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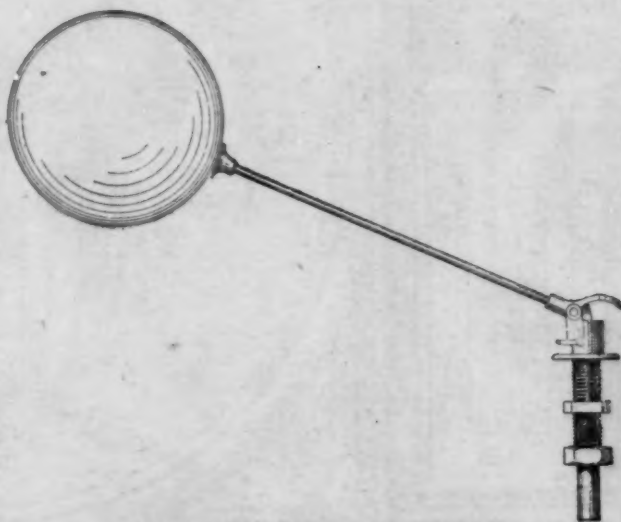
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A GREAT deal of discussion is going on just now everywhere about the expediency of having architects examined, and furnished with some sort of certificate or diploma, before allowing them to practise their profession. In this country, the local associations of architects of several States have taken up the matter, and are urging the adoption of statutes requiring such examination. In England, a recent attempt to secure legislation of the kind, which was made with very little thought, and without the coöperation of any architects of reputation, failed, but the compulsory examination for admission to the Royal Institute of British Architects is quietly, but surely, weeding out the pretenders from the men of attainment and skill, and giving the latter a recognized position. In France, a Government Commission has been appointed to consider and report upon the subject, and the technical journals are full of letters from architects and others, with suggestions of all sorts. Among the rest is a letter in *La Semaine des Constructeurs*, from "an old proprietor," which is not only written with a force, and an evident familiarity with building matters, which renders it extremely interesting, but is particularly valuable as indicating the feeling of the public, outside the profession, toward the proposed scheme for certifying by diploma the competency of architects. To begin by quoting the end of the letter, the "old proprietor" very strongly favors the examination of architects before they are allowed to practise. "We proprietors," he says, "cannot examine our architects for ourselves. If we could, we should certainly do so, but, not having the necessary knowledge, we must look to the public authority to assure us that the men whom that authority permits to act as architects for other people understand their business." "The Municipal Council of Paris," he goes on to say, "requires all hackmen to pass a satisfactory examination as to their knowledge of the geography of the city before they are licensed to convey passengers; physicians and lawyers have to prove their competency before experts before they are allowed to practise"; yet he is told that to ascertain, and give the public the means of knowing, whether a so-called architect knows a cellar from a garret, would be a task of "extreme difficulty," that "the community would rebel," that "great artists would have less scope for their genius," and so on. When he hears this, he says, he makes no reply, but goes home sadly, and turns over the pages of his old account-

books, the "eloquent witnesses" of the troubles into which incompetent architects can get their clients, and of which he describes some samples.

THE writer of the letter speaks of himself as a man who had always had a good deal of money, accompanied with a passion for building, which has brought him an unusual experience of architects. He is considerate enough not to say much about his personal misfortunes, but he gives a lively description of an incident which occurred to one of his friends. Our readers, by the way, will bear in mind that it is not an architect, but a proprietor, who tells the story. This friend came to him one day in an excited state of mind, and said that he had been building an addition to his house. "Mr. N., the experienced old architect, came to me," he said, "and proposed to make the plans and direct the execution merely for the love of art." "There was to be no five per cent, nothing but a little present to Mrs. N., and I accepted his offer. This morning," he continued, "a terrific noise, accompanied by a dazzling light, awakened me. I leaped out of bed, and found that the whole side of my chamber, which adjoined the new addition, was open. The addition had fallen down!" "Well," said *La Semaine's* correspondent, "and what are you going to do?" "There is nothing to do," replied the victim, "but to claim damages from the rascally contractor. Poor N. is overwhelmed with grief, and, besides, he did the work gratuitously." The matter was carried into the courts. The owner of the collapsed building sued the contractor, and the contractor sued the architect. There was an expert examination, which proved that the disaster was caused partly by the bad quality of the mortar, and partly by the unskilful planning, through which the walls were dangerously weakened by flues. The architect defended himself from responsibility on the ground that his services were gratuitous, whereupon the contractor caused a sensation in the court by remarking: "Yes, gratuitous for the proprietor, but not for me. You forget the ten per cent that I was to pay you!" It turned out, on investigation, that the "experienced old architect" was formerly a shop-keeper, who had made some money, and spent it in building speculations. By looking on at his building operations so long, he had come to imagine that he knew something of construction, and then, by an easy transition, after his money was all gone, gave himself out as an architect, and made plans for his acquaintances, finding his reward either in "pure love of art," or in other compensations, as the case might be.

ON another occasion, the "old proprietor," who thinks of building in the town of B, mentions the matter to the mayor, who is a friend of his. The mayor knows an architect, who is just the man he wants. He will arrange a little lunch, so that the two can meet. The lunch is prepared, and the architect, a man of considerable local reputation, decorated with the Legion of Honor, appears. The "old proprietor," who is fond of equestrian similes, "rears" a little when he sees the professional man with rings in his ears, and notices that he has difficulty in managing his knife and fork, and lacks a good deal of perfect elegance of expression. However, he may be stronger in art than in literature, and he asks him which style he likes best, that of Duc or Garnier? The distinguished architect laughs. "Oh," he says, "I don't pretend to know much about your theory, but no one can get ahead of me on practice." The mayor speaks up for his friend, "X," he says, "is not himself an artist, but he is very successful, and employs the best designers." The "old proprietor" avoids further connection with the distinguished architect, and learns that he was once a journeyman mason; then a contractor, and finally an architect; that he signs the drawings that he gives out as his own work, hastens to settle and hush up any claim against him for damages for incompetency, and enjoys a large business and extensive influence, or rather, did enjoy it until his quality was found out, for the letter says that he fell later into disrepute, and was reduced to the business of advancing money at high interest, to small contractors. Architects will think that this particular "old proprietor" must have been a man of unusual discernment to escape the attractions of the successful ex-mason; but this is not so certain. Many other

proprietors have, he says, learned the lesson that the best policy in building is to employ contractors who give good materials, well put together, at reasonable prices, and strictly according to their agreement, rather than those who expect to gain by substituting inferior materials and workmanship for those called for by the contract, and whose eye is always in search of flaws in the specifications, from which to extract profit; and, moreover, that contractor and owner can work to their mutual satisfaction and advantage only when they have the benefit of the services of an architect of skill, experience and honor. Under such an architect, the plans and specifications will be complete, well considered and precise; the contractor will know just what materials to get, how many men he will have to employ, what will be expected of him under his contract; and he can, and will, carry out his agreement economically for himself, and to the satisfaction of the owner; while, with an ignorant or careless architect, the plans or specifications will be defective; the contractor does not know, when the time comes, what is expected of him; when he asks for instructions, the architect hesitates, or gives contradictory or erroneous directions, which cause further trouble; work is done and undone, materials are spoiled, time is lost, and the result is unsatisfactory, as well as expensive, even if the architect's intentions are good; while, if his sense of honor is feebly developed, he is likely to try to hide his own omissions by consenting to serious violations of the contract at his client's expense.

NOW that so many architects and students, young and old, are making preparations for a summer trip abroad, it may not be amiss to remind them of the most important new architectural works now going on, or recently completed, which it will be for their advantage to see. As every traveller knows, the time to make a memorandum of what to look at is before one starts from home. After arriving on the other side of the ocean there is little opportunity for learning about the newer buildings. Those mentioned in Baedeker can be hunted up, and duly inspected; but the architectural tourist, unless he stumbles upon a new construction by chance, is apt to miss it altogether. Beginning with England, the traveller landing at Liverpool should visit the Mersey Tunnel, and, if he has a taste for engineering, the Manchester Ship-canal. After this, the most interesting modern work, outside of London, is to be found in Oxford and Cambridge, where good building is always going on, and, the size of the two towns being limited, can always be readily found. The largest new building belonging to either University, although not extremely recent, is the Examination Schools at Oxford, by Mr. T. G. Jackson, which deserves long and careful study; but there are charming new colleges, and additions to old ones, at both places. In London, the most important recent work is to be found at South Kensington, Chelsea, and on the Thames Embankments, and among the Government Buildings at Whitehall. A great deal of beautiful architecture is also to be found in the London suburbs, particularly to the northward, about Hampstead, westerly, around Chiswick and Putney, and in the neighborhood of Bedford Park, and southerly, at Sydenham.

ON the Continent, Paris is usually the first place to which the student turns for modern architecture, after he is tired of sketching picturesque antiquity in Normandy or Picardy; and there is plenty of it to be found. The most important single new building is perhaps Nénot's addition to the College of the Sorbonne, near the Pantheon, which is now receiving the final decoration. Next to this, Ginain's Ecole de Médecine, comprising a splendid façade on the Boulevard St. Germain, and a group of buildings extending up the hill toward the Pantheon, is the most interesting new work; and the Pantheon itself, in which there is always some great historical fresco-painting going on, should be visited before leaving the neighborhood. Not very far off from these is the Jardin des Plantes, with André's great Musée d'Histoire Naturelle, which is barely completed. On the north of the Seine, the new Hôtel des Postes, near the Palais Royal, is interesting, partly from the savage criticism which has been directed at its plan, and, beyond the Opéra, is the "Printemps," Sedille's splendid dry-goods store, on the way to which is the pretty Eden-Theatre. Westerly from the "Printemps" is the Parc Monceaux, around which lies the beautiful "English quarter." Abadie's enormous church of the Sacré Cœur, on the

heights of Montmartre, directly north from the Boulevard des Italiens, but at a considerable distance, and the Exhibition Buildings on the Champ de Mars, will deserve separate visits. In Germany, the new Reichstagshaus, or Parliament House, at Berlin, the Imperial Palace at Strasburg, the Booksellers' Club at Leipsic, the Central Railway Station at Frankfort, the Hofburg-Theatre, and the new University Buildings, at Vienna, are perhaps the most important structures, although Germany is very prosperous just now, and new buildings are going up in all directions. In Italy, professional tourists will wish to see the new façade of the Cathedral of Florence, and the "Mole Antonelliana" at Turin, besides the modern part of Rome, and the extensive improvements in Venice and Naples.

AMONG the most interesting papers that come to us are those containing the observations of the workmen who visited the recent Exposition in Paris, on the methods of construction and the ways of living among the workmen in different parts of Europe. A bricklayer and mason, Mr. William Delaney, sends to the *Philadelphia Press* a particularly good account of masons and masonwork abroad. That he is an excellent observer is shown by his remark upon Fountains Abbey and other "historical buildings of England and the Continent." Although he does not pretend to know anything more about the style in which these structures are designed than that it is "old," but "is still copied in modern buildings," he is struck at once with the fact that in all the real Gothic and Romanesque buildings "each piece of stone is of a convenient size to handle by hand." Architects will remember that in Amiens Cathedral, for example, there is not a stone so large that a man could not carry it up a ladder, and will appreciate the quickness and precision of Mr. Delaney's observation. So far as modern work goes, he thinks the "highest perfection of the building-trade" is attained in Paris, where "everything is artistic, from the beginning of the building to the last stroke of the painter's brush." "Every artisan and mechanic in Paris," he tells us, "is an artist," and "works with an eye to what would be beautiful and artistic in his industry." He is "not in a hurry to get the work off his hands," but "tries to make it look good, and generally succeeds." This remark, true as it is, shows an appreciation of artistic workmanship which we hope is widespread among American mechanics. Mr. Delaney attributes the superior taste of his French brethren to the "museums, art-galleries and gardens" which are free to all comers, and of which the French workmen avail themselves; and we hope that the time is not far off when our own mechanics will have the same advantages. Many persons will be surprised to hear that "the bricklayers in England do not seem to be well organized," and that on the Continent there is "no trace of organization" anywhere except in Paris. Many of the English bricklayers, it seems, "object to organization," and "claim that they can do as well outside of a union"; but the result is, Mr. Delaney thinks, that "they are not quite so independent in manner and appearance as the American workman of the same class." It is conceivable that the American workman might get through life just as prosperously, and a good deal more comfortably, if he were a little less "independent" in manner, but it is not necessary to discuss that matter here. As to the way in which the foreign workmen live, Mr. Delaney thinks that their "homes are less comfortable," their children are "not so bright-looking," and their houses are furnished less cheerfully, than is the case in America. Payment in England is by the hour, but masons usually work ten hours a day, with a half-holiday Saturday, making fifty-four hours per week. In France, Saturday is also a half-holiday, but the regular day is eleven or twelve hours, and in Holland and Germany the hours are even longer; but the French work less steadily than the English, and the Dutch are very slow, accomplishing little in a day. An English bricklayer will lay, in rough work, a thousand bricks a day, on an average, in a good and solid manner. In France, Germany, Belgium and Holland the average is much less. The wages paid in England to bricklayers vary from fifteen to sixteen cents an hour, the London men getting the most. In Paris, the wages are about the same as in London, although the work accomplished is less. In Germany and Holland, bricklayers earn only about a dollar a day. These are Mr. Delaney's figures, and, we imagine, are open to some correction, as are certainly those which he gives as to the cost of bricks in England.

RELIGIOUS ARCHITECTURE.¹—I.

human knowledge. Religion, therefore, embraces at the same time the entire philosophy, ethics and science of a nation. And so it has a preponderant influence in the realm of politics, as well as in the moral and intellectual spheres.

In what art does religion seek and find its highest expression? From earliest times architecture has been preëminently destined to this mission, for it is, above all other arts, the work of man. Painting and sculpture have models on every hand; they borrow from around them the images of nature. Man, undoubtedly, brings his own conceptions of beauty, of purity of forms, of combinations of lines, of masses and of color to all the arts—conceptions which seemingly have no existence outside of himself, but are simple creations of his intelligence. Yet the painter and sculptor find already portrayed in nature itself the aspects of things which satisfy the innate need of harmony and purity; it is their office to reproduce these aspects, to express them after having selected them, to interpret, to eliminate, to bring out in relief the chief features, and sometimes to introduce order, precision and system into a confused or ill-arranged whole.

The architect's art is of an entirely different character; here, with no model, everything, *ensemble* and details alike, is drawn from the artist's own conceptions. In certain respects, architecture bears a strong analogy to music: it neither borrows nor imitates; it creates for itself fitting forms of expression—chords, harmonies and melodies endowed with power to furnish us keen intellectual enjoyment.

Why? And whence comes this power? We hardly know; at most, we can go but little farther than to surmise that the essential elements of these secret harmonies are founded, above all, on order and fitness. Traditional customs, mental bias, fluctuating tendencies, all combine with a fixed and permanent standard of arrangement to form what is called taste, in a measure almost impossible to discern, and which renders criticism difficult, delicate and transient.

In the early stages of its secular existence, every race has found the most complete expression of its faith, or of its cult, in its architecture, as the first glimmerings of knowledge have always been applied to this art. By way of recompense, each nation's architecture was destined to preserve the indelible impress of the soul that created it.

In favored, temperate climes, where life is not hard, when man has learned the secret of existence under institutions that have not proved too crushing for his growth, the well-balanced race develops easily and naturally. It finds its joy in the bosom of the present world, without looking beyond for compensations of which it feels no need; its spirit takes on a hue of naturalism or realism. This term is not to be understood in the modern, vulgar acceptance, which is a veritable misconception; we do not mean by our use of it that the artist seeks inspiration everywhere, and that he lovingly reproduces all sorts of ugliness, but, on the contrary, that he devotes himself to the task of detaching from the real such of its aspects as are indeed beautiful and worthy of being brought out in relief.

The conditions noted above have been realized from early times along the shores of the Mediterranean, which witnessed the inception of the first and noblest civilizations. Here art, without making any effort, but simply following the natural course of things, attained plastic perfection from the very outset.

In heat-oppressed regions, under a torrid sun, man, enervated and irresolute, shuns vigorous action, taking refuge in medita-

tion, which he carries to the height of ecstasy. Powerless, and subjected to all sorts of tyranny through lack of physical and moral energy, he soon falls a prey to institutions which enslave him: in the bosom of overflowing abundance human distress becomes intolerable. There arise those philosophical speculations which descend to depths wherein the human mind strays bewildered, and finally reaches the bottomless abyss of annihilation. In the infinite there unveiled to philosophy everything is confounded under forms of continually increasing vagueness, and all culminates in annihilation. At the same time, from a religious point-of-view, annihilation becomes the image of eternal repose, sole refuge from the ills which assail mankind—a repose which humanity can hope for only on condition of losing all separate personality, all that constitutes individuality proper.

The art which takes birth among such races never attains the sovereign beauty of that which has its origin in perfect balance; but it may offer other qualities in compensation: the consciousness of boundless infinity supplants the perception of measured and limited proportion. Our Occidental ideas may be disturbed by this, and at first approach we may, perhaps, be surprised rather than charmed. This beauty none the less exists, as the countless edifices of India prove.

In the cold climates of the North, under mysterious fogs, the struggle for existence is likewise hard; but it is more vigorously sustained by races that know how to conserve their moral and physical force. To these virile generations, tempered by their struggles, complete self-abandonment and annihilation could never figure as their only reward; they have too much elasticity for that. If this world is too devoid of pleasures to satisfy them, they seek and find their joys above and beyond; with all the tenacity of their strong souls and their steady faith, they cling to the consolations offered them by a religion constituted expressly for them. Hence came that Western transformation of the Christian religion, which, in danger at one moment of being lost in the subtleties, useless discussions and petty quarrels of Byzantinism, reappeared, rejuvenated and ere long triumphant, among the barbarous nations of the North.

