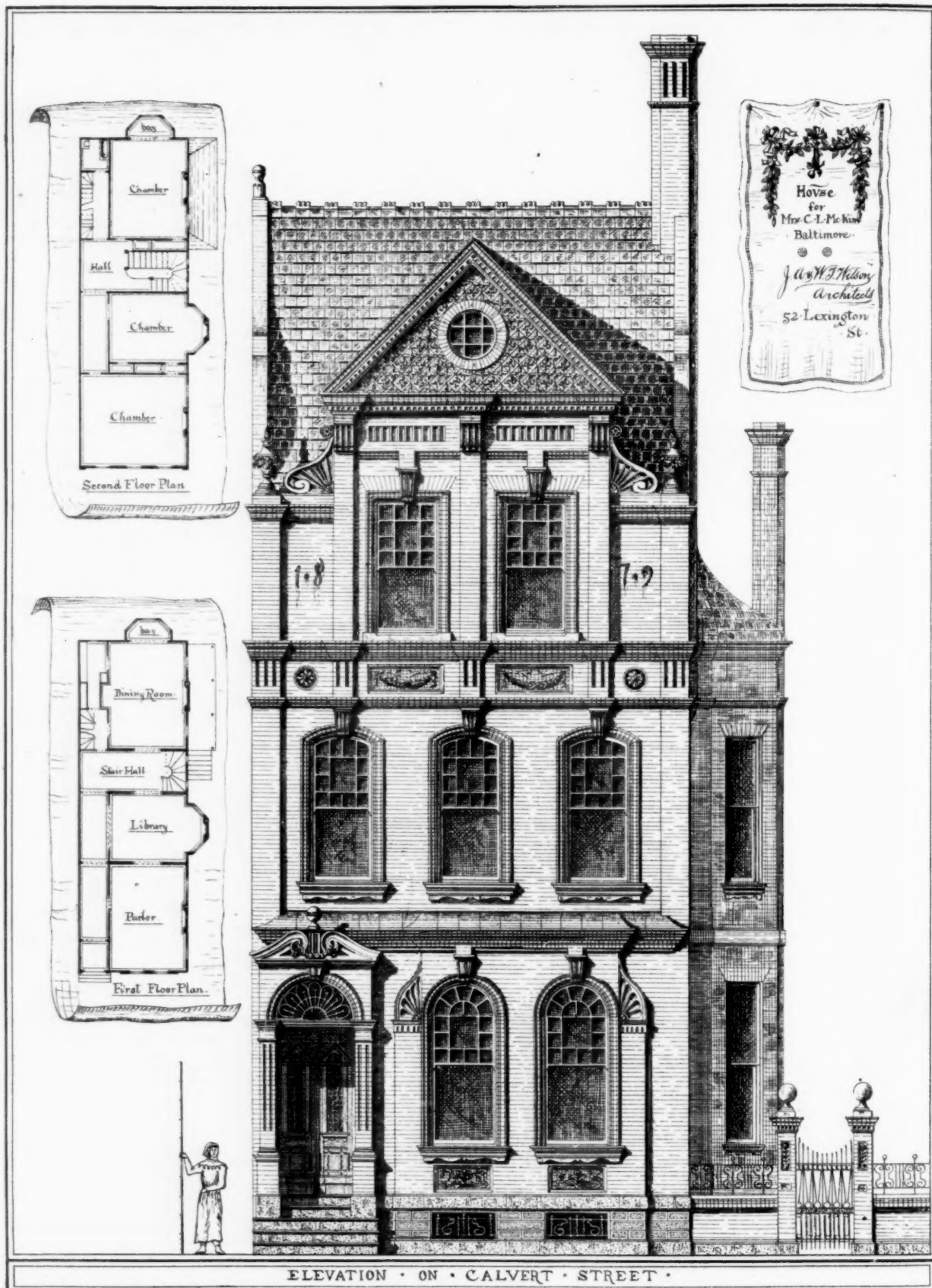
Furthermore, the admission of surface-water from ill kept or from unpaved streets results in the carrying into the sewers of heavy earthy matters which the ordinary flow is incapable of moving forward to the outlet, and these are largely intermixed with horse-droppings and with other organic matters, which, so far as they remain within the sewers, cannot fail to be subject to the gravest objection. Whether or not the difficulty increases as we pass from the smaller sewers to the larger ones will depend very much upon the gradient or inclination of these latter. If they are steep enough for an active current, most of the foul substances which they receive may be carried forward to the outlet though the flow may be only a few inches in depth. If, as is very often the case, the land through which they pass is nearly level, and their gradient is very slight, they accumulate rubbish more and more until it becomes necessary to cleanse them by hand or by the use of mechanical appliances. During the whole time that this foul matter lies in the branch sewer or in the main it is necessarily undergoing decomposition. It is producing the condition which has given to ordinary city sewers the frequent appellation of "elongated cesspools." I believe that this condition is inevitably inherent in the character of all large sewers which are not furnished with such means of thorough flushing as will be adequate to sweep them entirely clean, from end to end, — and at intervals not longer than twenty-four hours, — of all earthy or organic matters which may have gained access to them. I believe that such sewers as are ordinarily used in large cities are, for reasons stated, extremely objectionable, and that they can be made satisfactory only by the general introduction of the most copious flushing appliances, — with a completeness which has never been adopted, and which probably has never been contemplated, in this country.

I believe that for the smaller towns, such as we are now considering, storm-water sewers are not only inadequate to the work for which they are designed, but are absolutely injurious, — to such a degree that it sometimes becomes a serious question whether they do not do more harm than good. In other words, I believe, not only that these large unflushed sewers, when applied to the uses of scattered communities, are extravagant in cost, but that the injury which they are capable of working may far outweigh any advantage that they may secure. They remove, without injury to public and private works, the water of heavy rains, and so they do good. But, on the other hand, they do not remove, they only conceal from sight and store up in a most dangerous condition, foul matters, which had much better be left to decompose on the surface of the ground in full exposure to sun and air. Better the absolute stink of dirty streets than the dangerous gases arising from unventilated accumulations of rotting filth.

