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CONTENTS

FOR so many-sided a man we have often been tempted to consider Mr. Edward Atkinson one of the most curiously one-sided men ever created when it comes to his considering those matters which fall under the direction of architects. The fact that architecture is a fine art and has to do with other structures than one-story mills has sometimes seemed so difficult for him to grasp that we were genuinely surprised to discover what an impression the architecture of the World's Fair buildings had created on his Philistine soul. But though, as will be seen elsewhere, he confesses that the architects have done their task admirably, his habit of finding fault with architects — a fault-finding in many respects justifiable and which has produced beneficial results — leads him to make complaints which are rather ill-timed and are contradicted by the very concessions he makes. To declare that "the whole architectural display is wonderful, beautiful and satisfactory within its purpose," that "the purposes of a great show are fully met in a high sense" is to make as strong statements as could be framed that the aim and purpose of the architects had been ably and effectively carried out. Then why should they be blamed for not having satisfied other aims and purposes which they were not called upon to fill? The World's Fair was not designed to be a "true industrial exhibition," as to do that would but be to call down certain failure and loss upon the projectors. We do not believe there are enough people in this country who could be interested in such an industrial exhibition as Mr. Atkinson and a limited number — ourselves amongst them — would like to see, to assure an income from attendance that would save the undertakers from ruin. No, a world's fair, to be successful, must always be a fair and the elements of the retail shop, the bazaar and the side-show can never be eliminated. A greater amount of thoroughness and completeness in the way of preparing and setting-up the industrial exhibits is desirable, but not to the extent of turning the Machinery Building into a succession of barrack-like shops and factories, full-size and in complete operation. As to Mr. Atkinson's prediction that in the next seven years "we may have exhausted the age of timber, of iron and of steel in the art of construction," all we can say is that we hope to be alive in 1900, to verify the truth of his supposition.

AN accident, very much resembling that which occurred in Washington a few years ago, and apparently due to the same cause, took place lately in Germany. The Government is building a garrison church at Hanover, from the plans and under the direction of an experienced architect. The nave, choir and transepts, including the tower over the crossing, were roofed in, and the two western towers were up nearly to the base of the spires, when, about five o'clock in the morning, one of these towers collapsed, bringing down with it most of the western end of the church, but leaving the sister tower standing. Fortunately, no one was injured. The church is built in part over the old city moat, so that the foundations of the western towers extended through the filling of the moat, to the virgin soil beneath, a distance of about twenty-five feet. For material, coursed sandstone rubble was used in the foundations, laid in cement mortar. The tower walls above ground were specified to be of roughly squared sandstone, with facing of coursed limestone rubble, and the other walls of brick, with limestone rubble facing, all the walls above ground being laid in lime-mortar. The walls appear to have been thick enough, and might perhaps have stood, if they had been built according to contract, but it is said that the greater part of the walling was laid with common rubble, with no pretense of coursing. When it is considered that the towers were built rapidly, and that the lime-mortar could hardly have had time to harden, it is not surprising that one of them should have fallen.

VERY few people, even among architects, have an adequate conception of the part which the mortar plays in rubble masonry. While walls of squared stone, or even of good coursed rubble, are nearly as strong without as with mortar, a wall of irregular rubble depends on the mortar for its very life. Many a wall of this sort would at first be more secure if laid dry than in lime-mortar, as the friction between dry stones helps greatly to keep them together, where fresh lime-mortar acts as a lubricant, aiding the stones to move on each other, and exerting little cohesive action; yet, if the mortar is of proper quality, it forms ultimately so strong a bond between the stones that a rubble wall in such mortar is, in the end, little inferior in strength to one of cut-stone. There is plenty of evidence of this in the churches of the English chalk district, which are generally built of flints. These are stones about the size of one's fist, rarely as large as a child's head, very hard and smooth, and about as nearly spherical as natural stones ever get to be. It would be next to impossible to lay a dry wall of them, with vertical sides, four feet high, yet there are scores of lofty towers built with them, which, without other assistance than that of the good lime-mortar in which they are laid, have stood in perfect condition for six hundred years. In these walls, the mortar is accepted frankly as the most important part of the construction. The joints are very thick, as they should be in all rough rubble masonry, and the flints form rather the aggregate of a concrete mass than the main element of the wall, as would be the case with squared blocks. Probably, our English ancestors either worked very slowly, so as to let the mortar harden in successive small portions of wall before straining its tenacity with a superposed load, or used some method of hardening it quickly which is unknown to us; but that they could not have carried up their walls more than a few feet at a time without allowing the mortar to harden is certain. We, however, possessing the inestimable advantage of cement, which gives us a matrix at once adhesive, strong, incompressible and quick-setting, can do with rubble what we will, and, if we would only use our materials as intelligently as our ancestors did, we might utilize an immense amount of small stone, which is now thrown away, and at the same time secure some novel and picturesque effects in our buildings.