Consolations, say we, hopes of rewards beyond this life, for that is all that religion could offer to a society still plunged in disorder and distress, like that of the Middle Ages, and it was in this that its power and grandeur lay. But how far away was this conception from the ancient religion whose only mission was to express the joy of living and to represent, under eternally beautiful symbols, the beauty of the present world.

Thus we find outlined three great divisions of religious architecture; thus have appeared three different arts having, as it were, no common point of contact; three almost hostile arts, because they originate in opposing even contradictory conceptions concerning the present existence and the last end, and because the manner of facing what may await him in life or death constitutes the very foundation of man.

Such is the picture presented to our eyes when we contemplate, as a whole, the earliest endeavors of the different races; and it is clear why the history of religious architecture forms one of the most extended chapters in the general history of architecture. How many peoples have left, as the only traces of their passage, the religious edifices reared by them!

But one should not stop at this first glance. In a measure, as social institutions develop or change, religion itself changes; its mission and rôle are modified, and at the same time transformations take place in architecture, which is their expression. As political centralization, which is necessary to national life, is effected, religion descends from its purely moral heights, and the Church, becoming less religious, if we may so express it, then forms, according to the sanctioned term, one of the great bodies of the State. It is converted into an active potency, one of the elemental forces of the central power.

This metamorphosis is already noticeable among the Egyptians and Greeks, and it is still more marked when we reach the Romans. With this last people, worship becomes almost a civil function, an official power; temples are henceforth nothing more than public monuments, indicative, not of the pagan faith, but of Roman might, which seeks expression in grandeur and pomp.

Later on, when the new religion of Christianity took root amid the still imposing ruins of the Empire, architecture found difficulty in freeing itself from the Roman traditions, which persisted along with the remnants of the powerful Roman organization. Byzantine art, a decadent form of ancient art, disappeared only with the last vestiges of this organization.

¹ From the French of P. Planat, in Planat's "Encyclopédie de l'Architecture et de la Construction."

Then Christianity was born anew among vigorous young nations, which created for it a new and profoundly original form of expression.

Centuries elapsed. Then the same phenomenon which we have already indicated was manifested once more. Barbarian invasions had left vast accumulations everywhere, which were slowly incorporated into the primitive soil. Peoples and civilizations sprung out of these remains; a new organization began. Then, when agglomerations had been effected, centralization was again rudely outlined. When the Renaissance came the nature of faith had changed; by the side of royalty, religion played a political rôle which was daily growing in importance. Religious architecture once more lost its real character; in truth, it was merely a secondary branch of the civil architecture of the day; it retained hardly any of its essentially fitting forms, and these were simply traditional. It became, for a second time, pompous and official.

Civil and public architecture, which had long been relegated to a subordinate rank, then assumed an importance which soon grew to be preponderant. If we are obliged to go to religious structures to learn the characteristic features of Egyptian, Indian, Greek and Gothic styles of architecture, such is not the case with the Renaissance and later types: it is in palaces or châteaux, in great royal or seigneurial edifices, or in monuments raised by wealthy and powerful cities, that we must study the art of the sixteenth century and of the centuries following.

Before beginning here a rapid review of the religious architecture of successive peoples since remotest antiquity, we must ask ourselves what features we shall attempt to describe most clearly, as being the most characteristic; in this necessarily long enumeration we will try to find a conducting thread.

If it were possible to detect a certain form or disposition existing in all edifices belonging to one of the great epochs of architecture—to a style, as it is termed—and nowhere else, our task would be an easy one. It would then suffice to say: Every structure in which this form, or this disposition, occurs is necessarily of such a period, and pertains to such a people. The principle once set forth, the reader could be left to make his own applications of it. But, unfortunately, this is not the case.

Some of the older archaeologists start out with the following statement: The beam or lintel is a special characteristic of Egyptian and Greek architecture, the semicircular arch of the Roman style, the cupola of the Byzantine and the pointed arch of the Gothic. They consider these to be sufficiently rigorous characterizations of the different styles. It would seem even that such a pronounced preference existed among these various peoples for one of these lines that the Egyptians would have suffered greatly if they had been compelled to employ a semicircular arch; that the Romans would doubtless have been very unhappy if necessity had forced the straight line upon them instead of the semicircle.

This simple classification, however, is far from being a rigid one; for the Assyrians, Phœnicians, Persians, Hindoos, Arabs and many other nations, whose civilization and architecture were profoundly original, archaeologists have not yet pronounced on the line exclusively adopted by them! The beam or lintel was used in Egypt as in Greece and India; and yet, what relationship existed between the three styles of architecture? In addition to the fact that semicircular, depressed and pointed arches occur in Egyptian architecture, and even in Assyrian, the pointed arch is sometimes Roman; the semicircular arch is continually employed in the Gothic style, in very important parts of structures, and the pointed arch is, in truth, as much Romanesque as Arabic or Gothic.

Doubtless the frequent recurrence of a certain line is an important feature, and one not to be neglected, especially because it is easily apprehended. But, in view of the number of exceptions encountered in all directions, it has long been deemed insufficient to determine the style of architecture.

Later archaeologists fell back upon other considerations; for them the characteristic of a style is the solution given by a people to some especially important problem of construction; they say, for example, that, when the question arose of roofing the vast halls of worship, which could not as formerly be covered with timber-work, since the edifices were thus most dangerously exposed to destruction by fire, the cupola on pendentives was adopted in Byzantine architecture, while later on Gothic architects invented groined vaulting on diagonal arches, with flying buttresses. We must recognize the importance, very characteristic, in fact, of these solutions, from which

widely different dispositions and external forms have resulted; but here again, one must not be too confident. Some dome-covered structures are much nearer Gothic than Byzantine art in plan, and in external or interior appearance; many a church in the Lombard style has groined vaulting over the nave and also over the aisles, which would never be confounded with a genuinely Gothic church. The cupola and groined vaulting which are encountered in still many other styles, furnish, then, no infallible rules.

We should, therefore, not place too much stress on these two standards of distinction. In seeking means of classification, more attention should be given to general forms and to details of ornamentation. It is in these, perhaps, that the spirit, taste and originality of a people are most strikingly manifested. Notwithstanding the use of the pointed arch, an edifice will, nevertheless, often be recognized as Romanesque, not only in the proportions of its plan, but also and especially, in its squat appearance and in the peculiar forms of ornamental details; doubt will scarcely be possible after an examination of these features. Even though the ogival forms employed in a Persian or Arab structure should differ but little from the Gothic, no one would fail for a moment to recognize the ornamentation peculiar to these Oriental peoples, and which in no way resembles Occidental embellishments.

In our opinion, writers have not always insisted sufficiently upon the certainty assured by this architectural decoration, a term under which we include not only the details of ornamentation, but the system of proportions adopted for the principal lines; and it seems to us that Arab, Indian, Gothic or Egyptian architects were never tempted to treat a capital, a frieze, a cornice, a portal, nor even a simple base of a column in the same manner.

Without desiring to deduce from these last characteristics, however significant they may appear to us, any more absolute rules than the preceding, we will then say: It is the *ensemble* of the characteristics noted above which must be examined, in order to form an accurate idea of each style.

The scope of our sketch does not permit us to go into all the most delicate and complex details of this multifold study, but we will, at least, try to indicate its most comprehensive features.

With every nation, nature and its peculiar religious needs and traditional customs decided the general form of the houses of worship. Technical problems came up in connection with the chief dispositions of the plan thus fixed, which each people has solved in its own way, in accordance with the nature of the materials at its disposal, and with the degree of progress attained by it in knowledge and technical processes. In this way the principal lines are determined, not only for the plan and elevation, but for the decorative system. Then comes in the ornamental element; this differs as widely as possible in different races, for therein are chiefly expressed a nation's inventive genius, its fancy and even caprice, its taste for simplicity or for richness and complexity, its artistic sense of a more or less harmonious, more or less picturesque arrangement, and even that deftness of hand which varies so greatly according to the particular stage of its civilization.

Ornamentation is all the more pliant and fruitful because of the diversity of sources from which its elements are drawn. Geometry furnishes the sculptor with regular and masterly combinations of lines. In the vegetable world he continually gathers inspiration, and from the varying forms of the flora of different regions he borrows, ready-made, models, which he conventionalizes to suit his instinctive tastes. The animal world frequently supplies him with motives, more or less realistic or fantastic, according to the modifications which he introduces by association with geometric or vegetable forms. Lastly and especially, we may notice, among these sources, the human figure, which though totally absent in Arabian and Persian architecture, provided the Greeks with exquisite models of balancing in the *ensemble* and of perfection in the details; which held an important place in Gothic art, under somewhat awkward though charmingly naïve types; and which superabounded in Indian art.

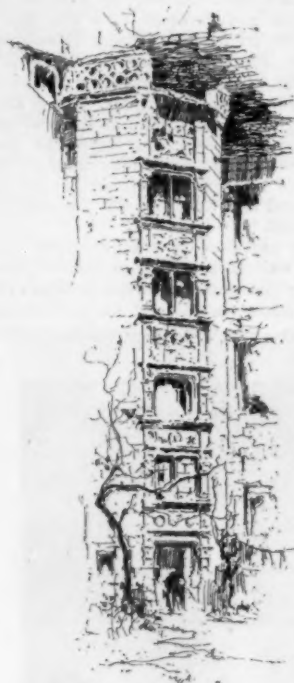
According to the proportion in which these divers elements interpose, according to the spirit in which they are treated, as well as according to the degree of plastic perfection displayed by a people in utilizing them, results of surprising diversity are obtained, which seem to us, as we have said, especially fitted to distinguish the different styles of architecture that we are about to study.

We will now pass in review the great epochs of religious

architecture, showing what ties link each school to its predecessors, and what original matter each has contributed to the history of the art.

[To be continued.]

THE BUREAU OF ETHNOLOGY'S FIFTH ANNUAL REPORT.¹—II.



MR. CHARLES C. ROYCE contributes from the "*Historical Atlas of Indian Affairs*," upon which he has been engaged for several years, an account of "The Cherokee Nation of Indians." In his introduction he explains the plan and scope of the work, the chief aim of which is to show upon a series of State and Territorial maps the boundaries of the various tracts of country which have from time to time been acquired through the medium of treaty stipulation or act of Congress from the several Indian tribes resident within the present territory of the United States from the beginning of the Federal period to the present day. Accompanying the atlas will be one or two volumes of historical text, wherein will be given with some detail a history of the official relations between the United States and these tribes, treating of the various negotiations, the causes rendering such negotiations necessary, the methods observed by the Government in this diplomacy, etc.

This monograph on the history of the Cherokees with its accompanying maps, is given as an illustration of the character of the

work in its treatment of each of the Indian tribes. The maps show the present as well as the ancestral home of the Cherokees, and also the various changes made by the different treaties in the boundaries of their tracts.

The Cherokees are appropriately selected for illustration of the method of Mr. Royce's important work, since they appear more prominently and for a longer period in the dealings of the United

States with the Indians than any other tribe or nation. They have, indeed, played a prominent part in the tragedy of our "Century of Dishonor." As Major Powell comments: "For two hundred years, in wars, in councils and in courts, they have been engaged in struggles involving their existence, and they are one of the few Indian peoples that have passed through such ordeals into present prosperity. Their history shows that when the

improperly directed power of the white race did not absolutely prohibit their advance in civilization some such advance was always attained, and it was always resumed after interruption when possible. During thirty years after the treaty of 1791 they made such manifest strides

towards civilization, both in herding and in husbandry, that at the end of that time their agent reported Government assistance to be no longer necessary or desirable, the people being perfectly competent to take care of themselves, and in 1827 they established a Government, Republican in form and satisfactory in its operation until paralyzed in 1830 by the hostile action of Georgia. Their forced removal in 1838 to the west of the Mississippi for a time diminished their numbers, impaired their confidence and menaced their prosperity; yet five years later their energy and determination had exhibited renewed improvements, which continued until the war of the rebellion brought to them more desolation than to any other community. They were raided and sacked alternately by the forces of the United States and by those of the Confederacy, and were divided among themselves into fighting factions. Their country became a waste, and in the few years of the war their numbers were reduced by at least one-third; yet to-day they are more prosperous than ever before, and have probably a greater population than at any time since they have been known in history."

A people must, indeed, contain splendid vitality to bear such a record as the Cherokees. The history of Mexico, which to-day is fundamentally an Indian Republic, reinforced by the example of the Cherokees and the other civilized tribes in the Indian Territory, demonstrate the inherent capacity of the Indian for advancement in culture; the fact that he has not progressed farther is not so much to be wondered at as that he has progressed at all in face of the brutal efforts of our own race to check and thwart every tendency towards improvement. Neither, in the light of the increase of the Cherokees, does the frequent prediction of the ultimate extinction of the Indians bid fair to be realized. It looks more like ultimate absorption in the great volume of our race. In this connection some far-seeing words by Walt Whitman, from a letter written to the Committee on the Tercio-millennial Celebration at Santa Fe in 1883, are appropriate: "Then another point, relating to American ethnology, past and to come, I will here touch upon at a venture. As to our aboriginal or Indian population—the Aztec in the South and many a tribe in the North and West—I know it seems to be agreed that they must gradually dwindle as time rolls on, and in a few generations more leave only a reminiscence, a blank. But I am not at all clear about that. As America, from its many far sources and current supplies, develops, adapts, entwines, faithfully identifies its own—are we to see it cheerfully accepting and using all the contributions of foreign lands from the whole outside globe—and then rejecting the only ones distinctively its own—the autochthonic ones?"

The value of the paper is enhanced by the many biographical notices, details of life in the early years of our country before and after the close of the Colonial period, and the sufferings borne by the Cherokees during their many persecutions by their covetous neighbors. Major Powell well says that the care and skill devoted by Mr. Royce to make the statement both accurate and comprehensive, fortifying it also by the citation of their best authorities, will

render it valuable to statesmen, historians and lawyers.

Mr. Royce, however, is more of a compiler than historian, and has committed one astonishing and unpardonable error of omission. With all the interesting accounts of the advancement of the Cherokees in civilization, the great feature which makes that people unique in the world's history has the barest and most identical mention. That is the fact that the Cherokees are



Navajo Medicine-lodge.

the only people who have suddenly sprung of their own volition from illiteracy to the rank of a lettered folk, with an alphabet and orthography devised by one of their own number on wholly original ideas, and particularly adapted to their needs. The only allusion to this fact, which is the greatest thing in the whole history of the Cherokees and one of the most important circumstances in the record of

¹Continued from No. 741, page 153. Charles C. Royce's "*Historical Atlas of Indian Affairs*":—the Cherokees; Dr. Washington Matthews on the Navajos.

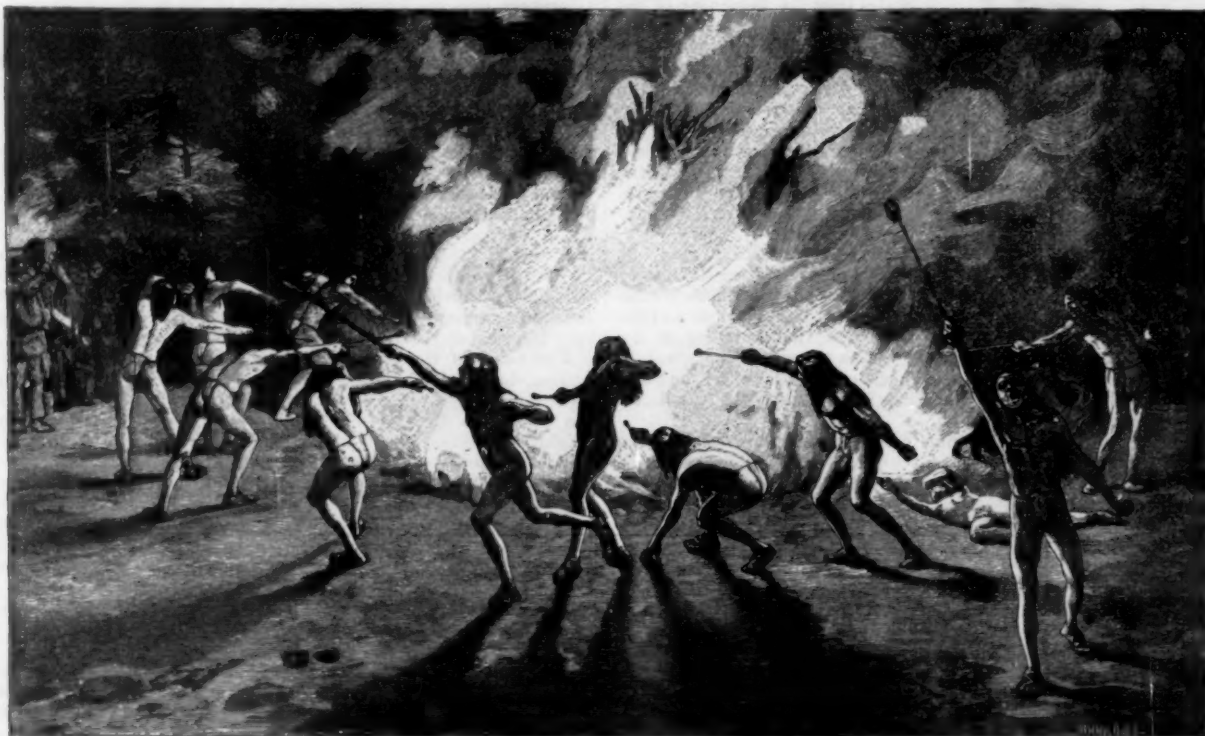
primitive races, and which in itself is enough to give the Cherokees immortality so long as the science of ethnology shall last, is contained in a few lines about the death of Sequoyah—who has a fitting monument in the name given the giant-trees of California—the Indian Cadmus whose great inventive mind wrought this work for his people. It is to be hoped that the fascinating history of the Cherokee alphabet will some day be written in the true scientific spirit that such an event merits.