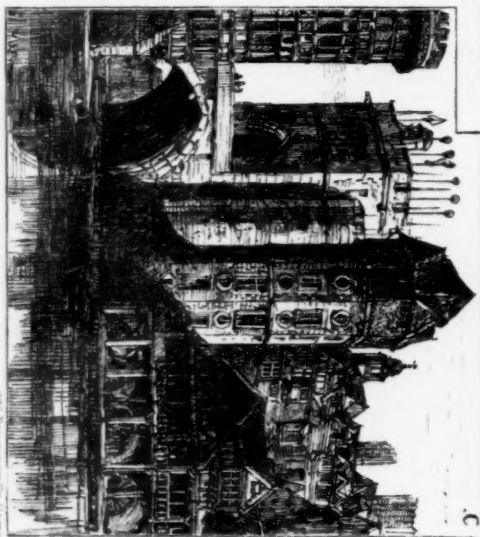
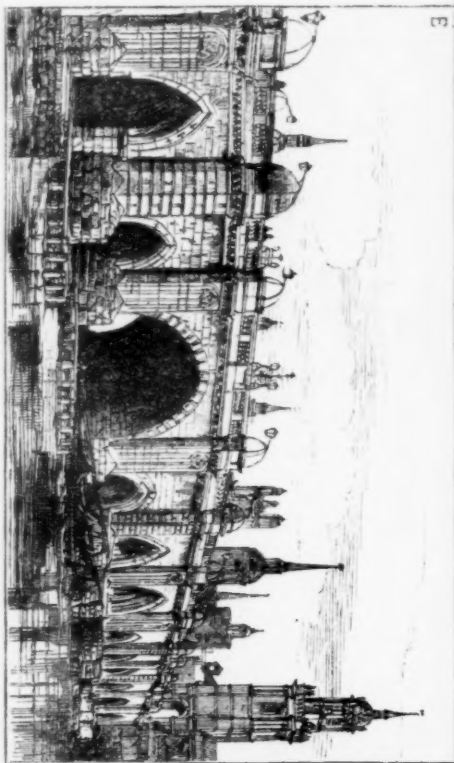
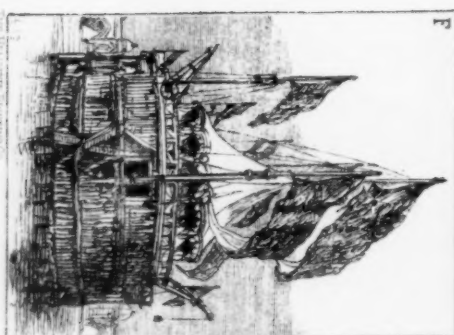
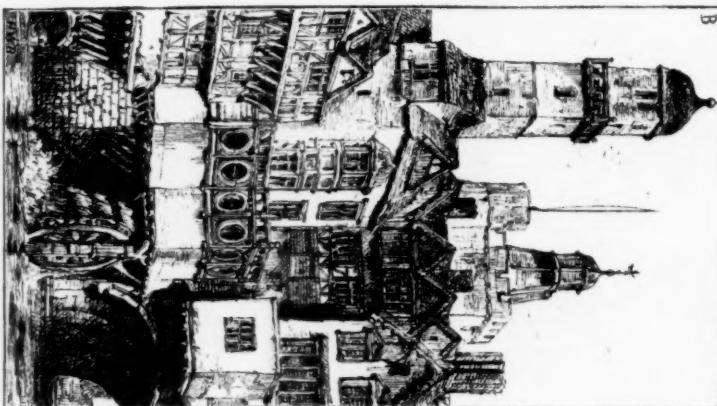
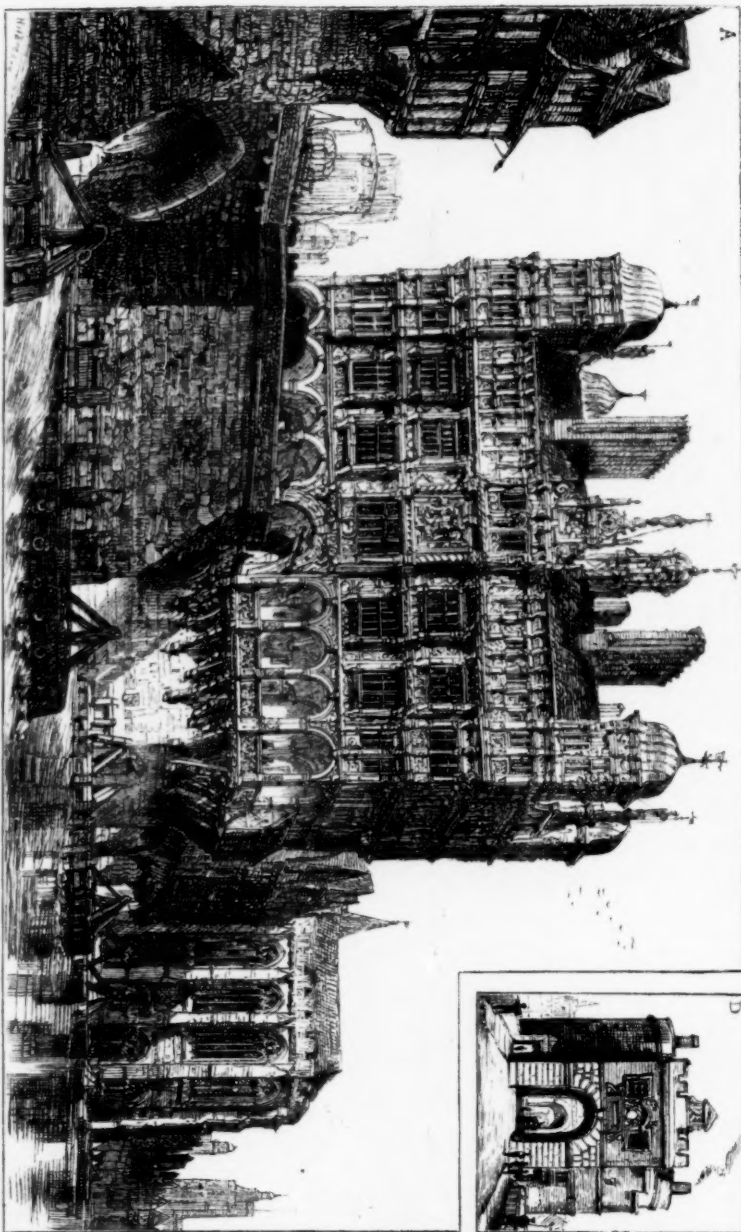
So far as the removal of storm-water is concerned, nothing more need be said in this connection than has already been said, namely, that it costs more than it comes to. I know of no instance, even when the grades are steep and the soil subject to wash, where the injury done by the heaviest storms bears any proportion to the interest on the cost of such gigantic engineering works.

Regarding these large sewers as out of the question for our purpose, I venture now to suggest what seems to me a satisfactory substitute for them.

I begin with the idea that the most costly and the most dangerous



(FROM THE GRAPHIC)

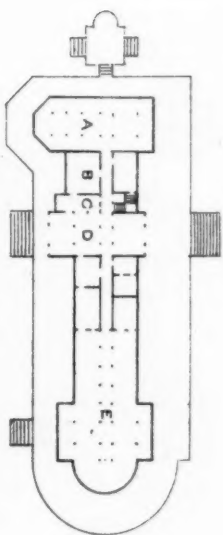


A. Norwich House, and Drawbridge of St. Thomas & Becket's Chapel.—B. Waterworks at the North end of the Bridge (1593).—C. "Tailor's Gate" and Old Southwark Flour Mills.—D. Gateway at Southwark end of the Bridge as rebuilt (1728).—E. General View of the Bridge after Repairs and Alterations (1760).—F. Cofferdam constructed for the building of "New London Bridge" (1825).