PEOPLE who have driven through the Bois de Boulogne will probably remember the "Croix Catelan," which, although not a cross, but a pyramid, is supposed to have been erected about the year 1700 on the site of a memorial cross, dating from the middle of the thirteenth century. What was the person or thing commemorated by the original cross, and, consequently, who or what it is proper to think of in contemplating its modern substitute, has been much disputed. The favorite legend is that a troubadour, named Arnaud Catelan, loved the princess Marguerite of Provence, and, when she left the South to become the wife of King Louis the Ninth, followed her on foot, carrying with him some verses, and a few faded Provençal flowers, as a wedding gift. When he arrived in Paris, the king and queen had left their

castle of the Louvre, and were making a visit to the king's native town of Poissy. The road from Paris to Poissy, though only fifteen or sixteen miles long, lay through the Bois de Boulogne, then called the Forest of La Rouvraye, which was infested with robbers, and the officers of the castle gave Arnaud an escort, to conduct him safely through the wood. On the way, Catelan, rejoiced at being so near the end of his journey, made a confidant of the captain of his escort, and showed him the little box which, as he said mysteriously, contained treasures to be offered to the queen. The captain apparently thought that the queen had treasures enough, and that this would be an excellent opportunity for enabling her to share some of them with her subjects; so, when they reached the depths of the forest, he and his men fell upon the troubadour and slew him, and gained possession of the precious box. On opening the case, to get out the jewels which he supposed it contained, he was disgusted to find nothing in it but some sentimental verses, and a packet of dry flowers. The verses he threw away at once, but the flowers had an aromatic scent which pleased him, and he kept them to perfume his clothes on state occasions. The corpse of the poet was soon afterwards found in the wood, but there was no clue to his assassins, and a prolonged investigation revealed nothing. One day, however, Queen Marguerite held a reception, and the captain of the escort appeared to pay his respects to his sovereign. As he approached, the queen recognized the fragrance of Provençal flowers, and a suspicion came into her mind. Officers were sent to search his habitation, and more relics of the troubadour were discovered. The captain was seized, with others of the poet's escort, and they were all roasted over a slow fire, while the king and queen had a stone cross set up on the spot where the unfortunate Catelan had met his death.

THERE is, in Paris, a society of nineteenth-century troubadours, known as the "Compagnie des Félibres Parisiens." To such a company, the tomb of an illustrious predecessor, particularly one who had lived and died so romantically as Catelan, would naturally be an object of the highest interest, and this year, in order to give special brilliancy to their proceedings, they held around it a Court of Love, of the most approved Mediæval pattern. They recited Provençal verses, crowned Queens of Beauty, and related fables, all in the traditional manner, and with such success that the Croix Catelan is likely to be adopted as the special representation of Provence in the Parisian Metropolitan district. It is true that the legend of the troubadour is gravely questioned by historians, but the popular feeling will always be on the side of the poets, and, before popular feeling and poetry together, mere prosaic fact is not of much account.