Mr. Royce concludes with some interesting general remarks, from which we learn that the Cherokees, after their long periods of adversity, are to-day more numerous and prosperous than they have been since they were removed west of the Mississippi.

Dr. Washington Matthews, Assistant Surgeon, U. S. A., has an exceedingly interesting and scholarly contribution called "The Mountain Chant: a Navajo Ceremony." Dr. Matthews became interested in the Navajos while stationed at Fort Wingate in New Mexico, and devoted all his leisure to studying them. Dr. Matthews had already accomplished much ethnological work of a high order while stationed in other sections, and the Navajos, that numerous and interesting division of the great Apache, or Tinné, family, presented an excellent opportunity for study, their reservation being not far from Fort Wingate to the northward. While at Fort Wingate Dr. Matthews became acquainted with Mr. Franklin Hamilton Cushing, Zuñi being something like forty miles to the southward; he perceived the rare genius of the youthful ethnologist immediately—the bearing of Mr. Cushing's studies was sadly misunderstood by

Indian of this ceremony is "Dsilidje qacal," and is said to have originated with the great prophet of the Navajos, who, like most other peoples, also appear to have had their great traditional teacher. The myth of Dsilic Neyani (Reared within the Mountains), this great teacher, shows his captivity among the Utes, his escape by the intervention of gods, and his travels, sufferings and adventures in regaining home, all of which, under divine guidance, were in the nature of an initiation into all religious rites, with the injunction that these should be communicated by him to his people. Shortly after his return, having performed his duty as teacher or prophet, he disappeared to rejoin the gods in accordance with their promise made to him during his initiatory travels. Major Powell, in his editorial comments, pronounces this presentation by Dr. Matthews, "given in the genuine Indian style and conception, without admixture of European interpretation and civilized gloss" one of the most important contributions to the history of Indian myths, and he finds in it essential similarities to the myths of the Egyptians, the Hindoos and the Greeks, and other peoples, furnishing instructive evidence of similarity in the stage of mythologic philosophy coming from a before unexplored source and only modified by the readily understood differences of environment.

Dr. Matthews writes that "the purposes of the ceremony are various. Its ostensible reason for existence is to cure disease; but it is made the occasion for invoking the unseen powers in behalf of the people at large for various purposes, particularly for good crops and abundant rains. It would appear that it is also designed to per-



A Navajo Dance.

most of the Americans in the country at that time—and a firm and lasting friendship sprang up between them, which has resulted in much invaluable mutual service in their respective lines of investigation.

The ceremony which forms the subject of Dr. Matthews's paper is one of a large number practised by the *shamans*, or medicine-men, of the Navajos, and was selected by the author because he had witnessed it the most frequently, because it was the most interesting to the Caucasian spectator, and because it is the best known to the whites who visit and reside around the Navajo country. "Its chief interest to the stranger lies in the various public performances of the last night. Like other great rites of the *shamans*, it has its secret ceremonies of many days' duration in the medicine lodge; but unlike the others, it ends with a varied show in the open air, which all are invited to witness. Another ceremony which I have attended, and which the whites usually call the 'Yaybichy Dance' [Yebitchai], has a final public exhibition which occupies the whole night, but it is unvaried. Few Europeans can be found who have remained awake later than midnight to watch it. Such is not the case with the rite now to be described. Here the white man is rarely the first to leave at dawn."

From this introduction, the extremely interesting character of the performance may be inferred. Indeed, it is one of the most fascinating accounts of Indian customs written since Capt. J. G. Bourke's book on the Rattlesnake Dance of the Moquis. The

petuate their religious symbolism. Some of the shows of the last night are undoubtedly intended to be dramatic and entertaining, as well as religious, while the merely social element of the whole affair is obvious. It is an occasion when the people gather to have a jolly time. The patient pays the expenses, and, probably in addition to the favor and help of the gods and the praise of the priesthood, he hopes to obtain social distinction for his liberality."

As very similar motives govern the course of many of our so-called "devout," can they be said fundamentally to occupy any different grade from that of the savages?

Dr. Matthews's account of the ceremonials is full of the most interesting incidents. Following is a description of the medicine-lodge in which the ceremonies took place at the time when he had the most complete view of them during a visit made to a place on the Navajo reservation about twenty miles from Fort Wingate, called Nigotlizi [hard Earth]. It was a simple conical structure of large, partly hewn piñon logs, set on end and inclined at an angle of about forty-five degrees, so as to join on top where they formed the apex of the lodge. The circle of logs was incomplete in the east, where the openings for the door and the smoke-hole were. A passage, or entry, about five feet high and three feet wide, led from the body of the lodge to the outer doorway, where some blankets hung as portières. The frame of logs was covered with sods and loose earth to keep out the wind and rain. Internally, the lodge was eight feet in height under the apex of the cone, and on an average twenty-five

feet in diameter at the base. The diameter was increased at the east to allow for the entry, and at the north. The irregularity in the circumference in the north was at first conjectured to be a mere accident; but in the ceremonies of the first night its use became apparent as affording a hiding-place for one of the characters in the ceremonial—the man dressed in evergreens.

Dr. Matthews was accorded the rare privilege of witnessing the ceremonials that took place within this lodge, one of the most interesting of which was the making of the elaborate "sand-painting" appropriate to the order of the day: "About noon they cleared off that portion of the floor of the lodge which lay west of the fire, and brought, in blankets, a quantity of dry sand, which they spread out over the cleared portion of the floor in a layer of the nearly constant depth of three inches. They smoothed the surface with the broad oaken battens used in weaving. Now for a time all operations were suspended in the lodge while the chanter went out to plant the *coholça*, or plumed wands, in front of the medicine lodge, and to lay beside them the collars of beaver skins and the symbols for wings which the couriers were to wear next day. These articles, it was said, were placed outside as a sign to the gods that the holy pictures were being drawn, but it is not improbable that they were intended also as a sign to uninitiated mortals. However that may be, they were taken in as soon as the picture was finished. The great painting

picture. The drawings are, as a rule, begun as much towards the centre as the nature of the figure will permit, due regard being paid to the order of precedence of the points of the compass, the figure in the east being begun first, that in the south next, that in the west third in order, and that in the north fourth. The periphery is finished last of all. The reason for thus working from within outwards is that the men employed on the picture disturb the smooth surface of the sand with their feet. If they proceed in the order described, they can smooth the sand as they advance, and need not cross the finished portions of the picture."

There are seventeen great healing dances in which pictures of this kind are drawn, and four pictures, with few exceptions, appropriate to each dance. "Some of the dances are practised somewhat differently by different schools or orders among the medicine-men, and in these divers forms the pictures, although agreeing in general design, vary somewhat in detail. Thus there are, on an average, probably more than four designs, belonging to each of the seventeen ceremonies, whose names I have obtained. If there were but four to each, this would give us sixty-eight such paintings known to the medicine-men of the tribe, and thus we may form some conception of the great number of these sacred pictures which they possess. But I have reason to believe, from many things I have heard, that besides these seventeen great nine days' ceremonies to which I refer, there



Navajo Fire-dance.

was begun about one o'clock P. M., was finished about three, and was allowed to remain until the ceremonies at night were concluded.

"The pictures are drawn according to an exact system. The *shaman* is frequently seen correcting the workmen, and making them erase and revise their work. In certain well-defined instances the artist is allowed to indulge his individual fancy. This is the case with the gaudy embroidered pouches which the gods carry at the waist. Within reasonable bounds, the artist may give his god just as handsome a pouch as he wishes. Some parts of the figures, on the other hand, are measured by palms and spans, and not a line of the sacred design can be varied. Straight and parallel lines are drawn by aid of a tightened cord. The mode of supplying the colored powder is peculiar. The artist has his bark trays laid on the sand, where they are convenient of access. He takes a small quantity of the powder in his closed palm, and allows it to pass out between his thumb and forefinger, while the former is moved across the latter. When he makes a mistake he does not brush away the pigment. He obliterates it by pouring sand on it, and then draws the corrected design on the new surface. The forms of the gods do not appear as I represented them, in the first coat of color. The naked figures of these mythical beings are first completely and accurately drawn, and then the clothing is put on. Even in the pictures of the 'Long Bodies,' which are drawn nine feet in length, the naked body is first made in its appropriate color—white for the east, blue for the south, yellow for the west and black for the north—and then the four red shirts are painted on from thigh to axilla, as shown in the

are many minor ceremonies, with their appropriate pictures, so that the number is probably greater than that which I give.

"These pictures, the medicine-men aver, are transmitted from teacher to pupil in each order and for each ceremony unaltered from year to year, and from generation to generation. That such is strictly the case I cannot believe. There are no standard pictures on hand anywhere. No permanent design for reference is ever in existence, and there is, so far as I can learn, no final authority in the tribe to settle any disputes that may arise. Few of these great ceremonies can be performed in the summer months. Most of the figures are, therefore, carried over from winter to winter in the memories of fallible men. But this much I do credit, that any innovations which may creep into their work are unintentional, and that, if changes occur, they are wrought very slowly. The *shamans* and their faithful followers believe, or profess to believe, that the direst vengeance of the gods would visit them if these rites were varied in the least in picture, prayer, song or ceremonial. The mere fact that there are different schools among the medicine-men may be regarded as an evidence that changes have occurred."

These pictures were made daily during the season of solemnity, and obliterated with elaborate ceremonials. On the eighth day, the building of the great stack of wood which was to furnish the fire in the centre of the corral on the last night proceeded simultaneously with the making of the picture, forming a pile of seasoned juniper and cedar, of the most inflammable character, about twelve feet high and sixty paces around, while large quantities of wood were made

ready to replenish the fire. The ninth day was occupied until sunset in preparing certain properties to be used in the ceremonies of the night. These were ingenious devices for the deception of the public in the apparent swallowing of arrows and saplings, and other tricks of magic. "As each set of implements was completed there was a ceremony with singing and rattling, the men who were to use them at night partook of powdered medicine on their extended tongues from the hands of the chanter, and then practised themselves in the use of the implements. Although they well knew the deceptive nature of these articles, and fully understood the frauds they were preparing to perpetrate on the public, these young men seemed to view the whole work with high reverence, and treat it with the greatest seriousness. For instance, when in the secrecy of the lodge they went through the motions of swallowing the trees, they showed indubitable signs of fear: all looked anxious, some trembled quite perceptibly, and one looked as pale as a live Indian can look. They probably dreaded the displeasure of the gods if all were not done well."

The performances of the night were extremely theatrical, and would make a first-class attraction on any stage. A dark circle of branches was built around the fire about eight feet high, forming an enclosure of sacred ground about forty feet in diameter. At eight o'clock a band of musicians forming a sort of orchestra entered and performed with hardly any interruption until morning. At the moment the music began the great fire was kindled, and in a few moments the entire pile was in flames. "A storm of sparks flew upward to the height of a hundred feet or more, and the descending ashes fell in the corral like a light shower of snow. The heat was soon so intense that in the remotest part of the enclosure it was necessary for one to screen his face when he looked towards the fire. And now all was ready to test the endurance of the dancers, who must expose, or seem to expose, their naked breasts to the torrid glow."

"When the fire gave out its most intense heat, a warning whistle was heard in the outer darkness, and a dozen forms, lithe and lean, dressed only in the narrow white breech-cloth and moccasins, and daubed with white earth, until they seemed a group of living marbles, came bounding through the entrance, yelping like wolves, and slowly moving around the fire. As they advanced in single file, they threw their bodies into divers attitudes—some graceful, some strained and difficult, and some menacing. Now they faced the east, now the south, the west, the north, bearing aloft their slender wands tipped with eagle-down, holding and waving them with surprising effects."

Many of these dances took place in succession, each of a different character, full of incident and theatrical display. We cannot forbear quoting in full the account of the eleventh of these, the fire-dance, or fire-play, the most picturesque and startling of all: "Some time before the actors entered, we heard, mingled with the blowing of the buffalo-horn, strange sounds, much like the call of the sand-hill crane; they will, for convenience, be called trumpeting. These sounds continued to grow louder and come nearer, until they were heard at the opening in the east, and in a second after, ten men, having no more clothing on than the performers in the first dance, entered. Every man except the leader bore a long, thick bundle of shredded cedar-bark in each hand, and one had two extra bundles on his shoulders for the later use of the leader. The latter carried four small fagots of the same material in his hands. Four times they all danced around the fire, waving their bundles of bark towards it. They halted in the east; the leader advanced towards the central fire, lighting one of the fagots, and, trumpeting loudly, threw it to the east over the fence of the corral. He performed a similar act at the south, at the west and at the north; but before the northern brand was thrown he lighted with it the bark bundles of his comrades. As each brand disappeared over the fence, some of the spectators blew into their hands and made a motion as if tossing some substance after the departing flame. When the fascicles were all lighted, the whole band began a wild race around the fire. At first they kept close together, and spat upon one another some substance of supposed medicinal virtue. Soon they scattered and ran, apparently without concert, the rapid racing causing the brands to throw out long, brilliant streamers of flame over the hands and arms of the dancers. Then they proceeded to apply the brands to their own nude bodies and to the bodies of their comrades in front of them, no man ever once turning around. At times the dancer struck his victim vigorous blows with his flaming wand; again, he seized the flame as if it were a sponge, and, keeping close to the one pursued, rubbed the back of the latter for several moments, as if he were bathing him. In the meantime the sufferer would, perhaps, catch up with some one in front of him, and in turn bathe him in flame. At times, when a dancer found no one in front of him, he proceeded to sponge his own back, and might keep this up while making two or three circuits around the fire, or until he caught up with some one else. At each application of the blaze the loud trumpeting was heard, and it often seemed as if a great flock of cranes was winging its way overhead southward through the darkness. If a brand became extinguished, it was lighted again in the central fire; but when it was so far consumed as to be no longer held conveniently in the hand, the dancer dropped it and rushed, trumpeting, out of the corral. Thus, one by one, they all departed. When they were gone many of the spectators came forward, picked up many of the fallen fragments of cedar-bark, lighted them, and

bathed their hands in the flames as a charm against the evil effects of fire.

"Did these dancers next day hide sore and blistered backs under their zarapes? I think not, for I have seen and conversed with some of the performers immediately after the fire-show, and they seemed happy, and had nothing to complain of. Did the medicine they spat on one another save them? Certainly not, although the Indians claim it as a true prophylactic against burns, and call it *aze sakazi*, or cold medicine. But it is probable that the cedar-bark ignites at low temperature, and more than probable that the coating of white earth with which their bodies were covered is an excellent non-conductor. However, the thought that their bodies might have been thus ingeniously protected lessened a little, if any, the effect produced upon the spectator. I have seen many fire-scenes on the stage, many acts of fire-eating and fire-handling by civilized jugglers, and many fire-dances by other Indian tribes, but nothing quite comparable to this in all its scenic effects."

The close and accurate observation of the author, his gift of clear and vivid literary expression, and his thorough scientific knowledge give this paper rank among the most notable contributions to American ethnology. The superb illustrations are worthy of the text. The extraordinary sand-paintings described are reproduced from drawings by Dr. Matthews in handsome colored plates, and there are many beautifully drawn and engraved cuts. The two full-page pictures, representing, respectively, the "Dance of Nahikai" and "The Fire-dance," are particularly admirable in their presentation of the wild scenes, so full of action, with effects of intense fire-light.

SYLVESTER BAXTER.

[To be continued.]

THE TUDOR EXHIBITION.¹—II.

ARMOR, RELICS, ETC.



"All the Modern Improvements."—No. 5.

THE first objects that we see on entering this exhibition are the suits of armor and cases of weapons, all most carefully arranged, by far the largest exhibitors being the Baron de Cosson, who has also described them, Edwin Brett, Esq., and S. J. Whawell, Esq.

We are told in the Catalogue "that it is only within the last few years, and by three or four students at most, that any critical study of the work of the great master-armors of the fifteenth and sixteenth centuries has been undertaken"; and doubtless we are indebted to these connoisseurs for many interesting facts connected with the manufacture and subsequent history of some of the more important specimens of the armorer's skill.

The chief armorers of the Tudor period were successively the families of Missaglia and Negroli, in Milan, whose work is largely represented here. After them ranked the Spanish and German manufacturers and the English. With regard, however, to the weapons called English, it is noticeable that the only part really deserving of

the name, is the hilt, often most beautifully decorated with engravings of silver, representing figures, fruit, foliage, etc., the blade generally bearing the name and private mark of a foreign maker.

It is, of course, beyond the limits of a letter to describe minutely so large and splendid a collection. Still, apart from the first-rate workmanship of those old artists in iron and steel, great national and historic interest attaches to it, as we shall show.

There are twenty complete suits of armor; *cap-à-pie*, or three-quarter, four of which deserve special mention: First, that of the Earl of Pembroke, commander of the English forces, coöperating with those of Philip II at the siege and battle of St. Quentin, 1557, during a war which brought little glory to us but this victory, in gratitude for which Philip built the Escorial, and resulting, as far as the English were concerned, in the loss of Calais. The suit is *cap-à-pie*, in russet and gilt, burgonet and buffe, and shows in several

¹Continued from No. 745, page 12.

places the arms and garter of the Earl. The present Earl of Pembroke lends this suit with those of two of the most notable prisoners taken by his ancestor at that fierce combat.