OLD LONDON BRIDGE

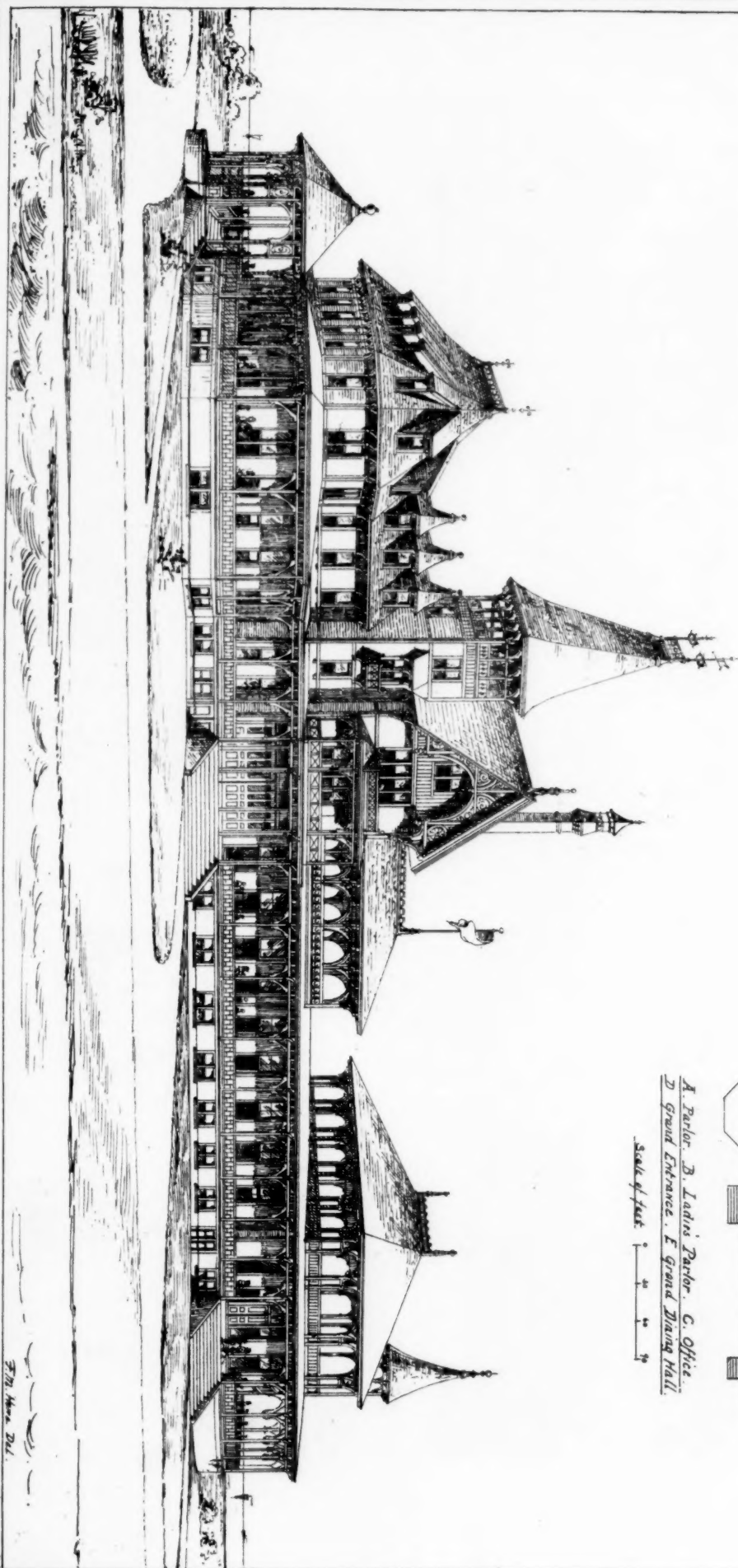
HOTEL NANTASKET
NANTASKET BEACH

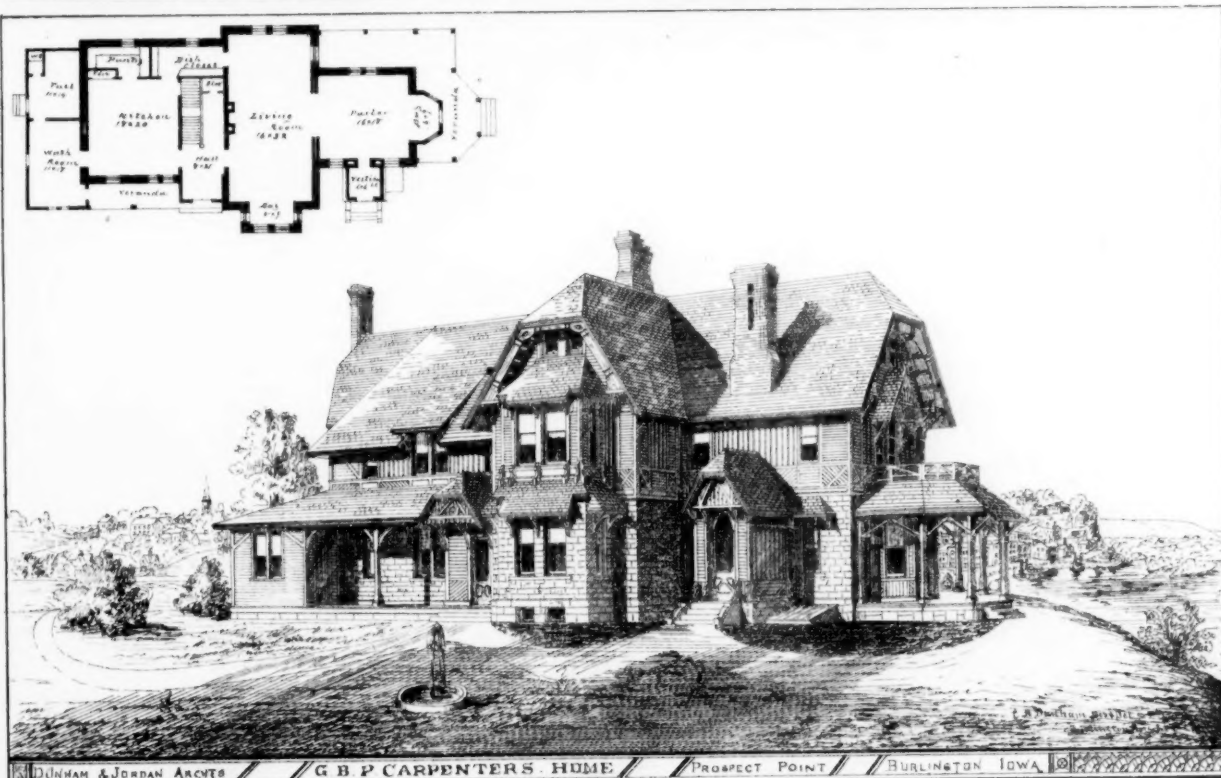
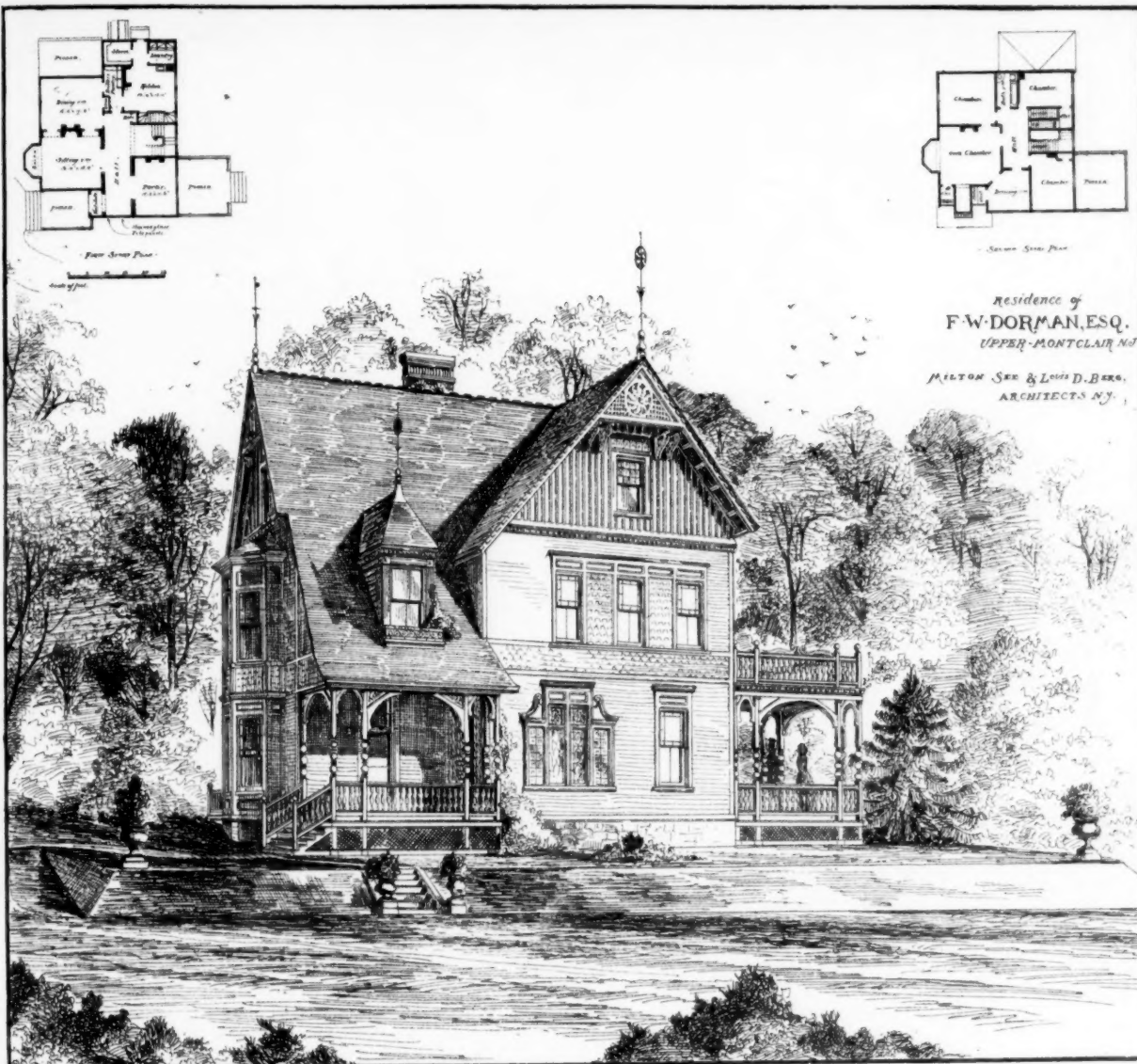
J. PICKERING PUTNAM, ARCHITECT, BOSTON.