THE Indian section of the South Kensington Museum has just come into possession of a carpet, which must be well worth seeing. The carpet, or rather rug, once belonged to the mosque of Ardebil in Persia, and, according to an inscription wrought into it, was made by Maksond of Kashan, who calls himself "the slave of this holy place," in the year 942, corresponding to the year 1535 of the Christian reckoning. It is about thirty-four feet long, by seventeen wide, with a dark blue centre, covered with a network of flowers, mostly in red and yellow. The pattern consists mainly of a circular central medallion, from which radiate sixteen panels, or cartouches, a quarter of the same being repeated in each corner. According to the *Builder*, the carpet is "faded." The most curious thing about the account is that the South Kensington authorities had not money enough to buy the rug, and private individuals subscribed what was necessary to make up the sum required. We are not told what this sum was, but it would be interesting to know how much the India Museum and its friends were willing to pay for a faded old carpet. The few tourists who find the Indian Section at South Kensington certainly do not observe either poverty or parsimony in the appearance of the exhibit. To say nothing of the enormous carpets of silk and camel's-hair, the display of jewels is, with the exception of the Regalia in the Tower, perhaps the richest in Europe. As we recollect it, a favorite decoration for the objects shown consisted of an inlaid vine, something like a myrtle, with stems of gold, leaves of emeralds, half an inch long or so, and flowers of rubies of corresponding size; and we remember particularly a good-sized teapot of jade, inlaid with a vine of this description, and having a diamond, as large as a marble, as a handle for lifting the lid.

THE introduction of the basic converter first gave an impetus to iron manufacture in Germany, which has an abundance of impure ores containing phosphorus, suitable for the basic process, but useless for any other. In addition to this, a process was invented in Westphalia for removing sulphur from raw iron by means of manganese, so as to bring another class of ores, formerly considered worthless, into use. Being thus in a position to use their own ores successfully, the Germans set themselves to improve the processes which they were henceforth to use. The greatest of their recent improvements of this sort consists in reducing the cost of coke, the indispensable fuel for iron metallurgy, and one, also, which has been comparatively high in price in Germany. Their theoretical science taught them that, in manufacturing coke from coal, hydrocarbon gas, ammonia and tar are driven off, all of which would be valuable if they could be saved; but the nearly unanimous opinion of experienced iron-workers was that these products could not be saved without greatly injuring the quality of the coke. However, the Germans prefer, instead of practising first and theorizing afterwards, to get their theory right to begin with, and bring their practice up to the theory. Theoretically, there must be some way to save the waste-products from the coking-ovens without spoiling the coke, and they set themselves to find it. Within the past five years, Mr. Mason informs us, probably three thousand coking-ovens have been put in operation in Germany, which save the waste-products. Of these, the more recent and effective are those known as the Otto-Hoffman ovens, of which 1,550 are now in use. These consist of ovens, or retorts, 32 feet long, 16 inches wide and 5½ feet high, grouped, in the best examples, in batteries of sixty, and connected with a Siemens regenerator in such a way as to utilize the surplus heat for warming air, to be subsequently driven, at a temperature of 1800° Fahrenheit, into the furnaces, to be there mixed with hydro-carbon gas and burned. Each oven is charged from the top, and contains 6½ tons of coal. As it is heated, crude gas and vapor are disengaged, which, instead of being allowed to go to waste, as in ordinary coking-ovens, are drawn off by a suction-fan and driven through coolers and scrubbers, where the tar and ammonia are retained in the water through which the gas is made to pass. From these purifiers, the gas is taken directly back to the fire-boxes under the ovens, where it is mixed with the heated air from the regenerators and burned for roasting the coal. The supply of gas is, with all the German coals, more than ample for this purpose, and the surplus is used for lighting the works and producing steam. The water in which the tar and ammonia have been retained is treated by decanting the supernatant portion, containing the ammonia, leaving the tar in shape for immediate use, while the ammonia is recovered by heating the water and condensing the ammoniacal vapors with sulphuric acid. Average German coal furnishes about 76 per cent of coke, 1¼ per cent of ammonia, and 2½ to 4 per cent of tar, the remainder being gas and water. As the sulphate of ammonia is worth about 2½ cents a pound, and tar half a cent, while the gas takes the place of coal for heating the retorts, it is found that a battery of sixty ovens, besides saving, on an average, eight thousand tons of coal a year, as fuel, over the old process, produces eight hundred tons of sulphate of ammonia, worth about forty-two thousand dollars, and three thousand tons of tar, worth about twenty-eight thousand dollars, all of which would, by the old processes, be wasted. As the coke produced is of the very best quality, there is no counter-charge to diminish this immense saving, which is said to amount to 40 per cent of the cost of coke-making. Very recently, a Dortmund inventor is said to have separated benzole directly from the coking-gases, and, as benzole is a valuable and staple product, being the foundation of the aniline colors, a still further economy may be made. In addition to these signal triumphs of educated theorizing in metallurgy, Mr. Mason points out that the Germans have an advantage over their competitors in their systematic economy of coal. The dust, which with us is thrown away, and which, at our anthracite mines, is said to amount to 1½ tons for every ton of salable coal, is, in Germany, regularly sold at 25 cents a ton, loaded on cars, and is either mixed with tar and pressed into bricks, which are used as fuel for steam-boilers and house-stoves, or is blown dry, by a steam-jet, into the fire-box of boilers, as petroleum spray sometimes is with us, and with very much the same effect. These several improvements may offer valuable suggestions to our own coke-burners.