The armor worn by Anne de Montmorency, Constable of France, who, though one of the most distinguished captains of the century, was thrice captured: first at Pavia, with Francis I, in 1525; next taken, badly wounded, at St. Quentin; and, thirdly, at Dreux in 1562. His is a three-quarter blue-and-gilt suit, with burgonet and buffe, splinted breast and back, and is of large size.

The third of this interesting group of magnificent suits is that of Louis de Bourbon, Duc de Montpensier, also taken prisoner at St. Quentin with many other French nobles. It is a full suit in russet and gilt, but reaching only to the ankles, the head-piece being a close helmet.

The last suit whose wearer's name is given is of more romantic interest, and belonged to George Clifford, Earl of Cumberland, whose mother was daughter of Mary Tudor and Charles Brandon, Duke of Suffolk. This suit, perhaps the finest one of russet and gilt extant, was probably worn by the Earl on taking over from Sir Henry Lee the office of Champion of Queen Elizabeth, in virtue of which office he presided at the jousts and tournaments held every Queen's Day, November 17, at Westminster, at the back of the present Horse Guards, then, as now, known as the Tilt Yard. A remarkably fine German suit, entirely fluted, of the fashion known as Maximilian armor, from Lord Stafford's armory, lent by the Baron de Cosson; in old English inventories it would have been called a "field" or "hosting (war) harness created," to distinguish it from the harness especially made for tilt or tourney. The helmet opens down the chin, and is attached to the gorget by a rim. The breast-plate is remarkable for being made in two pieces, after the fashion of fifteenth-century armor, with some delicate open-work at upper edge of lower portion. The fluting is close and narrow, and the steel exceedingly hard; it is of the date of Henry VIII.

An incomplete fluted and crested suit, thought to be by Negrol, is remarkable for the richness, simplicity and taste of its decoration. This consists, where the ground is not covered with engraving and gilding, in alternate bands of bright steel and of engraving and gilding, separated by ridges in low relief, the armor being thus of the kind called fluted and crested. On the upper part of the breast is a broad band, on which are engraved and gilt the Virgin and Child, with an architectural background, having on either side St. Paul and St. George in glory. Below, in two lines, is the following inscription in large characters: "*Christus. Res (sic) Venit. In Pace. Et Deus. Homo. Factus. Est.*" The back-plate has "*Jesus. Avtem. Transiens. Per. Medium. Illorum. Ibat.*" and below a large triangular space covered with engraving and gilding, with flutings on either side. A similar space in front of the gorget has a gilt and engraved representation of the Trinity on a nimbus.

Among the other suits are a great variety of styles; viz., black and bright, embossed with designs of foliage, etc.; black with white stripes; and several engraved with the Crucifixion, one of the latter kind having, besides, the figures of four kneeling knights.

The tournament helm of Sir Giles Capel, one of the knights who, with Henry VIII, challenged all comers at the Field of the Cloth of Gold, 1520, hung over his tomb in Rayne Church, Essex, till 1840, when the church was pulled down. It was so large that he could turn about his head inside it, numerous apertures being pierced in the visor in several places to enable him to see in different directions; but these were so narrow that the point of the finest pointing sword could not injure him. This helm was firmly fixed to the breast-plate. The thickly-wadded hood, always worn inside, was fastened by rivets to the neck and elsewhere to prevent it flapping about.

One embossed casque of great artistic beauty and of Italian workmanship was picked up for £1 at a pawnbroker's at Hampstead. The figures represent a warrior (Mars?) with Victory and Fame holding his moustaches; the date is about 1540. This casque, and one in the Musée d'Artillerie, Paris, closely resembling it, are believed to be by Piccinino from Negrol's design.

Of great strength and beauty is a German sallad, a head-piece used by all men-at-arms throughout Europe at the close of the fifteenth century; it was completed by the bevor, which was screwed firmly to the breast-plate, and the sallad was fixed to it. This sallad has had a singular history. At one time it formed part of the stage-property of the Opera-House, Madrid; it thence passed into the collection of Don Jose Vera, and afterwards into that of Fortuny, the painter. It has been identified in authentic drawings of Charles the Fifth's armory, where it is called "old stuff that came from Flanders." It is, therefore, thought probable that it belonged to Philip the Fair, and was sent to Spain when Charles I became King of that country, afterwards known as Charles V, Emperor of Germany.

English helmets were peculiar for the very prominent visor with a hollow curve, and having a little door on the right side, which, by pressing a spring, could be opened, thus enabling the wearer to breathe more freely after an encounter, or even speak, without removing his helmet.

Among about one hundred swords, rapiers and daggers, we find, naturally, great variety, both of size and style; for example, the heavy war-sword, used with gauntlets; the lighter town-sword or rapier, provided with knuckle-guard; the duelling rapier, much longer than others, one here having a blade of forty-eight inches;

swords two-handed and two-edged; practising swords without points, and others, for soldiers, with the points strong and "very serviceable."

As with the suits of armor, so with the weapons; there is a profusion of fanciful designs and mottoes. One rapier has New Testament subjects, with mounted combatants chased on the hilt; the blade of another has "Hea, Hea, Hea, Hea," on each face; while "Inri," "Maria," "Soli Deo Gloria" and "Fides Sed Cui Vide," with a king's head in a gilt medallion, ornament others. The two-handed sword of Dudley, Earl of Leicester, has his badge of the Bear and Ragged Staff several times on the hilt; the quillons of chased-steel being fashioned like ragged staves, and terminating in bears with ragged staves.

The blade of a dagger is inscribed "God Guide The Hand. That I In Stand." One of two executioners' swords has a gallows and a wheel on the blade in copper. An iron hand-buckler or target, for use with a sword, bears rude representations of the rose, portcullis, fleur-de-lis and harp; in the centre is a boss, acting as a sword-breaker, and round the margin "Wisdom. Faith. And. Prowess. Support Kingdoms."

Several wheel-lock pistols and guns are exhibited, many having the stock beautifully inlaid with ivory, or even mother-of-pearl and ivory.

Leaving these mementos of a warlike age, we turn to the more romantic portion of the exhibition, and, making our way through knots of admiring onlookers, we pause at the cases: the gold cups, etc., and silver spoons, but find the gold to be only silver-gilt. Indeed, in the whole collection, less than a dozen are made of gold; viz., some watches and rings, which we leave for the present while we linger a short time over the cups, rose-water basins and salt-drums, all with covers. Interspersed with these are about two dozen silver spoons—"Apostle," "Maiden-head," "Christening" or seal-headed, none of which call for notice except four "Apostle" spoons, forming part of a set of thirteen, which, with some belonging to the Goldsmith's Company, are the only two sets of thirteen spoons now known.

The oldest piece of plate is dated 1490, and is a mazer or maple-wood cup, with silver-gilt rim, and monogram "ihc" on dark-blue enamel encircled with rays. The ivory "Grace Cup" of Thomas à Becket is exceedingly rich, with silver-gilt, precious stones and pearls. A silver-gilt rim and lining has been fixed to the ivory cup, the foot and cover being strengthened and beautified in the same way; the whole further ornamented by bands of rich chasing alternating with pearls and jewels. Sir Henry Howard, standard-bearer to Henry VIII, bequeathed this cup to Katharine of Aragon, who left it to the Howard family at her death.

A great point of attraction is a cocoanut cup given to Sir Francis Drake by Queen Elizabeth. The cup has a rim of silver-gilt delicately engraved with beasts, etc., and is divided by the straps connecting the rim with the stem into three panels, engraved, respectively, with the royal arms, those of Drake, with date, 1580, and with a picture of his ship and several prizes, all gilt. A boldly-modelled figure of a dragon with outstretched wings supports the cup, and the foot is richly ornamented. The cover is very beautiful, being composed of ships and sea-monsters in silver-gilt, surmounted by the vessel in which he circumnavigated the globe, most exquisitely wrought. Another magnificent cup given by Elizabeth to the great navigator is also silver-gilt, ornamented by rich filigree-work, the cover being surmounted by a figure of Hercules. These are lent by the present Sir Francis Drake.

A silver-gilt tankard, known as the "Poison Tankard," has the body of crystal encased in filigree; on the flat top surrounded by filigree work is a pyramidal crystal, which was supposed to become cloudy or milky, if poison was in the cup. The foot rests on three cherubs' heads. This is English work, circa 1570.

The silver-gilt rose-water basin, lent by the Corporation of Bristol, owes its present existence to a Mr. Williams, a Bristol silversmith. During the riots of 1831, a man named Ives stole the basin, and, cutting it up into 167 pieces, offered them for sale to Mr. Williams. He had Ives arrested, and he received fourteen years transportation. The silversmith, with infinite pains, fitted the pieces together and rivetted them to a silverplate now forming the back of the bowl. It is engraved all over its surface with characteristic arabesque work, with scallop-shells, flowers, etc., and in the middle has a raised coat-of-arms. The ewer is jug-shape, similarly ornamented, and has in front a cherub's head, in high relief.

There are some quaint watches, three of which belonged to Queen Elizabeth: two gold ones, one in the shape of a cross, and one in silver, melon-shaped, in a shagreen-case. Besides these, there are several metal-gilt watches, two having iron works and an open-work brass watch-case.

There are not many rings, but the romance entwined round one of them makes up for their paucity.

This is the famous ring given by Elizabeth to Essex. It is a gold sardonix ring, the cameo representing a portrait of the Queen in high relief; the inside is enamelled in blue and gold. It seems to have been originally made for a very small finger, and afterwards enlarged.

There are nine gold posy rings, temp. Henry VIII, Elizabeth, with the following mottoes: "*As you yows me you shale find me; Kepe faith till Death: Once myne and ever Thyne; God I pray your happiness inivy, etc.*"

But it is impossible to classify everything in this *omnium gatherum* of relics, we can only name a few of the more interesting. The rosary of Henry; a small gold *etui*, about two inches long, given by Queen Anne Boleyn to the officer on guard at her execution. When presenting it, she told him "it was the first token the King had given her," bidding him observe "that a serpent formed part of the device, and a serpent the giver had proved to her." It is in the form of a pistol, the barrel serving the purpose of a whistle and enclosing a set of toothpicks; a serpent is coiled round the handle. A medallion in soapstone with bust profile of Maximilian I. In Germany, models for medals were made in soapstone; in Italy in wax, but in England usually in clay.

A "Book of Hours," belonging to Mary Tudor, Duchess of Suffolk, whose arms and badge are on the cover; it is supposed to have been used by Mary, Queen of Scots, on the scaffold. It is a little book about five inches long. The christening mantle of red velvet and silver tissue, worn by Henry VIII; a lace canopy, said to have been worked by Anne Boleyn and used at Princess Elizabeth's christening, and a piece of silver tissue, part of the canopy used at that of Edward VI. A purse, embroidered with the Tudor rose and the motto: "Money maketh mirth when it is plenty, but small is the mirth when the purse is empty."

The Phoenix badge of Queen Elizabeth in silver (A. D. 1558). Elizabeth, early in her reign, adopted the Phoenix as her device; it was the symbol of celibacy; and she told her first Parliament that she wished her monument to inform posterity "Here lies a Queen that lived and died a Virgin." One rosary has beads of coral and silver; in another they are made of carved horn, in which are set small portraits of saints, etc.; a reliquary with *églomisé* work is attached to it. There are many specimens of Queen Elizabeth's needlework for which she had abundant leisure in her earlier life, the more interesting being the set of baby-clothes she made for her sister Mary, but which were never required, and remained unused; and a pair of infant's lace gloves made and presented by Elizabeth to the Burton family with her portrait, which is fixed on the wall at Lougher Hall, when she heard that Edward Burton had died of joy at her accession; he having been bitterly tormented by Queen Mary. Sir John Burton, his father, was Groom of the Stole to Henry VIII.

There is a red hat with bright green feather, of Henry VIII, with a pair of embroidered slippers without heels, of Anne Boleyn, of which we give the story. Nicholas Bristowe, a favorite courtier of Henry's, was riding with him and the Queen, in Hertfordshire. Passing Ayot St. Lawrence he greatly admired the place, wondering whose it was. The King said "It is mine, but now shall be yours." Bristowe asking what evidence he was to produce of the gift, the King gave him the hat he was wearing and asked the Queen for her slippers, saying, "Bring me these in London, and I will give you the title deeds." The hat and slippers have since always gone with the estate. Near these is Cardinal Wolsey's hat, red felt, with a very wide brim; it looks rather weather-beaten.

We have here two small carvings of Henry VIII, by Holbein, one in bone-stone, considered to be one of the finest portraits of the King, it is full-length, and is in a curious carved frame; the other is in boxwood; Henry wears a watch round his neck. There is also a medallion in wax of this sovereign, lent by Her Majesty, with one of Sir Thomas More and Cardinal Wolsey; all three exceedingly clear and good.

Above a lock of sandy-colored hair is the following: "This Lock of Queen Elizabeth's own Hair was presented to Sir Philip Sidney by Her Majesty's own fair hands, on which he made these verses, and gave them to the Queen on his bended knee, Anno Domini, 1573":

"Her inward worth all outward show transcends,
Envy her merits with Regret Commends;
Like Sparkling Gems her Virtues draw the sight,
And in her Conduct she is always Bright,
When she imparts her thoughts, her words have force
And Sense and Wisdom flow in Sweet Discourse."

Among some wooden chests and cabinets, is an Aragon cabinet of chestnut, in two parts. The interior of the upper part contains a central door of Moorish architectural design and twelve drawers, all arched with spiral columns and plaques of ivory, richly gilt and diapered after the Vargueno-manner. The handles and clamps are of wrought and pierced iron. The ornamentation of the lower half, two drawers and two cupboards, is Gothic, richly gilt; its height is four feet seven inches; width, three feet five inches.

Among the medals is one in bronze commemorating the Restoration of the Roman Catholic religion in England, A. D. 1554; with Pope Julius II, accompanied by Mary, Charles V, Philip II and Cardinal Pole, giving his hand to a kneeling figure personifying England, by Cavino. A silver-gilt medal on the destruction of the Spanish Armada, 1588, has on one side, the Pope, kings, bishops, etc., seated in council; and on the other, the Spanish fleet driven against rocks. Another has the bust of the Queen and on the reverse, the sun shining on the ark on waves. This medal was distributed to all who had taken part in the attack on the Armada, and is the first instance of a naval reward medal.

The Exhibition is rich in manuscripts of various kinds, such as papal bulls, royal proclamations, letters, receipts, etc., of which we will merely enumerate a few: A bull of Pope Innocent VIII, confirming the marriage of Henry VII with Elizabeth of York. Letter

with autograph signature from Charles V to an abbot at Metz, directing him to admit a certain man into his convent: one from Campeggio—Papal Legate in the matter of Henry's divorce from Catherine—to Francis II, Duke of Milan; an autograph letter from Katherine of Aragon, in Spanish, to her nephew Charles V, respecting the divorce, complaining of the delay, and asking him to persuade the Pope to give his decision, dated Buxton, 8 February, 1584; and one from Henry VIII to Grace, Lady Bedingfield, concerning the burial of Catherine of Aragon, spoken of in the letter as "widow and douagier of the right excellent prince, our derest and naturall brother Prince Arthur," dated at Greenwich, 10 January, 1536, with the King's signature. In a letter from Queen Elizabeth with autograph signature, she calls on Sir Henry Bedingfield to supply "one fable man" to go to Newcastle.

All the signatures of the period appear to be written with a very fine-pointed pen, and are a mixture of Roman and Italian characters.

There is a melancholy letter from Sir Walter Raleigh—from the Tower—to Sir Walter Cope, in which he begs, that, on account of his great poverty, his wife might "agayne be made a prisoner with me as she hath bine for six years last past." "A miserable sute it is, and yet great to me, who, in this wretched estate, can hope for no other thing than peaceable sorrow." The letter concludes: "Sir, the matter is of no great importance (though a cruell destinie hath made it so to me) to desire that my wife may live with mee in this unsavory place. If, by your mediation I may detain it, I will acknowledge in the highest degree of thankfulness, and rest redy in trew fayth to be commanded by you—W. Raleigh." Dated 15 October—no year.

A sumptuary proclamation—1517—determines the number of dishes allowed at the dinner of the various grades of men, from cardinals, archbishops, dukes, downwards; disobedience being threatened with punishment at the King's pleasure to the "example of other that shal enterpresse any suche folyous and sensual appetites hereafter." It was to take effect from the last day of May—the IX yere of the raygne of the King nowe our soueraygne lorde Henry the VIII.

There is also a sumptuary proclamation by Queen Elizabeth, controlling women's apparel. "Do as I say and not as I do," might very well have headed both these amusing documents. The woodcut and advertisement of a royal lottery, "all prices and no blankes," is quaint in its way. There were to be "four hundredth thousand and no moe lots"; the first prize was £5,000; the second, £3,500. The profits were to be devoted to the repair of the havens, etc.; and the lots were to be read by the Lord Mayor, on Lady-day, 1568.

There is just one warrant from Lady Jane Grey—about some tents—dated "July 19, I Jane (1553)" with the signature "Jane the Quene."

We close our brief survey of this deeply interesting exhibition, with a few remarks on what is by no means the least glorious portion of it, viz., that set apart to printed books. "At the accession of Henry VIII there seem to have been only four printers in England; before his death there were forty-five; of these, thirty-three appeared in the last twenty years of his reign, i. e., during the time when he was gradually seceding from Rome and had begun to relax, in his arbitrary and vacillating way, the restrictions by which literary communication was fettered. The fourteen of the forty-five surviving when Edward VI ascended to the throne, were increased to fifty-seven during his short reign, and of these more than a half took part in the printing or publication of the Scriptures."