*A. Parlor. B. Ladies' Parlor. C. Office.
D. Grand Entrance. E. Grand Dining Hall.*

Scale of feet: 1" = 40'





scavenger that a city can employ is the rain that falls upon the surface of its streets. Under proper municipal control the organic matter deposited in the streets may easily be confined almost entirely to the droppings of horses, and this material has a value which will go a long way towards paying the cost of its immediate collection and removal. Even were this not the case, the necessity for performing such work regularly and systematically, with a view to the preservation of the purity of the atmosphere of the town, needs no argument.

There are exceptional cases, where the surface flow of the streets, accumulating in valleys, may require some special means for its removal. But even here it will often be cheapest and safest to arrange the surface conformation and the pavement of the necessary street surfaces so as to secure its removal above ground. It may occasionally be necessary to construct underground sewers for its secure discharge.

These exceptional cases do not, of course, affect the main argument. So far as the sewers themselves are concerned, which it is proposed to furnish to a town of the class under consideration, we have only the sanitary question to regard. Our aim should be to collect all foul outflow from private houses and other establishments, in the most direct and immediate way, and to carry it, within the shortest time possible, to its final point of disposal beyond the limits of the town. The sewers should be adjusted to this work, and to no other; and every pipe of the whole system should be swept entirely clean, at least once a day, leaving nothing to decompose and contaminate the confined atmosphere within it, except such matters as may attach themselves, as slime, to the walls of the pipes; and the amount even of this sliming should be as much as possible reduced.

These ends are to be secured by making absolutely tight sewers of a size proportionate to the service which they are to perform; by giving these, so far as practicable, a uniform descent; by gathering the branch sewers into collecting drains, and mains which are only large enough for the purpose, and by carrying the outlet of the whole system to a suitable point of discharge. There should be nowhere in the whole course of any one of the drains an opportunity for halting and decomposing by the way; no depression where the flow may at any time slacken, to deposit silt and gradually form a hardened accumulation, lessening the capacity and injuring the channel of the drain.

Those who have not considered the subject have little idea of the discharging capacity of small pipes. The following calculation is suggestive.

A pipe six inches in diameter, having an inclination of four inches in one hundred feet (a fall of one to three hundred), has a capacity of discharge of nearly two hundred gallons per minute, or twelve thousand gallons per hour; or between eight and eleven in the morning of thirty-six thousand gallons. If one fourth of the daily flow is discharged in these three hours, then the daily capacity of this sewer would be one hundred and forty-four thousand gallons. Suppose, now, that each household numbers five persons, and that the consumption of water or the amount of outflow is thirty-three and one third gallons per head per day. Suppose, too, that the sewer is to run at no time more than half full, a six-inch sewer on such a grade would then serve for the drainage of over four hundred houses. Allowing a width of only twenty-five feet for each house-lot, this six-inch sewer would suffice for a street nearly half a mile long, built up on both sides.

It has been amply shown by experience that the sectional area of a drain which receives numerous branches need not be increased in proportion to the combined capacity of those branches, for the reason that additions to the stream, if introduced at proper curves, add to the velocity of the flow, and increase the discharging capacity.

A computation of the capacity of collecting and main drains needed to discharge the outflow of a number of six-inch drains, conditioned as I have described, would show very much smaller sizes than would generally be supposed.

Until recently, the objection has existed to the adoption of so small a size as six inches diameter, that it was found necessary in order to remove the accumulation of deposit at the upper ends of sewers, where the flow is slight, to adopt some system for hand-cleansing; and this cannot well be done in a six-inch sewer. More recently the adaptation to the flushing of sewers of the automatic siphon-tank of Rogers Field, of London, has so far removed this objection as to reduce the risk of obstruction to insignificance.

Sewers of this size should receive no inlet from any source more than four inches in diameter, and this should be the extreme limit of size of all connecting drains throughout their whole length. Any solid matter which could find its way through a four-inch drain would surely be swept on by a copious flow through a six-inch sewer.

THE ILLUSTRATIONS.

HOTEL NANTASKET, HINGHAM, MASS. MR. J. P. PUTNAM, ARCHITECT, BOSTON, MASS.

This hotel was built during the past spring.

LONDON BRIDGE.

We reproduce from the London *Graphic* the drawings of London Bridge and its former surroundings, and Mr. Brewer's description of it.

"The threatened alterations to London Bridge naturally make us turn our minds to the consideration of the history of that remarkable structure. Fortunately the annals of London Bridge have been most carefully collected in an excellent work, entitled *The Chronicles of London Bridge*, by an Antiquary. (London, 1827.) The work is illustrated with wood-cuts which, though architecturally incorrect, are suggestive and interesting. In the short account of London Bridge which we are about to give, we shall borrow considerably from the work we have just named.

"When the first bridge across the Thames was erected seems to be extremely doubtful. Probably the Romans established a bridge of boats across the Thames, either at London or in the immediate neighborhood; but there does not seem to have been any really permanent bridge before about the year 994, and it is said that the fleet of Sweyn was driven against it by the wind.

"In 1008 the good King Olaf of Norway, who was an ally of Ethelred, captured London Bridge from the Danes, by attaching boats to the piers, which, being violently rowed in an opposite direction, tore away the piles and brought the bridge to grief. It was restored shortly after, but again destroyed in 1091, — this time by a terrible whirlwind, which unroofed more than sixty houses in the neighborhood. William Rufus, in 1097, commenced the reconstruction of London Bridge; but it still seemed to have been doomed to misfortune, for in 1136 it was consumed by fire, and again rebuilt in 1163.

"In 1176 the great work of constructing a stone bridge was commenced under the superintendence of a priest, called Peter of Colechurch, and the structure which he erected was, though altered and partly rebuilt at various times, substantially the building known as 'Old London Bridge,' which existed down to the year 1830.

"Now, much as modern engineers and architects have criticised the work of Peter of Colechurch, yet it was no small thing to have constructed a bridge which resisted the force of the Thames for six centuries and a half. As originally erected Peter Colechurch's bridge consisted of nineteen arches and a drawbridge, so that there was a pier in the centre; this pier was of immense size, in fact, a small island, 125 feet long and 35 feet wide! The other piers were about 50 feet long and from 20 to 30 feet wide, whereas the arches between them varied from 10 to about 30 feet. The roadway between the piers was 40 feet. Upon the eastern half of the vast central pier Peter of Colechurch erected a beautiful chapel, with an open crypt beneath it; he also built two gateways, one defending the drawbridge, which occupied the place of the seventh arch from the Surrey side, and one near the London end of the bridge; no other buildings of any kind stood upon the bridge. It is clear, however, from ancient illustrations and descriptions, that there were houses built upon it, at least as early as the time of Henry VI.; and it is related by the old chroniclers that Jack Cade 'cut the ropes which suspended the drawbridge,' and Hall adds, 'The houses on London Bridge were burnt during this rebellion.'