APSES.[1]—I.

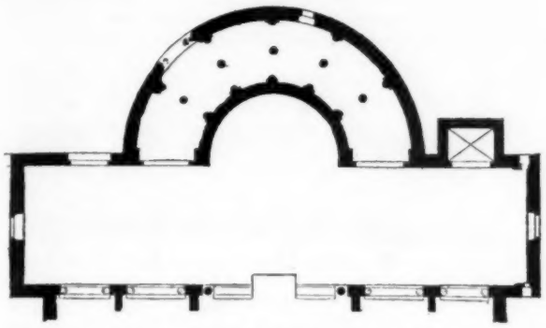


Fig. 1. Plan of St. John Lateran, Rome.

IN the earliest Christian basilicas the apse constituted the part of the *chevet* occupied by the tribune or presbyterium. It was appropriated to the use of the clergy, with the bishop's throne or cathedra in the centre; it was semicircular in plan and vaulted *en cul de four*, that is,

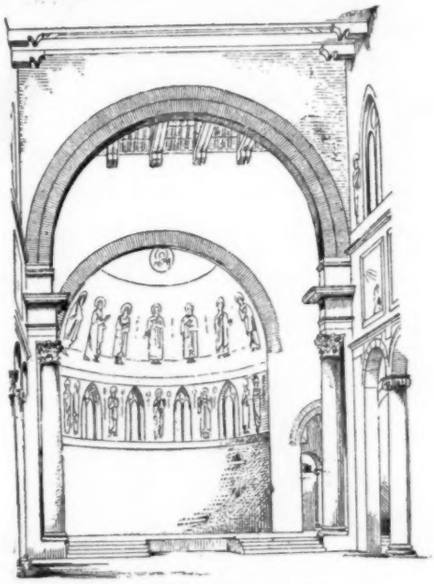


Fig. 2. Apse of St. John Lateran, Rome.

covered by a demi-cupola. In the first Roman basilicas, which were not religious edifices, the tribune was just at the end of the nave; but it was afterwards separated from the latter by a sort of transept, forming the choir, and intended for the lower order of the clergy and the choristers. This disposition was adopted in the fifth century. It was preserved in later structures, and notably in the basilica of S. Giovanni Laterano, which was rebuilt in the tenth century; Figures 1 and 2 give

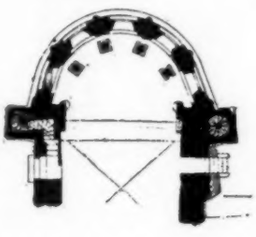


Fig. 3. Plan of the Apse of La Trinité, Caen.

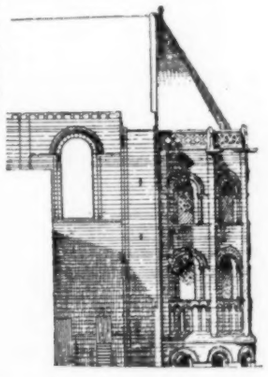


Fig. 4. Apse of La Trinité, Caen.

the plan and a perspective view of the apse taken from the central aisle. In the plan, a gallery encircling the apse will be remarked; this is not usually present, but its introduction here is accounted for by the fact that it was designed to place the basilica in communication with the court and with the Patriarchal Palace and Baptistery, both of which are in the rear of the *chevet*.