Beginning with these, as in duty bound, we may remark that, with the exception of one, lent by the Archbishop of Canterbury, and another by Sir Charles Dilke, all the seventeen copies of the Bible, in whole or in part, are lent by Earl Spenser; besides several prayer-books and missals.

In Tynedale's second edition of the Pentateuch, Numbers is in black-letter, the rest being in Roman type. Each book of the first edition was printed, for the sake of safety, at a different town, the second edition being these five books collected into one volume, which was said to have been printed at "Malborow, in the land of Hesse" as it was dangerous to give the real town. Its date is 1530. Next to this is the first edition of "Miles Coverdale's" Bible, the first complete bible printed in English, (partly in Paris and partly in London). It was published in 1537 with a dedication to the King and Queen; from this version are taken the Psalms still used in the Book of Common Prayer. And now editions follow each other fast. We have the fourth of Tynedale's New Testament, the Bible called "Matthew's" Bible, a fictitious name, as it was really edited by John Rogers, the first Protestant burnt in Mary's reign—these like all that followed, being revisions or copies in part of Tynedale's and Coverdale's. The "Great" Bible, is so called from its size, also "Cranmer's," as he revised and promoted the edition and wrote a Prologue. The New Testament here seen, and printed at Geneva, in 1557—but not the "Geneva Version" which first appeared in 1560—is interesting for the innovation of division into verses, and that of putting italics where the word does not appear in the original. It was a revision by Whittingham, afterwards Dean of Durham, and has a preface by Calvin; the "Geneva" Bible, known also as the "Breeches" Bible, was a very popular edition, being used in private long after the "Bishop's" was authorized to be read in churches. The latter edition was the work of more than twelve bishops, each of whom affixed his initials to the books he translated.

The "Rheims" New Testament and the "Douay" Bible were translations for the use of English Catholics. Besides all these we have here the first edition of the authorized version, by James I; and the first edition of the "Irish" Bible, for which "Elizabeth gave the presses and types in the hope that some one would be raised up to undertake the translation." This was done by William O'Donnell, Protestant Archbishop of Tuam, and it was published in the beginning of the reign of James I. The list closes with a translation of the "Four Evangelists" into old Saxon, collected from "Ancient Monuments" and a book entitled "Here Begynneth the Pystles and Gospels, of every Sunday and Holy Day in the yere." Printed at Paris, 1538.

Perhaps nothing shows the oscillations in the doctrines of the church as by law established in England, so much as the different books of Prayers appointed to be read in churches.

There is a specimen of each exhibited, from the "Missal of Salisbury, unreformed and reformed," down to the "Exhortation unto Prayer thoughte mete by the Kynges maiestie and his clergie to be redde to the people in every churche afore processions," and the various Service-books of Edward VI; the list being completed by the Prayer-book of Queen Elizabeth, 1559; the copy of which here, has the signatures of the Lords of the Council, authorizing the price at which it should be sold.

We trust our readers will not fancy they are being inveigled into a dissertation on the forms of religion in Tudor times, since nothing is further from our purpose, still "as among the works couched in the living tongue the most important by far were those devoted to theology," they ought not, in fairness to themselves and the Exhibition, to be omitted. We notice, then, Henry VIII's "Defence of the Seven Sacraments." Copies of it were sent at once to the Pope and cardinals, besides some to be distributed among various princes and universities. The present copy has on the fly-leaf the words, "Regi Dacie," and was probably given to the King of Denmark: it was printed in London, 1521, on vellum, and is beautifully illuminated in gold and colors. "The Obedience of Christian Man, and how Christen Rulers ought to Gouverne, 1528, printed by Hans Luft, Malborow in the Lande of Hesse" (like the copy of the Pentateuch), is the largest and most important of Tynedale's works, and is interesting besides, as being the book, of which a copy was given by Anne Boleyn to Henry. He read it with great interest, but in 1530, in a proclamation, it is mentioned among the "bokes of heresie worthy to be dampned and set in perpetual oblivion," that had recently been printed beyond seas. "The Apology of Sir Thomas More, Knight, made by him Anno 1533," after he resigned the Chancellorship of England, is the last of a controversial series between him and Tynedale. "The Institution of a Christen Man containing the Exposition of the Commune Crede," etc., was set forth by the bishops and clergy, but was superseded in a short time by "Necessary Doctrine, etc.," set forth in the King's name.

Besides these, we have Martin Luther's "Chief Articles of the Chrysten Faythe," etc., and "Fruitfull Sermons," by Hugh Latimer, Bishop of Worcester, printed thirty years after his martyrdom.

There is not much that calls for notice in the historical section, except the life and voyages of Sir Francis Drake, and Sir Walter Raleigh's "Discoverie of the large, rich and beautiful Empire of Guiana, etc." Performed in the yeare 1595, by Sir W. Raleigh, Knight, etc."

Among the Belles Lettres the earliest work is Virgil's "Æneid," translated and printed by Caxton, having been revised by John Skelton. It is dedicated "unto the hye born my to comynge naturell souerayn lord Arthur, by the grace of God, Prince of Wales," London, 1490.

A hundred years separate this from the next work exhibited, viz., the first edition of Sir Philip Sidney's "Sonnets," followed by the Countess of Pembroke's "Arcadia," written by Sydney for the amusement of her, of whom, long after, Ben Jonson wrote as:

"The subject of all verse
Sydney's sister, Pembroke's mother."

Of the works of Shake-Speare—as the name is spelt on one title-page—we have here his "Sonnets," printed 1609; the second quarto of "A Midsommer's Night's Dreame," 1600; "King Lear," 1608; and three copies of his plays: one of these—printed 1632—has on the fly-leaf a note signed by Dr. Johnson, to the effect that it was given him by a bookseller, named Osbourn.

Of Spenser's works, we see the epithalamium on his own marriage, printed 1595; the first complete folio edition of his "Fairie Queene," 1609; and "The Shepheard's Calender," containing twelve æglogues proportionable to the twelve months."

This, his earliest work, was written at Sir Philip Sydney's house at Penshurst, in 1579. Leaving these poems, the glory of our English tongue, we find in another case, Garrick's copy of Ben Jonson's works, 1616, and "Hero and Leander," begun by Christopher Marlowe and finished by George Chapman."

Science is represented by a French grammar written by an English graduate of Paris, who was French tutor to Mary Tudor before she became the wife of Louis XII of France; some anatomical plates—believed to be the first copperplate engravings executed in England; also by thirty-five maps of English and Welsh counties, 11½ x 16½ inches; and "The Mariners' Mirrour, a chart of the seas with soundings, etc., of the greatest part of Europe. Herein also may be understood the exploits lately atchieved by Sir Francis Drake." Printed at London, 1588.

THE DANGERS OF ELECTRIC-LIGHTING.¹—I.



From the Facade of Notre Dame, Paris.

show what are the "dangers of electric-lighting," whether a high tension or a low tension system is used.

In the first place it is of primary importance to understand that, when dealing with an electric-current, two things require immediate attention; first of all, the "tension" or "pressure" of the current; and secondly, the "quantity," and to understand fully the meaning of the terms pressure and quantity, take water by way of illustration. With water no one has any difficulty in understanding that, with a pipe of a given size, and with water flowing through it from a cistern placed 20 feet above it, a certain quantity of water would flow through the pipe in a minute; but if the cistern were then placed 40 feet above the pipe, a considerably larger quantity of water would flow through the same pipe in a minute, this result being brought about by the extra pressure due to the water falling through 40 feet in lieu of 20 feet. Tension or pressure of an electric-current, technically called "volts," may be taken as similar to water-pressure. Now, with regard to quantity, here again a pipe of a certain size will, at a given pressure, allow a certain quantity of water to flow through it in a given time, and if the water-pressure be doubled, about twice the quantity of water will flow through it in the minute. So again with the electric-current, if a conductor, or bar, or tube of copper of a given size be taken, the quantity of current which will pass along it varies with the pressure, that is to say, that if the current is sent into the conductor with a pressure we will call one, a given quantity of current passes along the conductor in a minute, and if we have a pressure of twice one, or two, twice the quantity of current will pass along the conductor in the minute. Quantity is technically called "ampères."

We will now pass to another matter; we must consider what work—or useful energy—can be got out of a current. This is arrived at by multiplying the pressure and the quantity together, and the result is called "watts," and watts, therefore, represent the actual work—or energy—any given current will give. Now let us explain clearly what this means: A horse-power is a power capable of raising a weight of 33,000 pounds 1 foot high in a minute, and to perform this work 746 watts are required, that is to say, the pressure of an electric-current multiplied by the quantity must give the answer 746 to make the electric-power equal one horse-power; thus a current with a pressure 1 (1 volt) and with a quantity 746 (746 ampères) will equal one horse-power, or a current with a pressure 2 (2 volts) and with a quantity 373 (373 ampères) will also give one horse-power, as $2 \times 373 = 746$; or again, if we have a pressure of 746 (746 volts), and a quantity of 1 (1 ampère), the two multiplied together still give 746, and thus we should still have a power equal to one horse.

Now, it will be remembered that when dealing with water passing through a pipe, the quantity passed in a minute was about doubled if the pressure was doubled, therefore if you wish the pipe only to deliver a certain quantity of water in a minute or to do a certain work, the size will be reduced, if your pressure is increased. So with electricity, if you increase your pressure you decrease the size of your conductor, as the quantity of electricity always passing will be less, to do certain work.

To make ourselves clear, let us give an illustration: The pressure at which electricity is used ordinarily for lighting incandescent lamps is 100 (100 volts), and the quantity of current a 10 candle-power lamp consumes is .35 (about $\frac{1}{3}$ of an ampère), therefore, to light 5,000 of such lamps a current is required at the constant pressure of 100 (100 volts) and the quantity that would be required is $5,000 \times .35$ or 1,750 ampères, the energy consumed in watts being equal to the pressure (100 volts) multiplied by the quantity 1,750 ampères, the result is 175,000 watts.

Thus to light 5,000 lamps, the current being sent out from the central station at a pressure of 100 volts, a conductor would have to be provided which would carry in quantity 1,750 ampères; thus the pressure $100 \times$ by the quantity of 1,750 gives 175,000 watts, the power required to do the work. Now, if the current were being sent out from the central station at a pressure of 10,000 volts, a conductor would have to be provided which would carry in quantity 17.5 ampères only, thus, again, the pressure $10,000 \times$ by the quantity 17.5 would again give 175,000 watts, the power required to do

¹ By S. Z. de Ferranti and Francis Ince, in *Engineering*.

the work, and the size of the conductors required, therefore, in the two cases to do the same work would be in the proportion of 1,750 to 17.5, that is to say, that with a pressure of 10,000 volts the size of the copper conductor would be about one-hundredth of the size required if dealing with a 100-volt current only.

It is now only necessary for us to point out one other scientific fact, and we shall then be in a position to clearly consider "the dangers of electric-lighting." That fact is that for heating purposes the quantity of the current only has to be considered, and not the voltage or pressure, as it is the passing of too great a quantity through a conductor that causes it to heat, and ultimately to melt, irrespective of the voltage or pressure, which has nothing whatever to do with the heating. A pipe, if too much water for its strength was being forced through it, would burst; the electrical conductor with too much quantity through it heats and ultimately melts. Thus, if a conductor is put underground of a size sufficient to carry current for 5,000 lamps only, and we turn on 10,000 lamps, the conductor will heat; and if we go on turning on more and more lamps, the conductor will ultimately melt at the weakest point, when the continuity of the conductor will be broken, no more current will be passed, the lights go out, and no further danger exists. Now, besides giving a conductor too much work by putting on too many lights, there is a second way in which an underground conductor may be made to do too much work, and so to heat or melt; that is to say, if the conductor is so constructed that it can, and is so placed in the ground that it may, and it does come into contact with another conductor, such as a telephone or telegraph wire, a gas or water pipe, the current will leak into and through such other conductor, and will find a short way back to the central station from whence it came, in preference to going through the lamps or doing other work, the resistance in going back through the earth by the short cut being less than the resistance of the work to be done. Just in the same way, if a pipe bursts, the water will spout out at the burst point in every direction, as the resistance is less at that point to the water than the resistance in the further length of pipe, if the water were to proceed to do its work. Again, as before pointed out, the pipe bursts under the pressure, but the main at the point of contact with another main or wire, where the rush of current takes place, heats, and finally melts, setting fire to or melting anything in its neighborhood. Here is the danger of fire. Now let us see how this danger is got over in this country. As before pointed out, if too many lights are put on any main or conductor, the main heats and finally melts at the weakest point; and in the second case, where the conductor comes across another conductor, as above pointed out, there is an enormous rush of current through the conductor, it heats and ultimately melts at the point of contact. Now, how is this danger to be entirely got rid of? This question is, in fact, answered by the above statement, which must be clear to any one, that when too many lights are turned on, the conductor heats and melts at the weakest point.

What have we to do then? We place at our central station, close to the dynamo which generates the current, the weakest point in every main or conductor that leaves the station; this weakest point is a short bridge of copper so slight and of a so carefully calculated capacity that if a conductor is of such a size that it should be used for lighting 5,000 lights only, if 6,000 lights are turned on, the rush of current is too great for the bridge, and it melts or fuses (hence the bridge is technically called a fuse), and that main or conductor is cut out long before any part of it even becomes warm; but you say, What occurs if it is not too many lights that are turned on, but is a contact, as suggested, with another conductor or a gas-pipe? Consider for a moment what happens at the point of contact; there is a too great rush of current to that point, and the result, therefore, is the same as turning on too many lights; if there is a too great rush of current from any cause it must all pass over the bridge into the conductor, and the bridge cares not for the reason that causes the great flow, but the great flow instantly causes the bridge to fuse, and with a conductor so arranged accident by fire is an impossibility. Mr. Edison has said, in a recent article by his pen on the same subject as that on which we are writing, that "near the corner of William and Wall Streets, New York, the underground conductors of the Edison Illuminating Company became crossed (by which he means they came in contact), and the current which was passing through them at a pressure of 110 volts melted not only the wires but several feet of iron tubing in which they were incased, and reduced the paving stones within a radius of three feet or four feet to a molten mass." Now, no man knows better than Mr. Edison that the tension of the current in the mains to which he refers had nothing whatever to do with the heating effect of the current; it was the quantity, and the quantity alone, that caused the heat. Now, if this main were lighting 5,000 lamps of 10 candle-power at 110 volts, the quantity of his current would have been, roughly, about 1,700 ampères, and by the contact, this quantity would have been enormously increased, whereas if he had been using a 10,000 volt current his quantity, as we have seen, would have been only 17 ampères about, and the heating power of this current would have been 100 times less; but where was Mr. Edison's bridge or fuse at his central station?

It is clear he could have had none, or it would have melted before any damage could by any possibility have been done; and his statement proves, as the reader will see, not that a higher tension would have been more dangerous (it would have been safer), but that the

work at the station to which he refers must have been done on most incorrect and inefficient principles. Mr. Edison may argue that with increased pressure it is possible to force a greater quantity through a main, and that, therefore, a 10,000 volt pressure is more unsafe than a 100 volt pressure, but this is not the fact, as the conductor to be melted is in size only one-hundredth of the size of his main it will heat and melt sooner, and there is not the same quantity of molten mass to deal with; but the real answer is, that the bridge or fuse at the station, if used, is with either low or high pressure, the real safety, as it will never allow so large a quantity of current to pass over it as is necessary to cause the conductor to heat, no matter whether the pressure be 100 or 10,000 volts. Take again the calorific effect of the low tension system. We have seen that to do the same work, the low tension system requires 1,750 ampères against 17.5 on the high pressure, and thus if an accident does happen on the low tension system the immediate calorific effect of 1,750 ampères is called into play. Now, if on the high tension system such an effect could be reached, our engines would be called on to do an absolute impossibility, as they would be required to give 100 times their nominal power before the quantity and equal heating effect of 1,750 ampères could be reached.

Then comes the further question, How did Mr. Edison's mains become crossed, or rather in contact, with another conductor crossing his mains at right angles apparently at a street crossing? This must have arisen through the negligent way in which the Edison mains were placed underground without sufficient protection. It is idle to suggest that this is a danger that cannot be guarded against. It is easy enough to protect one conductor underground from by any possibility coming in contact with another crossing it, and we should be wasting the reader's time if we were to attempt to describe the thousand and one ways in which this may be done, for many ways will suggest themselves to every reader. But the further question arises, Is it not possible to construct your mains or underground conductors in such a manner that the passing of another main or conductor at an angle above and in contact with it will produce no harmful result whatever? The answer is Yes, distinctly yes.

[To be continued.]

WIND PRESSURE.



DOOR-PULL AT ULM

THE report of the Bidston Observatory for the five years, 1884-8, is mainly composed of meteorological observations from which it appears that the anemographs furnish very questionable data. The velocity of the wind has been computed on the assumption that the motion of the anemograph's cups is equal to one-third that of the air. The anemograph's pressure-plate presents a surface of two superficial feet to the wind. Both these anemographs are about 210 feet above the sea-level.

The investigations conducted by Sir G. Stokes tend to show that the constant for the cups is not 3 but more probably 2.4; and the experiments made by Dines establish the relation between the velocity and the pressure of the wind to be $P = V^2 \times .0035$ though hitherto it has been considered to be $P = V^2 \times .005$.