"Although none of the accounts of London Bridge notice the fact, yet it is quite clear that Peter Colechurch's chapel must have been rebuilt some time between the reigns Richard II. and Henry VII., as from all existing illustrations, and the remains discovered in 1826, it was evidently of the Perpendicular style of Gothic architecture. During the reign of Elizabeth, great alterations were made, the old gateway at the drawbridge being taken down and rebuilt at the Southwark end, as shown in our sketch marked c. This gate received the name of 'Traitor's Gate,' from the fact that the heads of those executed for high treason were exposed upon it, stuck upon iron spikes. In the foreground of our sketch the old Southwark flour mills are seen, with their tower and numerous water-wheels. But the most remarkable building on London Bridge was the old 'Mansion House,' the residence of the Lord Mayor, called 'Nonesuch House.' This magnificent building was erected about the year 1579, and was entirely constructed of timber, and adorned with such a profusion of carving and ornamentation that it received the appellation of 'Nonesuch House.' It is said to have been constructed in Holland, and floated up the river in pieces, which were fixed together when they arrived at their destination. Nonesuch House, together with the drawbridge and the old Chapel of St. Thomas à Becket, are shown in our sketch marked a.

"In 1582 Peter Moris, a Dutchman, established the first waterworks at the north end of London Bridge. This building is shown in our sketch (b). The ancient buildings of London Bridge were frequently destroyed by fire; thus in 1632-33 all the buildings at the north end of the bridge were burnt down. The bridge did not suffer greatly by the Fire of London, 1666, only one large building at the north end being destroyed. It did not, however, enjoy this immunity long, for in 1726 the bridge gate and sixty houses at the south end of the bridge were burnt down; in 1728 the gateway was again rebuilt, as shown in our sketch (d). Probably about this time the apse of the chapel was pulled down, and the building, which had previously served as a school, was converted into a paper factory. In 1758, whilst some extensive alterations to the bridge were in progress, the temporary footway which had been erected caught fire, and not only burnt down many houses, but even four or five of the arches. After this a clear sweep was made of all the buildings upon the bridge, the great centre pier removed and replaced by a large arch, and a balustrade erected in the place of the old solid parapets. These alterations were completed about the year 1760. The general appearance

of the bridge after they had been carried out may be gathered from our sketch (E).

"The destruction of the central pier proved that if Peter Colechurch was not a greater engineer than his eighteenth-century critics, he was at least a wiser man, for no sooner was this great pier removed than the bridge began to exhibit signs of decay, and from that time until it was finally pulled down it was perpetually requiring repairs. William Gifford, in his Works of Ben Jonson, London, 1816, makes the following violent attack upon the bridge authorities: 'This pernicious structure has wasted more money in perpetual repairs than would have sufficed to build a dozen safe and commodious bridges; and the lives perhaps of as many thousand people. This may seem little to those whom it concerns, but there is blood on the city, and a heavy account is before them. Had an alderman or a turtle been lost there, the nuisance would have been long since removed.' The first stone of the new London Bridge was laid on the 15th of June, 1825, and our sketch (F) shows the magnificent cofferdam constructed for that purpose.

"As the Old London Bridge was ruined by injudicious alterations, it is sincerely to be hoped that the present noble structure will not share the same fate, and that its beauty shall not be destroyed nor its stability endangered by any experimental patch-work. The experience gained by patching up the old bridge ought to make us consider for a long time before submitting the present structure to any similar risk. We trust that both the legislature and the city authorities will reject any scheme which does not insure the beauty and stability of this noble work. The city authorities of our day have shown so much public spirit in purchasing Epping Forest and Burnham Beeches, that we may feel some confidence that they will be equally active and judicious in this matter, and that without their attention being called to it by the sacrifice of 'an alderman' or even 'a turtle.' What is really wanted is undoubtedly another bridge a hundred yards from the present one, so that the heavy wagons could keep to one bridge and the lighter traffic to the other."

HOUSE FOR MRS. C. L. MCKIM, BALTIMORE, MD. MESSRS. J. A. & W. T. WILSON, ARCHITECTS, BALTIMORE.

This house is now building on Calvert Street, near Chase. It has a front of 23 feet, with a depth of 68 feet 6 inches. The stories are somewhat higher than usual. The front is of the finest quality red pressed brick, laid in red mortar, with all string-courses, mouldings, etc., of "Peerless" brick, which give nearly as true and sharp a line as cut stone. All other decoration, carved work, sills, etc., is of red terra-cotta from Perth Amboy, N. J. Basement of red granite. Roofs of black slate with red terra-cotta crests.

HOUSE OF G. B. P. CARPENTER, ESQ., BURLINGTON, IOWA. MESSRS. DUNHAM & JORDAN, ARCHITECTS, BURLINGTON.

This sketch is made from a house finished about two years ago at a cost of \$7,000. First story stone, second story wood, filled in with brick laid flat.

HOUSE OF F. W. DORMAN, ESQ., UPPER MONTCLAIR, N. J. MESSRS. SEE & BERG, ARCHITECTS, NEW YORK.

This house was completed this year at a cost of \$4,700.

A MILLIONAIRE'S CATHEDRAL CITY. II.

THE width of the church across transepts is 96 feet, the height of the spire 197, and though I do not know the height of the ridge, height is the one dimension in which the cathedral scale is approached. The cathedral arrangement, however, is carried out to the last detail. There is only one tower, a central one, but there are a nave and aisles, though only of four short bays; there are transepts of twelve feet projection, and transept aisles; there is an ample choir, covering nearly half of the ground plan, and, attached to the transepts, though separately roofed, there is a baptistery on one side and an organ-loft on the other. The tower stands free on three sides and forms the porch. Close at hand one becomes aware that there is a profusion of carved work for which he has seen no other American examples. Real flying buttresses are turned from the buttresses of the aisle wall, albeit some feet above the point at which they would be useful to resist the thrust of the vault, if there were a vault, and every pinnacle of the aisle wall and every pinnacle of the clerestory is flanked with gargoyles. Every gable is copiously crocketed, every offset is intricately moulded. All the aisle windows have moulded labels and carved label terminations, and are filled with rich tracery. The clerestory windows, however, have only flat, unmoulded voussours, which look bold amid all this regardlessness. Buttresses divide the narrow bays of the seven-sided apse; the pinnacle of each buttress here, too, is flanked by gargoyles, and the nine windows have profuse and real tracery. Through the openings of the basement of the apse one gets glimpses of the marble traceries of the crypt. The first stage of the tower contains a deep doorway, the arch abundantly moulded and the jambs modelled into a succession of shafts, with capitals profusely carved in natural foliage; and over this is a high gabled canopy richly crocketed, crowned with a large finial, and filled with tracery, not pierced, but in relief against the wall. The second stage is an arcade of slender openings, with slender and richly decorated canopies. The belfry stage consists of a very large traceried window in each of the three free faces. The canopy of the window is a gable of very steep pitch, which completes the tower.

The octagonal spire becomes visible in the sharp angles between these gables, where the buttress ends in a long pinnacle. After the spire is fairly detached and well on its way four other pinnacles appear out of the spire itself, not against, but between, its ribs. The windows, the gables, and the pinnacles are all lavishly decorated.