In apses of the Roman period, the circular form was quite generally maintained in France; however, in Provence, they were often built on a polygonal plan, as, for instance, in the church of Thor (Vaucluse), which has one of the most remarkable apses in the province. We must note also that at this time, independently of the principal apse, which was in the axis of the church, other apses, or apsidal chapels, were constructed along the transepts and at the extremity of the side-aisles. In certain houses of worship, notably the Cathedral of Noyon, even the transepts have circular, apse-like terminations; still, these are not of frequent occurrence, and their position is, moreover, inconsistent with a rule adopted for the orientation of the apsidal chapels, which are generally on the eastern side.

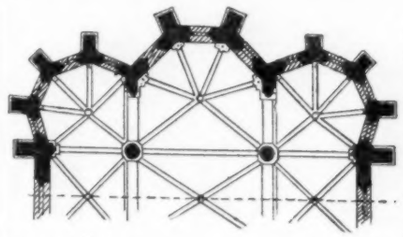


Fig. 5. Plan of the Apse of the Church of Ferrières.

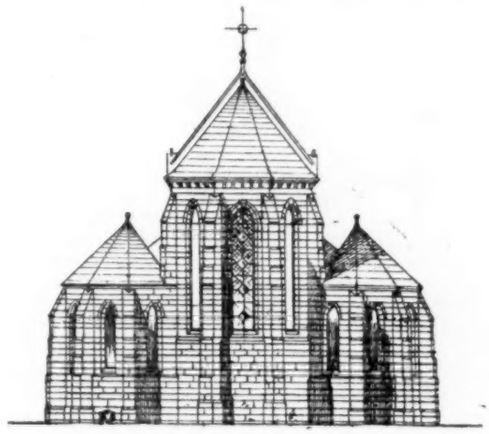


Fig. 6. Apse of the Church of Ferrières.

In the discussion of apses, we must distinguish those belonging to churches with a single nave, those in edifices with simple collaterals, and, lastly, those in important monuments, such as most of the large cathedrals, where the side-aisles run around the choir and constitute circular or polygonal galleries, termed deambulatories.

Churches of the first class are sometimes of vast size, but this simple plan is most often applied to small structures in hamlets and villages. The apses in these are merely a prolongation of the nave, of the same breadth and height, and terminating in a curved or polygonal wall; such is the apse of La Trinité at Caen (Abbaye aux Dames), a church of the twelfth century; the plan and one side are shown in Figures 3 and 4. The same general disposition is often adopted when the nave is flanked by side-aisles, only, in this case, the collaterals frequently terminate in chapels affecting divers forms, and materially modifying the aspect of the *chevet*. As an example, we give (Figs. 5, 6) the interesting and well-defined

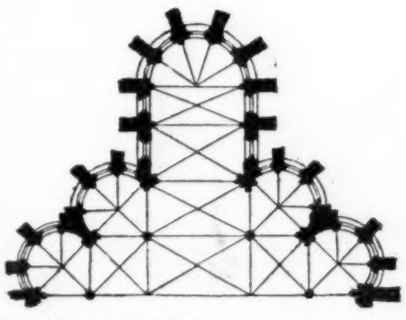


Fig. 7. Plan of the Apse of the Church of Braisne (Aisne).

[1] From the French of G. Redon, in Planat's *Encyclopédie de l'Architecture et de la Construction.*

design of this part of the thirteenth-century church of Ferrières (Seine-et-Marne); the student will notice the ingenious fashion in which the lateral chapels are planned, so as to make them wider than the corresponding side-aisles, and join them to the central apse in a way to prevent any defect in the joint that would interfere with the shedding of the rain-water; this disposition

Fig. 8. Apse of the Church of Braisne (Aisne).