On January 23, 1884, the pressure of wind recorded at Bidston was 70.2 pounds per square foot, and the velocity 78 miles per hour. Other extraordinary pressures, with accompanying velocities, are as follows:

	lb.	miles.
October 26, 1884.....	40.6	and 64
March 30, 1886.....	41.9	" 62
December 9, 1886.....	40.4	" 60
February 3, 1887.....	40.1	" 66
May 20, 1887.....	65.2	" 78
November 1, 1887.....	40.0	" 57
January 26, 1888.....	49.2	" 74
May 3, 1888.....	44.4	" 66
November 20, 1888.....	49.0	" 71

The five maximum pressures about 40, averaging 40.6, accompany consistently hourly velocities, averaging 64 miles. Now, if the constant for velocity must be reduced from 3 to 2.4, this 64 becomes 51 miles. According to the old formula, the pressure corresponding to 51 miles would be 13, and according to the new formula only 9 pounds, which numbers are in startling contrast to 40.6. Conversely, accepting 40.6 pounds, the velocity by the old formula would be 90, and by the new formula 108, which figures are in startling contrast to 64 miles. Hence, whichever way the data are considered, the results are eminently unsatisfactory. For a pressure of 70 pounds, the corresponding velocity would be 141 miles per hour by the new formula. Only the highest pressures have here been tested, but similar discrepancies prevail all through the series of these anemological statistics. Assuming these maxima pressures to be correct, then the given velocities are greatly in defect; but, as the factor 3 has been employed, which is now considered to be one-fifth too great, the given velocities are just as much too large. Hence

that which is already great should be greater, an absurdity which leads to the inference that the instruments are unreliable. The mean velocity per hour is really given, whereas the absolute velocity, expressed as rate per hour, of the most violent gusts, lasting perhaps only a few seconds, is wanted. It seems too much of a stretch of confidence to accept the pressures as reliable, inasmuch as none so high have been obtained anywhere else. The inference, therefore, must be that the accuracy of the anemographs at Bidston, is extremely doubtful, and it becomes important to make these apparatus the subject of critical investigation. Until this has been efficiently done, no reliance whatever can be put upon their results, which is very much to be regretted, as the data extend over a long series of years, and if reliable, or could be made so, would be of the utmost scientific value. — *Engineering.*

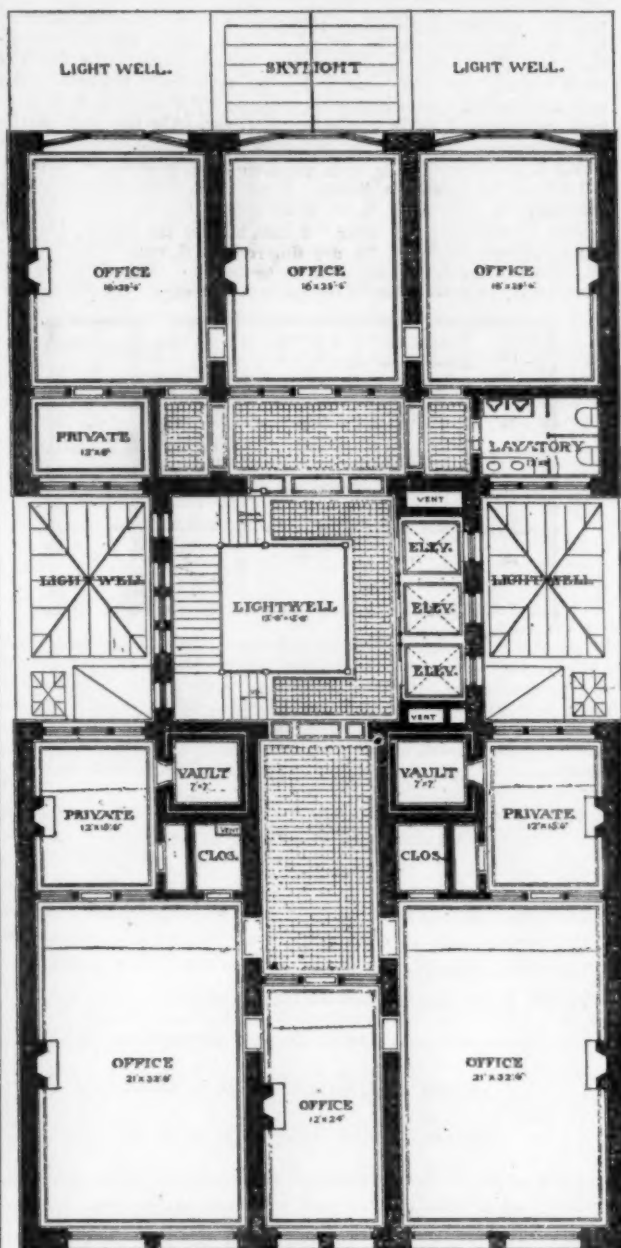
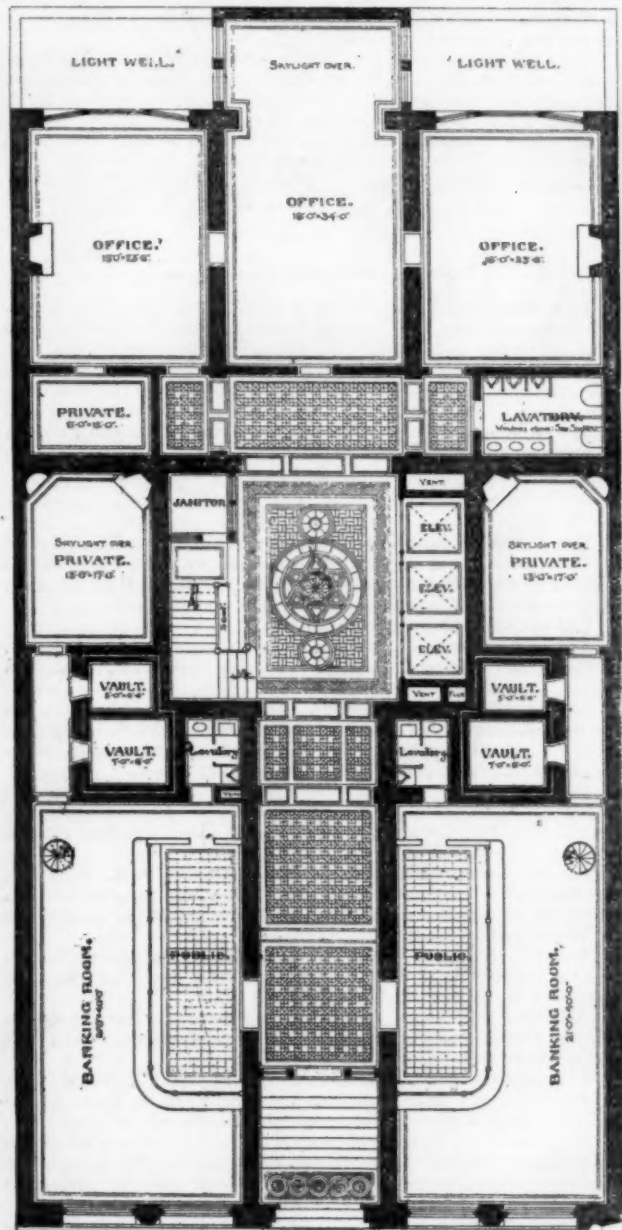
ILLUSTRATIONS

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

HOUSE OF CHARLES HEAD, ESQ., BEACON ST., BOSTON, MASS.
MESSRS. SHAW & HUNNEWELL, ARCHITECTS, BOSTON, MASS.

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

THE J. J. VANDERGRIFT BUILDING, PITTSBURGH, PA. MESSRS.
LONGFELLOW, ALDEN & HARLOW, ARCHITECTS, BOSTON, MASS.



DESIGN FOR PRESBYTERIAN CHURCH, EAST MINNEAPOLIS, MINN.
MR. L. S. BUFFINGTON, ARCHITECT, MINNEAPOLIS, MINN.

DOORWAY FOR JOHN DWIGHT, ESQ., MT. MORRIS PARK, NEW YORK, N. Y. MR. FRANK HILL SMITH, ARCHITECT, BOSTON, MASS.

DESIGN FOR AN ENTRANCE TO A WORLD'S FAIR. BY MR. W. PELL PULIS.

SKETCH FOR A COUNTRY CHURCH. MESSRS. BALL & DABNEY, ARCHITECTS, BOSTON, MASS.

SIDEBOARD DESIGNED BY MR. JAMES THOMSON, BOSTON, MASS.

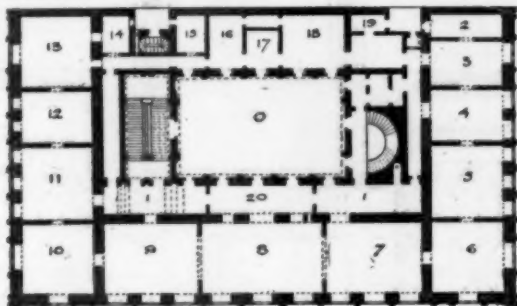
[Additional Illustrations in the International Edition.]

THE GAS COMPANY'S OFFICE IN VIENNA — FORMERLY THE PALACE EPSTEIN. BARON DR. THEOPHIL HANSEN, ARCHITECT.

[Gelatin Print.]

THE admirable interior arrangement of this building which has a frontage on three streets may be seen by referring to the accompanying plan of the first story. In the basement is stall-room for six horses besides storage for fodder; an ice-room; large cellar-rooms;

and the apparatus for heating the reception-room, ball-room, banquet-hall, winter-garden and the grand staircase hall. On the ground-floor are offices, carriage-houses and harness-rooms. In the first story are the dwelling-rooms which are artistically finished. Renaissance ceilings in stucco with frescoes by Bitterlich & Gripenkerl, richly-gilded walls, costly tapestry, etc. On the wall of the dining-room are landscapes by Hoffman. In the plan O is the courtyard; 1, entrance-hall; 2, room for a tutor or mentor; 3, room for the son of the house; 4, library; 5, study; 6, dining-room; 7, banquet-hall; 8, ball-room; 9, reception-room; 10, boudoir; 11, bedroom; 12, nursery; 13, room for daughter of the house; 14, governess's room; 15, bath; 16, dressing-room; 17, room for governess; 18, kitchen; 19, store-room; 20, winter-garden. The whole of the second story is intended to be rented to one family. The third story



is arranged for three separate tenants. This necessitates two separate staircases: one for the first story which is a straight flight richly ornamented with marble and sculpture, and a half-round flight for the two stories above. A third flight connects all the floors with the courtyard. The foregoing description, of course, refers to arrangement as originally planned. Since the building has been used for its present purpose many changes have been made.

PORTE COCHERE OF THE HOTEL OF MME. LA COMTESSE DE LAS CASES, RUE VANNEAU, PARIS.

[Gelatine Print.]

DESIGN FOR THE ENTRANCE TO A WORLD'S FAIR, SUBMITTED IN THE THIRD ANNUAL COMPETITION OF THE NEW YORK ARCHITECTURAL LEAGUE, BY MR. JULIUS HARDER, NEW YORK, N. Y.

To this design was awarded the Gold Medal.

CHATEAU DE LA FERRE-EN-TARDENOIS, FRANCE.

SKETCH FROM DIJON. BY D. J. BLOW.

ARCADING, BEAUVAIS. BY D. J. BLOW.

CHURCH OF ST. JOHN THE BAPTIST, LOWER CAVERSHAM, READING, ENG. MR. F. PRIOLEAU WARREN, ARCHITECT.

On February 8, views of the exterior of this new church, with a description, were published.

BEDDINGTON NATIONAL SCHOOLS, BEDDINGTON, ENG. MR. EDWARD CRUTCHLOE, ARCHITECT, LONDON, ENG.

This view shows an addition to the Church National Schools at Beddington, Surrey, which was carried out in the latter end of 1888. It consists of a large room 40 feet long, 22 feet wide and 14 feet up to wall-plate, with an open roof above, with two lobby entrances at the end. It is built with hollow walls in stock-bricks, with red brick dressings, and covered with Bangor slates. The room is warmed by a large open fireplace, with hot-air chamber at the back and sides, communicating with the room by regulating gratings, and ventilated by upright funnels leading in fresh air from outside the building, and by the upper portion of each window being made to open, and a funnel from the ceiling surmounted by one of Boyle's ventilators. The cost of the building, including a large block of latrines in the rear and some repairs to the old schools, amounted to £670.

WALLINGTON SUNDAY-SCHOOL, CARSHALTON, ENG. MR. EDWARD CRUTCHLOE, ARCHITECT, LONDON, ENG.

This school was built last year at a cost of £700, and consists of one large room 50 feet long, 27 feet wide and 21 feet high to the ceiling; an entrance-porch in front and two class-rooms in the rear. It is built of stock-bricks, hollow walls, with red brick buttresses opposite the roof principals. The gable windows, copings and buttress-weatherings are in Bath stone. The roof is covered with slates, arranged in bands of different colors, and the warming, ventilating and lighting is upon the same principle as the addition to the Beddington Schools.



THE NEW YORK CHAPTER OF THE AMERICAN INSTITUTE OF ARCHITECTS.

THE New York Chapter of the American Institute of Architects beg leave respectfully to protest against the measure embodied in Assembly Bill, No. 853, entitled "An Act fixing the salary of the Commissioner of the Capitol," for the following reasons:

1. The result of this bill would be to throw the design and construction of all State buildings into the hands of one man, selected, as a rule, for reasons other than the highest aesthetic and constructional ability.
2. The people of this State have a right to be properly represented in their buildings, which are the monuments by which they themselves are judged; and they cannot be so represented by any single person, whether selected mainly for political or any other reasons.
3. This bill deprives the people of the State of the services of the best members of the architectural profession, and provides an insufficient substitute.
4. The bill deprives the architects of the State of the natural rewards of eminence in their profession.
5. The bill would repeat in this State the evils surrounding the constitution of the office of the Supervising Architect of the Treasury in Washington, as admitted in official report for 1875, pp. 14 and 15.
6. The bill would create a centre for the distribution of patronage with all its attendant evils, to some of which the attention of the people has lately been directed.
7. The scheme of an official architect is more expensive to the taxpayers than if the State engaged the services of the best architects at the usual rates of compensation.

We respectfully submit that the appointment of an Architectural Commission or Advisory Board, consisting of three architects and two officials of the State would better serve to secure the best architectural results—the Commission to exercise in general all the functions of a building committee, where work is being done for a private corporation; and to be remunerated for their services.

Respectfully submitted, EMMEN T. LITTELL, *President*.
A. J. BLOOR, *Secretary*.

BOSTON ARCHITECTURAL CLUB.

THE committees for the coming Annual Exhibition of the Boston Architectural Club, met Tuesday evening at the Parker House to compare notes and perfect the plans. The prospects are very encouraging, so that there is every reason to hope for a large and very interesting collection of drawings. Readers of the *American Architect and Building News*, will please bear in mind that all contributions should be delivered at the Club, No. 6 Hamilton Place, as speedily as possible, and not later than May 1.

R. CLIPSTON STURGIS, *Secretary*.

THE Boston Architectural Club proposes to hold an Exhibition of Architectural Work, in Horticultural Hall, for three weeks beginning May 12, 1890, and contributions are requested from all those who are interested in art and architecture.

The exhibits will be grouped as follows:

Section I. Sketches. Including work in this country and abroad, sketches of historical buildings, details, decoration, etc., also measured drawings of old work.

Section II. Architectural designs. Drawings of buildings designed by the exhibitor, either projected, in process of construction, or completed, including perspectives, working-drawings, studies, scale-drawings, interiors, and details.

Section III. Photographs of executed work. It is requested that a sketch-plan should accompany the photographs of each building.

Section IV. Interior work. Designs for furniture, decorations, carvings, ornaments, etc.

Section V. Special exhibits illustrative of the allied arts. Including examples of stained-glass, decoration, artistic ironwork, gas-fixtures, furniture, carvings, etc. The articles illustrated in this section are to be selected by the club.

Section VI. Students' work. Including the work of the students in the leading schools of architecture and design, and the work of the classes of the Boston Architectural Club.

Section VII. Works of the Rotch Scholarship. Envois of Mr. Harry Bacon, competition drawings for the present year, and selections from previous work.

Drawings must be delivered at the Club Rooms, 6 Hamilton Place, express paid, not later than May 1. There are no limits to the number of drawings from each exhibitor which will be considered. It is desired that all contributions be either framed, or mounted on stretchers or cardboard. Each drawing should bear the name of the designer and the draughtsman. All work will be subject to the approval of the Committee on Reception and Awards.

A full exhibition of the best English, French, Italian, German,

and Spanish work is expected, and it is hoped that every city in the United States may likewise be fully represented.

By order of the Executive Committee,

R. CLIPSTON STURGIS, Secretary.



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

SLOW-BURNING CONSTRUCTION.

VICTORIA, B. C.

TO THE EDITORS OF THE AMERICAN ARCHITECT:

Dear Sirs,—Having read in the columns of the *American Architect* the discussions on slow-burning construction in connection with the recent Boston fire, with your permission I will give you my experience on the subject.