This description is not by any means exhaustive, but from the description it will be evident that here is elaboration beyond anything to which we are accustomed in church architecture. Here, in at least the sense of Wackford Squeers, is richness; and indeed there is richness in a much better sense also. The repetition of so many parts in so small compass tends to that result, and still more the abundance of carving. The carving is as careful as can be, imitated directly from natural objects, and in the right places. And yet one finds himself wondering all the time that this superfluity of means does not more fully attain an end, and that this fretted front and this intricate succession of bay and buttress make less impression on him than many a flank of rock-faced wall pierced with rude but purposeful openings. There are no powerful masses of structure felt through these meshes of ornament, no leading lines to accentuate with all these moulded subdivisions. The whole is not large enough, in mere physical magnitude or in idea, to dominate this multiplicity of petty parts, and the cathedral becomes a toy, and recalls the attenuated confectionery of "Greenwood Gothic." The tower with its slim terminal gables looks weak, and its weakness is enhanced by the wealth of carving which it carries. It is nowhere belted by an emphatic band or an emphatic line. The strange, irrational pinnacles that are inserted like spikes in the steeply slanting spire, as they have no purpose, can scarcely have had any other origin than the desire to make more "things." The portal is deep, and yet so commonplace is the series of shafts below and archivolts above that its depth is ascertained as a matter of mensuration, not of instant poetical impression. All of the detail, rich and careful as it is, furthers the character of an elegant feebleness that belongs to the church. The foliage is as natural as chisels could make it. Everywhere accurate reproduction is aimed at; nowhere the use of natural foliage as a type, to be adapted to its material and function, — that is to say, conventionalized. As a consequence, it lacks altogether architectural significance. The gargoyles have nothing of the grotesqueness of one good manner, and nothing of the abstraction and severity of another. I recall but three patterns among the scores of them, and these are but figure-head portraits of uninteresting faces, with a three-inch leader emanating from the mouth of each. The mouldings add to the undecided look of things. The crisp emphasis of lines of light and hollows of black shade is abandoned for wavering profiles in which emphasis seems to be studiously avoided. What is aimed at is elaborate elegance; what is attained, as I have said, is weak elegance. The most successful feature of the exterior is the baptistery attached to the south transept, which is roofed with slabs of stone and crowned with a rich and slender *fleche*. In proportion and in detail this is a pretty toy, though it is still a toy.

I have dwelt upon the exterior in detail, because of its extreme elaboration and costliness, and because it is considerably more successful than the interior. One is surprised after all this lavish expense to come upon a lath-and-plaster barrel vault. The nave walls are carried upon columns which are at present fasces of cast-iron, but are ultimately to be sheathed in jackets of bronze and crowned with bronze capitals. The wall-arches of the nave are of sandstone, and are the most vigorous pieces of design in the whole church, though they would not be noteworthy for vigor in another church. A panelled wainscoting of sandstone skirts the whole church, and the porch is lined with the same material. The spandrels of the nave arches are filled with panelling in plaster, with a panelled arcade under the sill course of the clerestory, and above this the vaulting shafts, now of iron like the nave piers, and like them to be jacketed in bronze, are to spring from long plaster corbels, and to be finished with spreading plaster capitals. There is no end to the plastering. Each shaft of the little arcade is to have a plaster capital, each label of the aisle windows two plaster pendants. There must be twenty patterns of these capitals, all carefully modelled from flowers and leaves. The corbels of the vaulting shafts are human faces, rather Greek than Gothic in type. The vaulting is very elaborate, with a great number of interesting ribs, applied to the plain surface of the pointed tunnel, and at almost every intersection there is an elaborate boss. Along the ridge rib these bosses attain a considerable size, and a very large stalactite was shown me, which is ultimately to decorate the intersection of the nave and transepts. The modeller of all this work is Mr. Bradley, an Englishman, and of its kind his work is excellent. "Photography in the round" could scarcely be carried to a higher perfection, and there is also in his plaster bouquets much grace of arrangement. But the moulded work of the interior is even more devoid of architectural character than the carved work of the outside. There also seems to be in it a defect of scale, which will deprive it in its place of the effect it has when seen close at hand, and it is likely that it looks better on the bench in the modelling room than it ever will hereafter. It will always attract attention by its extraordinary and in this country unexampled profusion. Except this modelling there will be nothing in the church to call for thoughtful admiration. It is intended to decorate the interior in color, but color as irrelevant as the moulded ornament can only assert itself, and color applied as a factor in the general result cannot redeem the tame mediocrity of the design.

Rich as the outside and the body of the church are, they are meagre compared with the crypt, which contains the mortuary chapel, and the elaboration of this is all wrought of noble material. The approaches to it are altogether without dignity. It is a curious feature of the conception of a cathedral which has inspired the design, that the basement of the body of the building is given to a "Sunday-school room" ceiled with brick arches turned between iron beams and resting on iron posts. The crypt itself is a polygon of fourteen sides, about sixteen feet in diameter and eighteen high. Seven of the sides are continuations downward of the faces of the apse; the other seven correspond to nothing above them, and end abruptly on the outside against the ceiling of the Sunday-school room. Each face constitutes a bay, and access to the room is gained through two of them, which are left open for the purpose. The walls, the cells, and even the ribs of the vaulting are of polished white marble. It would be hard enough to get sharp mouldings from this material, however they were drawn, but the attempt is not made here, and the section of a rib shows the same meaninglessly meandering lines that we have noted elsewhere. The junction of the ribs is not a boss; in fact, the ribs do not join, but stop upon a sixteen-sided ring some four feet across, closed by a slab of polished marble. The junction of each rib is marked by a very rich pendant carved in flowers or leafage. Each rib springs from a triple capital of disproportionate size similarly carved. The workmanship of all this carving is exquisite; the design of it amenable to the same criticism as the other carved work in the church. The triple shafts which support these capitals are of costly foreign marbles, of mottled black and red and yellow. The head of each bay is filled with elaborate and wire-drawn tracery, of a design not repeated in any other, and, between the polish of this tracery and its twisted tenuity, it seems less like stone-work and more like confectionery than any of the other carved decoration. Half of the openings thus formed correspond to real windows, and half of course look into the basement of the church.

Of the crypt particularly it may be said, what is applicable to the whole church, that the attempt to make a small wonder of the world has pretty evidently had more to do with the design than any more artistic purpose. At any rate, the church is highly successful in the former point of view. The Canda monument in Greenwood, felicitously miscalled by its admirers the candy monument, which for so many years held the preëminence in capacity to hold the casual visitor in open-mouthed wonder, yields in that capacity to the newer marvel in the matter of architecture, though certainly the newer is the better, as certainly they belong to the same class. Setting aside the inflation of a parish church into a cathedral, and setting aside too the shams which deform it, the Garden City Memorial Church appears noteworthy only for the exuberance of means with which a design essentially commonplace has been carried out. The only church in this country with which it can fairly be compared is the Colt Memorial Church at Hartford. Considering that the dimensions of the two churches must be nearly the same, that their purpose is similar, and that Mr. Harrison must have had the spending of many times as much money as it cost to attain the beautiful result of Mr. Potter's work, the memorial cathedral of Long Island, as an architectural work, must be added to the long list of lost opportunities.

M.

CORRESPONDENCE.

THE CITY OF TOLEDO. — THE ALCAZAR. — THE CATHEDRAL. — MADRID. — BURGOS.

TOLEDO.

WE are apt to associate Moorish architecture only with the orange and palm tree of the sunny South, forgetting that the Moors established their empire over the whole of Spain, and that some of their most remarkable works are to be found in the North. This one city contains a number of fine monuments of the Saracenic period, which lasted three hundred and fifty years. One of the first sights to the stranger slowly climbing up the long hill from the railway station — for this ancient city, like Rome, stands on seven rugged hills, half surrounded by the Tagus — is the Puerta del Sol, a magnificent Moorish gateway, which may be ranked among the finest military monuments in the world. Many leave the Alhambra with a strong impression of nothing but "gingerbread work," and without noticing that the gateways and towers there are treated with a massive simplicity in perfect artistic accord with their use. Here however there is no danger of missing this lesson of a most artistic people in thus changing entirely their style for buildings of various characters. In proportion as their summer palaces are light and richly decorated, their military monuments are massive and plain. The Puerta del Sol has a simple and grand pointed horseshoe arch, or rather arches, for there is a large vaulted space in the middle, and above plain cusped mural arcades in brick.

Seeking out the Moorish remains, the small church of Cristo de la Luz first claims attention, for it is anterior to the eleventh century, and shows a strong similarity in the capitals and interlacing domes with the mosque of Cordova; this, too, was formerly a mosque. Of about a century later is the celebrated synagogue now called Santa Maria la Blanca. It is not large, but has five aisles, with horseshoe arches on polygonal pillars, whose capitals are rudely foliated and accentuated by a countless number of small holes, like some of the Byzantine capitals. Much finer architecturally, though with no pre-

tence of purity of style, is another synagogue in the neighborhood called El Transito, built in the fourteenth century with a wonderful mingling of Hebrew, Moorish, and Gothic characteristics. It consists of a large hall with a beautiful inlaid wooden ceiling, and below this a series of windows filled with delicate geometric tracery. In enriching these windows every device has been lavished upon them: cusps, foliated capitals, lace-like bands that give a bewilderingly rich effect, while below is a frieze of elaborate Byzantine design. From this to the ground, some thirty feet, is a bare wall, with not a moulding or ornament. The effect is very striking. The altar end of the hall is covered with Alhambraic reliefs in stucco, but a modern altar injures that aspect now; even as it stands, this hall, fulfilling exactly the conditions of our modern public halls, is a most interesting type for us. The former rich colors of the stucco-work have faded to soft neutral tints, perhaps more grateful to our sensitive eyes than the original blaze of colors. It is curious to see how naturally the inscriptions in Hebrew take the place of the Arabic letters in the Saracenic ornamentation, and again this is a hint for the employment of our Old English letters. Passing out from this synagogue the view before the visitor shows him what a wonder of strength Toledo was for defensive purposes. It crowns a rocky height one half of which the Tagus guards with its deep gorge, while the other half so towers above the valley that it was easily defended. The contrast is striking between the bare rocky hills on one side, through which the torrent bursts its way, and the fertile valley beyond, where the same stream lingers peacefully through the meadows. Behind, frowning over the city, stands the Alcazar, a huge rectangular building with square corner towers. The entrance façade (sixteenth century) by Covarrubias is one of the most elegant Renaissance designs I have ever seen, and certainly shows a more original talent in dealing with the Renaissance than any one building in Italy. From the bold rugged passages it may be described as Florentine in style, but this massive façade is pierced with windows and doorway treated with such exquisite refinement, and the small decorative orders there employed are so delicate that the whole effect is one of extraordinary elegance. Curiously this *chef-d'œuvre* is little known or noticed, as the guide-books pass lightly over it to speak of the great interior court with its fine galleries and staircase by Herrera. The building is now used as a military school; and I was surprised to see some good modern decoration in one or two halls recently restored.

Descending from the Alcazar into the town again one passes through a large triangular plaza swarming with peasants and venders of various brilliant articles, — for to sell well a thing must be bright in color, whether a can or a kerchief; the Spaniards, like their bulls, run after color. Traversing this place to reach the cathedral one runs the gauntlet of a narrow and thoroughly Spanish street, — gauntlet here stands for a whole haberdasher's equipment, which dangles across one's path, and as one dodges the flapping drawers and skirts redolent of grease, and teeming with a migratory population, a new significance is given to the old poet's lines: —

"A winning wave, deserving note,
In the tempestuous petticoat . . .
Does more bewitch me, than when Art
Is too precise in every part."

The west end of the cathedral stands quite free, but even from here the exterior does not correspond with the far-famed interior, and the other sides are hidden by houses. The square tower surmounted by a Gothic steeple is dry and uninteresting, though three hundred and twenty-five feet high, and the domed chapel which forms its pendant on the other side of the west end ruins the composition as a mass. There are several florid late Gothic portals. But it is only on gaining the interior that one realizes its beauties. Though not completed till the end of the fifteenth century, the style is the purest thirteenth century, and in Mr. Street's opinion it rivals the finest of the French cathedrals. It has one great advantage over other Spanish cathedrals, inasmuch as its *trascoro* is not so high as to break the view down the nave to the apse. It has double aisles on each side of the nave with eighty-four grand piers. The length is about four hundred and four and the width two hundred and four feet.

The chapels are unusually small, being niched in between the small piers, which have no projection on the ground plan. There are however two chapels in the church which are very large. One of Santiago is a magnificent specimen of flamboyant Gothic, and contains finely sculptured tombs; next it is an almost equally large chapel with even finer tombs and sculpture. Indeed, the whole cathedral is so full of fine sculpture, metal-work, vestments, etc., that at each step new wonders come to light. The choir alone is a museum of carving in wood and marble as well as of metal-work. There are two large pulpits of brass, worthy of Cellini, by the choir facing the high altar; and there is much gilded iron-work of the sixteenth century, a period which in a still higher sense may be termed "the golden age of iron," so noble were the designs of great iron screens then erected.

There is one chapel of peculiar interest, for here every Sunday is still said the Muzarabic service which in 1572 was established by Cardinal Ximenes, to show the Pope that however Romanist they were in policy they were zealously independent in practice. This service was persistently opposed by the Popes as unauthorized by the Vatican, and obstinately continued by the Spaniards as a national ritual, for many years. The paintings as a rule are inferior in this cathedral, but the stained glass is full of the richest color, and the sacristies have such splendid vestments that this loss is little felt.

In short, there is so much to examine that only after repeated visits can any clear idea of the cathedral as a whole be had, and then it stands out as one of the most complete interiors in the world.

The other important Gothic building here is the Church of San Juan de los Reyes, in the most florid style. The exterior is overloaded and vulgar, but the adjoining cloisters are beautiful. Their details, though late in date, show that it is never too late to mend, and the architect here suddenly struck a key-note which rings pure and fresh as a young style, instead of the pretentious decadence of the rest of the church. I have already said so much of the Plateresque style that I only mention a wonderful example of it in the Hospital de la Santa Cruz. Its entrance façade long ago attracted the pencil of travellers. It is curious to notice the contrast between the doorways in the south of Spain, barred only by a delicate wrought-iron screen, and the doors here, which are not only massive enough for a fortress, but are studded with bolts with large caps, generally in the form of shells. These iron-bound doors set in solid walls with few windows give to each house the aspect of a donjon keep, — and so they were built to be.

Madrid I have kept for the last simply because, being the least in architectural interest of Spanish cities, I might leave it out if necessary. The capital of a land strewn with glorious monuments of the past, it stands as barren of interest and as careless of the inspiration about it as if built on one of our western plains. Only founded in the middle of the sixteenth century, its oldest monuments are the vilest rococo churches, and its newest the wretched imitations of French *maisons-à-loyer*. The palace is the only building worthy of notice, and this though commonplace in plan and architecture — it was built by an Italian in the eighteenth century — is really fine in its proportions, and so unpretending in detail that its effect is grand and dignified. Its situation is fine, upon the brow of the high plateau on which the city stands. From its rear windows the view is over plains below and down the little river Manganares to distant snow mountains; it is like a vast royal park, for hardly a house is visible. The interior is every inch a palace, — almost theatrically so. There is the traditional prodigality of statues, marbles, velvets, gilt bronzes, tapestries, etc. The throne-room is truly magnificent with its crimson wall-hangings, against which are relieved dark bronze statues on black marble pedestals. These and rich marble tables and rock crystal chandeliers are reflected in enormous looking-glasses. Over all is a magnificent ceiling by Tiepolo, whose painting, however rococo it may appear in churches, is here entirely appropriate to the luxury beneath. A man whose facility knew no limits, Tiepolo, although at times a tremendous worker, was really but an elegant trifler, owing to his surroundings and his country; yet his color makes those who are familiar with his best work pardon him his want of discipline. In this ceiling, as in the celebrated staircase at Wurtzburg, he is at his best. To the delicate tints and rich shadows of Veronese, to whom his contemporaries compared him, he adds the purely decorative style of drawing and grouping which distinguishes his talent.