My first experiment in October, 1878, was on a small building 6' x 6', with ceiling 7' high. The walls, ceiling and floors were constructed of three thicknesses of 1" x 12" boards (green), the joints lapped to centres in each course; the walls lathed on both sides with dovetailed lath, so that the mortar keys lay against the boards; the inner and outer faces of walls plastered with mortar composed of four parts of sand to one of lime, laid on three-eighths-inch thick. When the mortar was fairly dry, the structure was filled one-third full with dry fir wood, a hole 18" square cut in one of the walls, and one 6" square in ceiling. The wood inside was then fired. In twenty-five minutes from starting the fire the steam began to force the plaster off the outer faces of the walls; in thirty minutes the plaster began to fall from the inner faces of the walls; in forty minutes hot, dry smoke began to come through the joints of the boards on the outer face of the walls; in forty-five minutes the blaze began to come through the joints, and in fifty-three minutes the structure fell, the walls and ceiling almost wholly destroyed, the floor being but slightly damaged. I then built another structure of the same dimensions of 3" x 12" plank (green), the joints worked to close fit and splined; the walls and ceiling lathed and plastered as in first structure; the firing done in same manner, and with the same sort and amount of wood. In twenty-eight minutes the steam forced the mortar off the outer face of walls at nearly all the joints; in forty minutes the blaze was coming through all the joints freely, and in a little less than fifty minutes the structure was burned and separated in the joints to such an extent that it fell, although the planks, on their inner faces, were not charred more than an inch in depth. I then built another structure of the same dimensions with well-seasoned lumber, one-half the structure being of 1" x 12" boards, and one-half of 3" x 12" plank, with splined joints; construction and plaster same as in former cases, the plaster being thoroughly dried before firing. The fuel used was of the same sort and amount as formerly. In this case, there being little or no steam to force the mortar off, no ruptures occurred in the face of the walls for forty minutes from the time of starting the fire when the mortar began to crack and give at the spline joints. In fifty minutes smoke, and, in some cases, flame, was seen coming through nearly all spline joints. Up to this time the outer face of walls on the boarded portion of the structure was almost intact, although burned deep on the inside. In sixty minutes the plank portion began to fall, but the board portion of the building stood until burned to a shell, and then with but little damage to the mortar on outer face of wall.

From these experiments, I concluded, first, that lath, when applied to the face of walls, is expensive; that it becomes charred when exposed to a hot fire, falls off, taking the mortar with it, and exposing the wall to the direct action of the fire. Second, that thick, wide planks with spline joints, although well-seasoned before use, will shrink so much when exposed to a hot fire that the joints will open so as to give a strong draught to the fire, and thus hasten the work of destruction.

The next experiment was on a structure of the same dimensions as formerly: built of 2" x 4" scantling, with semi-dovetail grooves and tongues worked on their edges, which served the purposes of lath. These grooves were upwards of three-eighths of an inch deep, thus reducing the width of the scantling to about 3". The scantling in the walls were laid one upon the other, and spiked at intervals of 18" to 20". In floor and ceiling the scantling were set on edge and spiked as above. The firing was the same as in former cases. In this instance the fire burned out in an hour and fifteen minutes, but did not penetrate to the outside of the structure, except through the vent-holes, that in the ceiling being burned from a diameter of six inches to three feet.

The plastering on outside of walls remained intact. The walls were charred and burned from 1½" to 2" deep. The great fire-resisting qualities of this structure were attributed to the large number of joints in a given space none of which from shrinkage opened sufficiently to produce a draught or permit the flames to penetrate to the outer walls as in the case of wide planks with

splined joints. As the mortar key in this system of construction was not suitable for setting the scantling in a vertical position, considerable settlement would no doubt take place where the scantling were laid upon each other in partitions, etc., and fermentation or dry-rot to some extent was apprehended.

In order to obviate the drawbacks above enumerated and to produce economically the necessary building material, I proceeded to perfect the required wood-working machinery. The material can be manufactured from rough scantling ready for building purposes at the rate of sixty running feet per minute. Of this material I constructed a one-room building 10' x 11' inside; ceiling 10' high; walls of 2" x 4" scantling set vertically.

The floor, ceiling and roof were formed of 2" x 3" scantling set on edge; door 2' 6" x 6' 6"; windows in opposite side 2' 4" x 2' 8"; scantling spiked together at intervals of 18". The interior was plastered with brown mortar about three-eighths of an inch thick. The exterior had a scratch coat of brown mortar, composed of the usual proportions of lime and sand with one-seventh Portland cement added; the finishing coat being two of clean sharp sand to one of Portland cement, laid on about one-fourth-inch thick. Exterior work included a bracketed cornice of fair design, base, pilasters, door and window sills, lintels, etc.

The roof had one coat of concrete three-fourths of an inch thick, composed of clean gravel and Portland cement in proportions of one to five, finished with a coat of equal parts of cement and sand three-eighths of an inch thick, trowelled to a smooth hard surface. The building was fired with three-fourths of a cord of dry fir wood piled and set inside so as to insure good draught. The fire burned fiercely and spent itself in fifty-five minutes. On examining the interior after the fire it was found that most of the plaster had fallen and the walls and roof were considerably charred. The outer faces of walls and roof were not in the least damaged and the building without any repairs has ever since been used as an office by a house and sign painter. Buildings erected on the principles laid down have proved in every respect satisfactory while costing from two and one-half to five per cent less than the ordinary frame building covered with sheathing and weather-boarding or rustic. Critically inclined people predicted in respect to these buildings great shrinkage of timbers and cracking of plaster, but such predictions have not been in any measure verified.

The following are some of the many lessons I have learned as an eyewitness of burning buildings:

That where timbers cross each other and there is not sufficient weight to hold them to a firm bearing, the fire works into the joint and destroys them more readily than where the timbers lie side by side and are spiked or bolted together.

That where wooden beams rest on wooden posts fire does not work into the joint so readily as where the post rests on the beam.

That light ironwork in connection with wood work hastens the destruction of the latter, but where the ironwork is of sufficient body to absorb heat for a considerable time it retards the progress of the fire.

That wooden beams, usually termed bressummers, where they rest on brick piers and support the fronts of buildings remain in position and serve their purpose under conditions which would destroy cast and wrought iron beams of same strength.

That laminated timbers of given sectional area where their joints are bedded in mortar resist fire longer than solid timbers of the same total area.

SAMUEL C. BURRIS.

BOOKS.

NEW YORK, N. Y.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—If not too much trouble could you kindly let me know in which number of your paper you gave a list of the most important and necessary architectural books.

Yours truly, M. R. KRESS.

[In our issue for July 30, 1887. — EDS. AMERICAN ARCHITECT.]

TO CALCULATE THE STRAINS IN A HIP-RAFTER.

NEW YORK, N. Y., April 2, 1890.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—Can you inform me through the medium of your paper, where I can find explained, a method of calculating the stresses in a hip-rafter? By doing so you would oblige,

Yours truly, ROBERT D. KOHN.

[Kidder's "Pocket-book," Greene's "Graphics," or any other book treating of graphical statics, will give the principles needed for deducing the strains in a hip-rafter. — EDS. AMERICAN ARCHITECT.]

A COLUMN CAPITAL FOUND AT SALAMIS.—At Salamis, in Cyprus, a big capital of a marble column has been unearthed, bearing a winged bull emerging as far as neck and wings. The latter form part of the architectural motive of the capital. Another side presents a caryatid passing at the waist into a floral ornament. These decorations are supposed to have been repeated on the two remaining sides.—*New York Times*.

NOTES AND CLIPPINGS

DISCOVERIES NEAR PODGORITZA.—It is reported from Cetinje that the excavations near Podgoritza, organized by Prince Nicholas in order to give employment to destitute laborers, have already brought to light the remains of the Basilica and the city walls of Dioclea, the birth-place of Diocletian. Many important and interesting inscriptions have also been disclosed. — *New York Evening Post.*

AN OLD NEW MEXICAN IDOL.—An elliptical-shaped gray stone, probably two feet in length and about six inches in diameter, was received at the White House recently, accompanied by a letter from Governor Prince, of New Mexico. He stated that the stone was of the idol age, anterior to the arrival of the Spaniards in the Western continent, and it was known to be over three hundred years old. Among the Pueblo Indians the stone was venerated as a household god. — *Invention.*

THE PANAMA CANAL.—The *Revue Industrielle*, in discussing the Panama Canal fiasco, states that but little more than one-fourth of the work to be done, if the canal is to be completed with locks, has as yet been accomplished. The excavation still remaining amounts to upwards of 52,000,000 cubic yards, and in addition to this nothing has yet been done in connection with the regulation of the Chagres River. The work as it now stands has cost 60,000,000, which expenditure the *Revue* holds is difficult to justify and attributes mainly to the wastefulness of the contractors and the inefficient superintendence of the engineers in charge of the work. — *Engineering.*

ASTONISHING FORCE OF SEA WAVES.—Some idea of the power exerted by sea waves may be formed from the following facts: An iron column, twenty-three feet long and weighing 6,000 pounds—part of a light-house being built—was, in course of operation, landed at Bishop Rock, England, and, a storm coming up, was left lashed by a chain at each end to two strong eye-bolts. Three days after, when the storm had abated, it was found that the great column had been moved a distance of twenty feet and landed on top of a projecting rock. A blacksmith's anvil, weighing nearly 200 pounds, and sunk in a pit three and one-half feet deep, had been washed entirely out of the sink and landed near the column of iron above mentioned. It had been floated nearly 200 feet after being lifted out of the hole. — *New York Commercial Advertiser.*

INDUSTRIAL EXHIBITION AT STOCKHOLM DURING 1892.—An industrial exhibition will be held at the Swedish capital during 1892, a remarkably well-positioned site in the proximity of the town having been fixed upon. A committee has been considering the financial question of the matter, and arrived at the result that the expenses would be likely to exceed the profits with 1,200,000 kr. This deficiency is proposed to be covered by a grant from the State of 400,000 kr. (half to be taken from the Industrial Manufacture Fund), by a grant of 300,000 kr. from the city of Stockholm, and the balance of 500,000 kr. it is proposed to raise through a lottery. Stockholm is a beautiful town, and the Swedish manufacturers are sure to exert themselves, so the exhibition should become one of some interest even in these days of excessive exhibitions. — *Engineering.*

IRON IN ROMAN MASONRY.—In old Roman masonry work, says *Engineering News*, the several blocks of stone were united by strong iron clamps, which effectually prevented the formation of cracks. To avoid corrosion of these clamps they were thickly coated with lead, which seems to have proved an excellent protection. Recent excavations near Moirans, France, which laid bare the remains of some Roman water conduits, are said to show this in a striking manner. Several large square blocks of dressed stone, weighing in the neighborhood of a hundredweight each, which were there found, were united by such lead-covered clamps, which had become so firmly imbedded that the blocks could be separated only by blasting. The iron, even after the lapse of eighteen centuries, is said to have been in a good state of preservation.

ANCIENT FURNITURE IN AMERICA.—A few years ago agents used to be sent all through the rural parts of New England to pick up superannuated furniture of every kind—such as was found astray in farm-houses, village attics, country hotels and elsewhere, having been handed down from generation to generation in the families of long resident natives. The latter were usually willing enough to part with the treasures, which were only valuable in the eyes of people of æsthetic tastes, and the dealer paid a mere song for the articles, reaping a big profit. But now the supply obtained in this way has been practically exhausted. Now it is the fashion for rich Yankee people to have in their houses one or two apartments in the old colonial style, with floor and walls of dark oak, massive rafters, huge fireplace, mahogany furniture, and an occasional spinning-wheel. There are not nearly enough of these precious relics to go around, so it is a blessing that provision is made for reproducing them indefinitely at comparatively cheap rates. The most approved method of giving a floor or wall a look of old age is to scrub it at intervals with gallons of old ale. This produces a fine effect. Mahogany is generally used for the manufacture of antique pieces of furniture. In its natural state it is no darker than black walnut, and to make it of the proper hue staining must be resorted to. If oak is wanted, it is rubbed with common shoe-blackening, and the usual wax finish put on afterward.

This is warranted to add fifty years to the apparent history of a bureau or desk in one hour. For the inside works of the desk or bureau pine is employed, and this is given the requisite look of antiquity by repeatedly firing a shot-gun loaded with nothing but powder, and plenty of it, into the drawers and around them until the surfaces exposed are sufficiently discolored, and all full of those curious indentations which ordinarily indicate age. Another process is to wash the drawers, etc., with a coarse sponge dipped in powerful acid, which eats wood here and there, and effects the same result. Brass fittings are manufactured in all the ancient designs that were ever used. In order to make them look dull and old, the moulds in which the brass is cast are rubbed and chipped somewhat, and in them a little gunpowder is placed and fired with a match. This occasions a discoloration, which seems to betoken the action of time's gnawing teeth, and the same is warranted to last until the merchandise is sold, though not much longer. A special branch of the work has to do with clocks of the ancient upright pattern, which are copied in every detail from the really old ones. Even the metal faces, with their curious numerals, are imitated, and the works of modern pattern are permitted to lie in a dusty corner and oxidize comfortably while the framework is in process of construction. There is nothing, the makers say, in the line of back-number furniture that cannot be reproduced at a few days' notice from brand-new materials, and yet so like the old that no ordinary person could possibly tell the difference. — *Building World.*

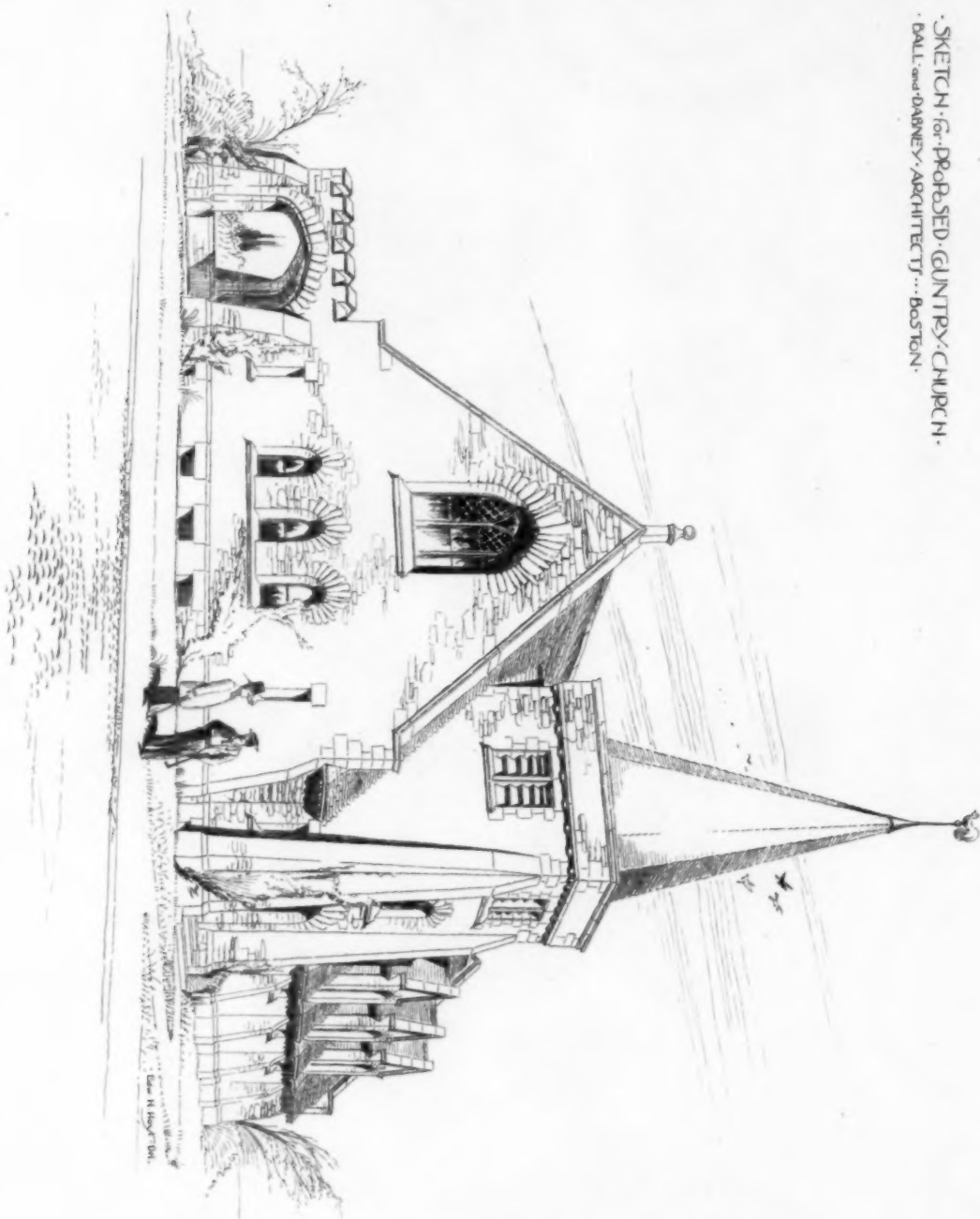
TRADE SURVEYS

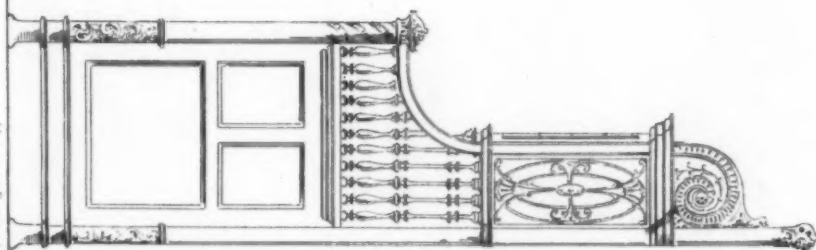
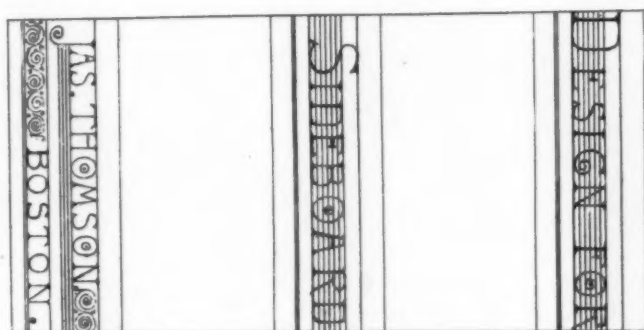
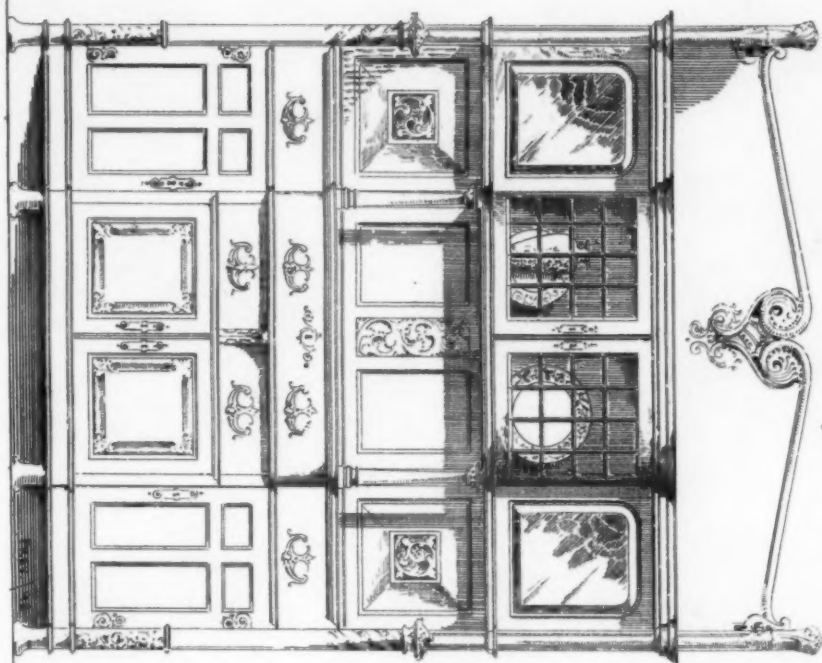
ALLUSION was recently made to the fact that somewhat radical or even revolutionary schemes for banking were receiving the apparently serious consideration of legislators in high position in the national councils. Another proposition looking to the same end has recently been introduced into the Senate, which aims at providing a system of banking which will make the borrowing of money at a low rate of interest much easier than at present. The scheme contemplates the establishment of branches at post-offices throughout the country, and loans to be made upon security, the character of which is not clearly defined. It is the old greenback idea revived, but this time it is presented with the approval of a much larger constituency. The farmers' organizations and the labor organizations are working in unison for some modification of the existing banking system which will destroy, as they claim, the present monopoly enjoyed by national banks. Throughout the East such schemes and propositions receive but very little attention. Throughout the West they are earnestly considered by a very large body of people, and politics has very little to do with it. The growth of sentiments or theories of this sort is somewhat remarkable. The idea is very deeply imbedded in the minds of the producing and hard-working classes generally that our recognized system of banking is to a large extent based upon injustice. It will not do to simply argue these propositions down in Eastern financial papers and magazines, for the rank and file, especially in the Western States, are doing their own thinking, and are obtaining the assistance of very reputable leaders. This movement is part and parcel of the granger movement, and grows out of it. It has the endorsement of the Supreme Court of the United States, with but one dissenting vote, and the approval of a vast body of business interests which are suffering every year more and more from a dearth of currency. It would be well for our self-satisfied managers of financial affairs to at least keep track of the growth of this sentiment. The volume of business, as compared to last year, is a little heavier, as shown by bank clearings, which are in the ratio of 90 to 85. With this expansion of trade there has been a quite general, but not universal, decline in values. This decline is attributable in large measure to the increased production, or, perhaps, more properly speaking, to increased producing-capacity. A portion of the increased activity is, no doubt, due to the assistance of foreign capital; but the influence of foreign capital is frequently over-estimated.

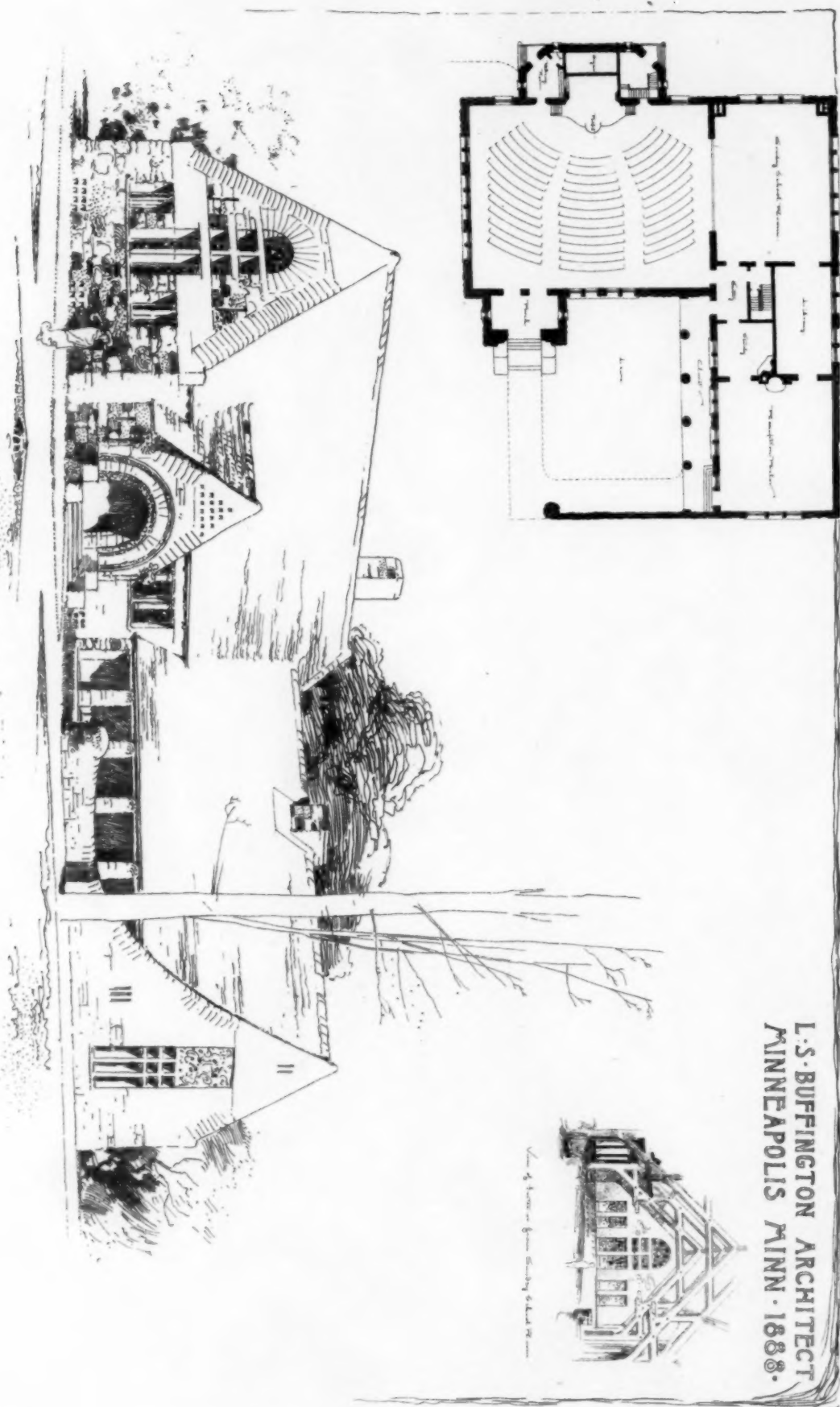
The volume of freight moved by rail is increasing as compared to corresponding weeks last year. The supply of building material is very heavy, and, generally speaking, is a little lower in price than last year. Building permits were not quite as numerous during March as had been anticipated, but the deficit was due to unfavorable weather. Our articles from a large number of building centres, up to date, confirm the previously expressed opinions and statements as to the magnitude of building operations in all sections of the country. Iron and steel material for construction purposes is in urgent demand. The pig-iron output is increasing. Crude iron and steel have decreased in price \$2 to \$6 per ton since the opening of the year. Twenty-eight new and thoroughly equipped blast-furnaces will soon be blown-in in the Southern States. Upwards of 1,100,000 tons of steel-rails have been sold this year out of an aggregate producing-capacity of some 2,600,000 tons. The car-builders, with very few exceptions, are crowded with orders to supply rolling stock for railroads. The locomotive-builders have increased their supply of work to be done, and there is a general movement among railroad-managers to add to their capacity to move freights, in view of the steady increase in traffic. It is impossible to say, just at this time, to what extent the decline in prices of iron and steel has been due to the building of new mills and furnaces. The opinion was very widely entertained, a few months ago, that so far as iron and its products were concerned, there would be a steady advance in prices throughout 1890, as the correlative of a steady expansion in demand. Notwithstanding the threatenings that have been given out by labor organizations for a year past, the fullest preparations have been made for building houses, factories and mills, and the work has been undertaken. There are signs of a good deal of commotion in the labor ranks, but, after all, the outcome will not be a tithe of what was at first feared. As usual, the turbulent workmen of Chicago take the lead, and the builders and employers there are showing a remarkably bold front in view of the vastness of the interests at stake. At Philadelphia, the striking fever will manifest itself chiefly in a grand parade and public meeting, wherein clerical and municipal magnates will vie with labor leaders in grandiloquent talk. In New York the workmen do not seem to know just what they will do; but their employers are not disconcerted. Throughout the South there will be scarcely any trouble. Among the shop-workmen of the New England States, there is very little disposition to engage in any general movement to unsettle existing conditions.

S. J. PARKHILL & Co., Printers, Boston.

SKETCH OF PROPOSED GENTRY CHURCH.
BALL and DARNEY ARCHITECTS... BOSTON.







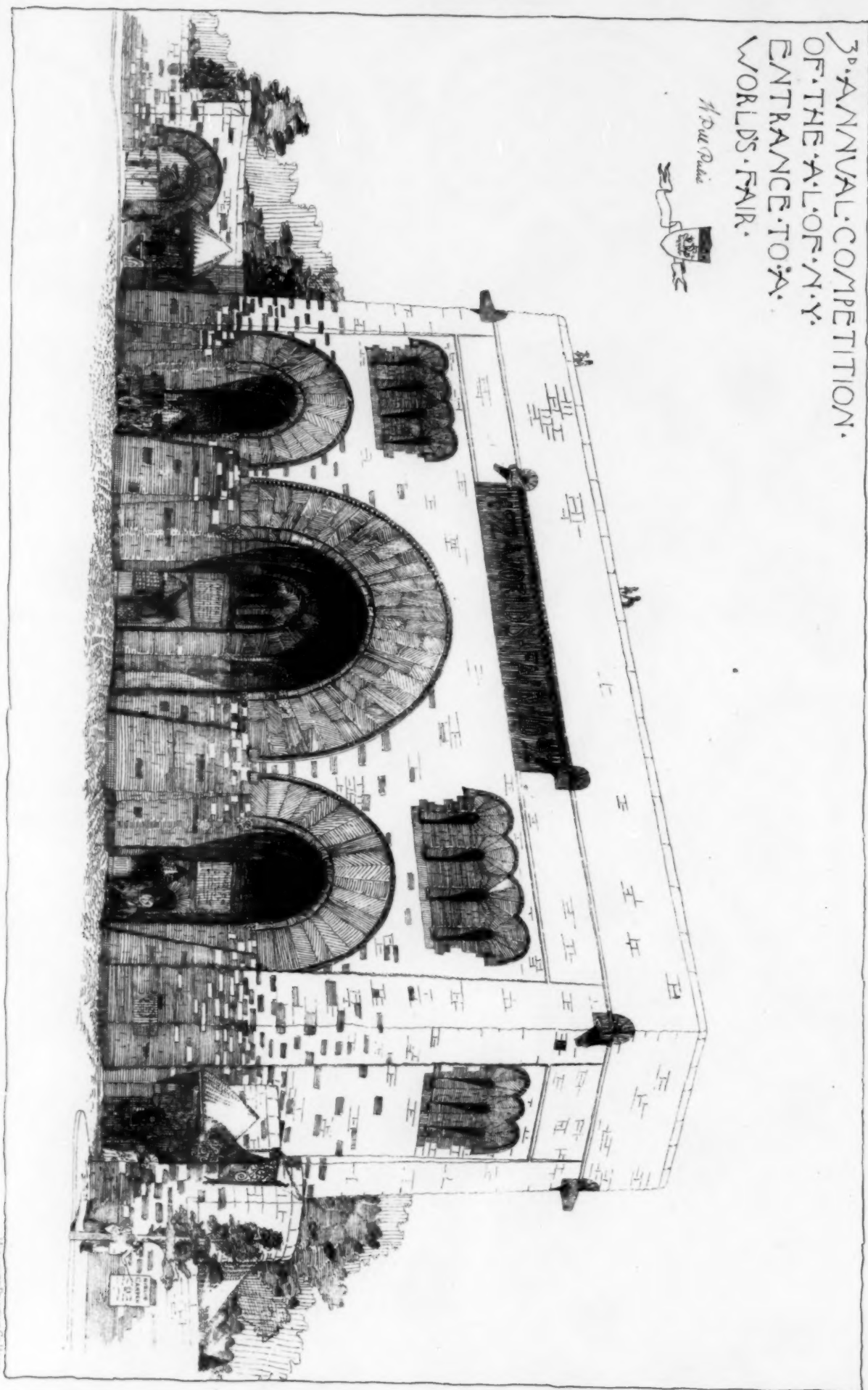
DESIGN FOR PRESBYTERIAN CHURCH
EAST MINNEAPOLIS.



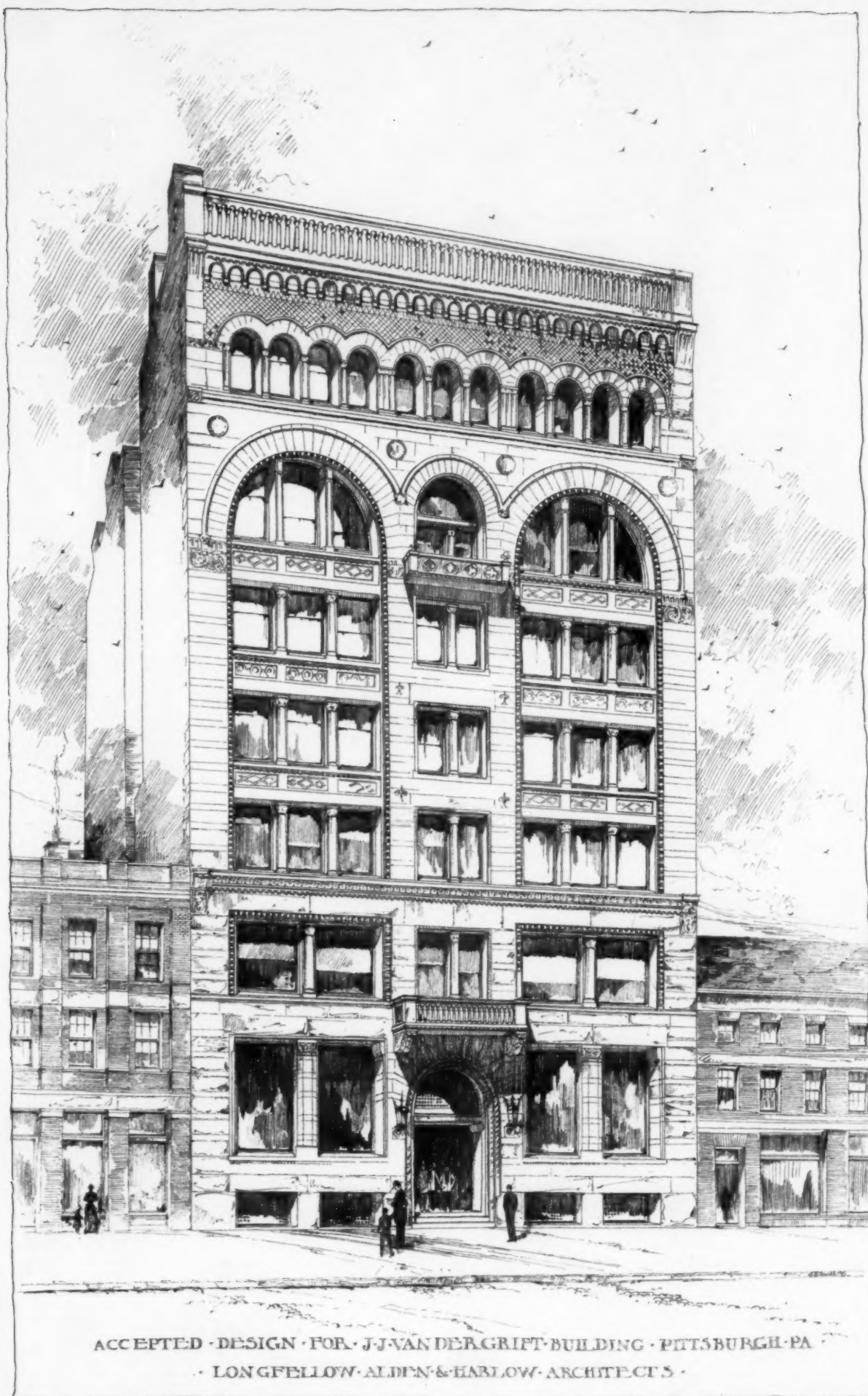
Frank Hillenbrand
Arch't

SKETCH OF DOORWAY
HOUSE FOR JOHN DWIGHT ESQ.
MT. MORRIS PARK NEW YORK

3^d. ANNUAL COMPETITION.
OF THE A. L. OF N. Y.
ENTRANCE TO A
WORLD'S FAIR.



H. S. T. 1890



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