From decorative painting to a word on the Madrid gallery is a natural and almost necessary step, for to all artists Madrid can have but this one interest. Familiar with the Valasquez of other important galleries, it needed but a glance at his work here to show me that my ideas of him were entirely wrong. I had thought his pictures careful, learned, and rather dry; I found him here the most careless and dashing of painters, overflowing with that emotion of art which the French call "temperament," and his later works full of wonderful short-hand expression, which his great power alone saved from being pure *chic*. It is easy to recognize whence Carolus Durand has drawn his inspiration and his exaggerations, which to those who have not been to Madrid seem so original. Bonat must be equally indebted to Ribera, who, also, can only be appreciated in Spain.

Burgos, as either the first or the last place seen in Spain, will be sure to be remembered by the traveller, and its splendid cathedral will be found worthy its great reputation.

On the whole, I think the value of Spanish architecture has been undervalued. Their buildings are not models to be copied, but much may be learned even from their faults, nearly always those of exaggeration, and all that is purely Moorish is full of hints and ideas capable of adaptation, of which thus far little or nothing has been made. Their iron-work and carving, as I have hinted, is remarkable both in North and in South Spain. I have confined my letters chiefly to Moorish architecture, as my main object was to trace the developments of Arabian architecture. Northern Spain is even more rich in motives which can be applied directly to our architecture. If some one would do for the early Renaissance in Spain what Mr. Street has so well done for the Gothic, our architecture would be the richer for it. Mr. Street profoundly despises any but Gothic art, but I am sure in avoiding southern Spain in all of his numerous trips, because as he says the Gothic there must be tainted by Eastern influence, he gives a most unjust idea of what really may be found there. R.

NOTES OF EXPERIENCE AND INEXPERIENCE.

37. ECHO. — "Provincial" has a tough subject in his echoing church. Proportion and material are all about as bad as possible, and it is unlikely that any number of wires would do it any good. To carry a new ceiling all through, level, about fourteen feet from the floor, would help very much; or if the present ceiling could be cleared away and the plan opened to the under side of the roof-boards, the echo would probably be cured, and the loss of power in the sound would not matter in so small a building,

though the extra cost of fuel for heating would be something. I doubt if anything less radical than one of these expedients would help much, unless the room were padded all over. C.

NOTES AND CLIPPINGS.

CONCERT ROOMS. — Mr. Cecil J. Saunders, in a paper read at a late session of the Musical Association, in England, on the Construction of Buildings, considered in Reference to Sound, made some very interesting statements and advanced some curious theories. Glass being one of the most elastic of sound reflectors, he was not surprised to find, when listening to a concert at the Crystal Palace, that the echo of one note returned to him at the same instant that he received the next note direct. He said that light had a remarkable modifying influence on sound, a statement which was corroborated by gentlemen who took part in the discussion which followed the reading of the paper, although the general opinion seemed to be that the cause lay not in the light itself but in the heat produced by it. Mr. Saunders then described the hall that he would have built to contain five thousand auditors. It would be a square room with rounded corners, and the orchestra in one of the corners. The audience would face the orchestra, and would thus look towards the converging walls. The number of performers provided for would be 700, as this was probably the limit of really good work, the orchestra seats rising tier above tier into the angle of the building. The organ should be chiefly below the orchestra, so as to allow of a low ceiling. By placing the orchestra in the angle of the building, very few of the audience can receive an echoed sound. The seats for the audience should be circular, so as to give every one a direct view. The floor should rise gradually towards the back of the room. The best material for the ceiling is wood. Ordinary plastering is one of the most perfect non-conductors of sound used in building. Zinc would be nearly as cheap, and perhaps even more efficacious than wood. The walls at the back of the orchestra should be covered with looking-glass, which has a strong reflecting power for sound. These glasses, however, should not be bedded in flannel as usual, but allowed to vibrate with every note. Boarding or cement would be best for the rest of the walls. Cement is hardly resonant, but it reflects sound well. Stone would do better, but its cost is too great. No doubt a good deal of the resonance of cathedrals is due to the surface of smooth and hard stone inside them. For quartet performances, a movable screen behind the players or singers might be arranged so as to reinforce the sound in its forward direction. This screen should be of two thicknesses of wood with a sounding-board at the top inclined slightly upwards. Empty and half-empty rooms always echo, so that the best way of avoiding an echo is by low prices and a good programme. When there is a certainty of a small audience in a large hall, heavy curtains should be hung from the ceiling, so as to reduce its size.

THE ORIGIN OF DORIC ARCHITECTURE. — First let us do justice to an erroneous conception of the origin of this Doric art. We have gone on repeating everywhere, in big books and little, basing the assertion on I know not what original premise, a premise more sentimental than critical, that the architecture of the Greeks — moreover the statement applied only to the temples, as if the architecture of a people were shown only in its religious edifices — was derived from the wooden hut. Unfortunately, if by setting about it with thorough earnestness certain similarities between the Parthenon and a wooden structure can be established, the matter becomes more difficult if we seek the edifices which have preceded this, such as the temples at Selinus or those at Pestum. It would be strange and contrary to all the laws of affinity if the origin of a style of architecture should be more apparent in proportion as the example is farther removed from its cradle. But there needs a vivid fancy to detect in a Doric building in stone, of an early epoch, anything which recalls the art of the carpenter. Just as the elementary structure of wood declares itself in Ionic architecture, just so much is it lacking in Doric architecture. — *M. Viollet-le-Duc in L'Art.*

THE HISTORY OF GREEK ART. — It is said that Professor Overbeck, in preparing a third edition of his work, *Geschichte der Griechischen Plastik*, has found that his theories must be changed so considerably in order to conform to the facts brought to light by the excavations at Olympia, that it will be necessary to re-write much of it.

THE FRAUEN KIRCHE AT NUREMBERG. — A correspondent of the *Athenæum* writes: "The Frauen Kirche at Nuremberg is in the hands of the 'restorers,' both inside and out; it is stripped of every bit of ornament to the bare walls. The work of restoration will occupy five years. The choir of the Stifts Kirche at Stuttgart is likewise in the hands of workmen, and new glass windows, with superabundant yellow tints, have been inserted."

CEMETERIES IN PARIS. — What to do with their dead is a question that is at present being discussed by the Parisians, who may well be alarmed at the insanitary condition of their graveyards, which are sources of constant danger, and in event of a serious epidemic breaking out could not fail of being sources of infection. About forty-five thousand corpses, large and small, have to be disposed of each year, so that it is not difficult to understand that the soil of the present cemeteries is "saturated," as a French paper has it. Two methods of meeting the difficulty are suggested; one cremation, the other the establishing at Méry-sur-Oise of a necropolis which shall replace all the cemeteries, old and new, of Paris. Together with this would be established a special railroad service, *chemin de fer des morts*, having a terminus in the city, — the designs of which, by the way, would offer architects an unusual opportunity, with its funeral cars and engines, which, as there are at present nine grades of funerals, each of which requires a distinct paraphernalia, would require extraordinary accommodation and would call for no mean outlay by the state. This scheme, which has much to recommend it, is opposed by the great railroad companies, and by the parish authorities generally.

SI MONUMENTUM QUERIS, CIRCUMSPICE. — Mr. William Strickland, the architect of the capitol at Nashville, died in 1854, before the building was finished, and in compliance with his expressed desire his encoffined body was built into the walls of the building.