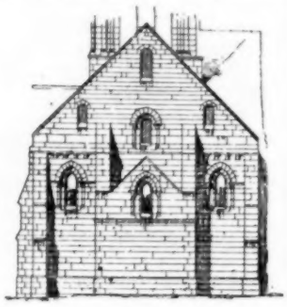


Fig. 10. Apse of the Church of Vernouillet.

not only adds to the interior and exterior effects, but it is so skilfully treated that it produces the happiest of impressions. The thirteenth-century apse of Braisne-le-Comte (Aisne) may also be cited as one of the finest in this same respect: the chapels attached to the side-aisles and the transept contribute greatly to the effect, which is very striking, especially in the interior; on the elevation of the central chapel, a device in the buttresses will be remarked; they are pierced, and assure means of circulation over the wall below where it is thicker than at the points where the windows are pierced. This arrangement, the object of which is to render the bays of the edifice easily accessible, is quite generally adopted, particularly in this part of France (Figs. 7, 8).

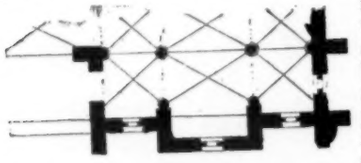


Fig. 9. Plan of the Apse of the Church of Vernouillet.

In churches analogous to those described above, and without enclosing side-aisles, mediæval architects often had recourse to rectangular apses, even in very important structures, as in the

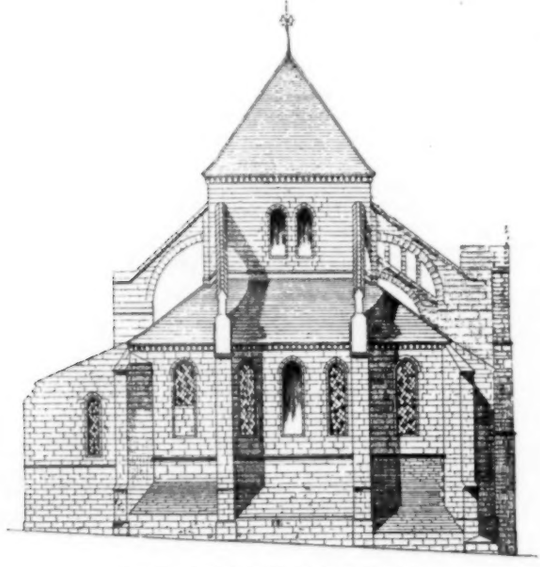


Fig. 11. Apse of St. Martin's, at Clamecy.

Cathedral of Laon; but this economical disposition was chiefly adopted in small edifices, and gave rise to solutions that are noteworthy from various standpoints. Especially striking and worthy of imitation is the effort displayed by the architects of the period so to dispose these rectangular apses as to secure by their form a suitable termination of the building, and avoid the appearance of a sudden cutting off of interior bays that might have been repeated indefinitely. Already, in the

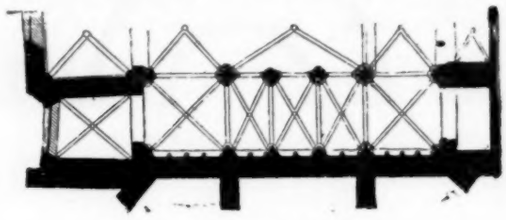


Fig. 12. Apse of St. Martin's, at Clamecy.

little church of Vernouillet (Seine-et-Oise), which dates from the latter part of the twelfth century, we see, in both the plan (Fig. 9) and the elevation (Fig. 10), this attempt asserting itself quite plainly in the establishment, between the two intermediary buttresses of the apse, of a projecting part covered by

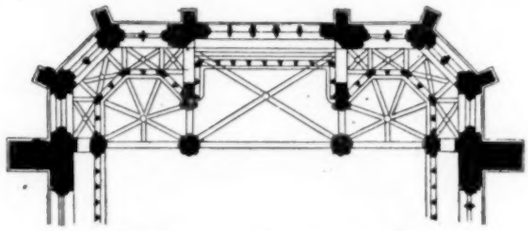


Fig. 13. Plan of the Apse of the Church of Tour (Calvados).

a special stone roof, the gable of which is sharply defined. In other edifices, like the church of Clamecy (Nièvre, see Figs. 11, 12), the square apse is surrounded by an aisle, the special object of which is to mark the limit of the construction, and the solution is clearly expressed externally as well as internally. But it is, above all, to the church of Tour, near Bayeux (Calvados), the apse of which goes back to the close of the thirteenth century, that we must turn for a really original disposition and one of exceptional artistic merit. At the

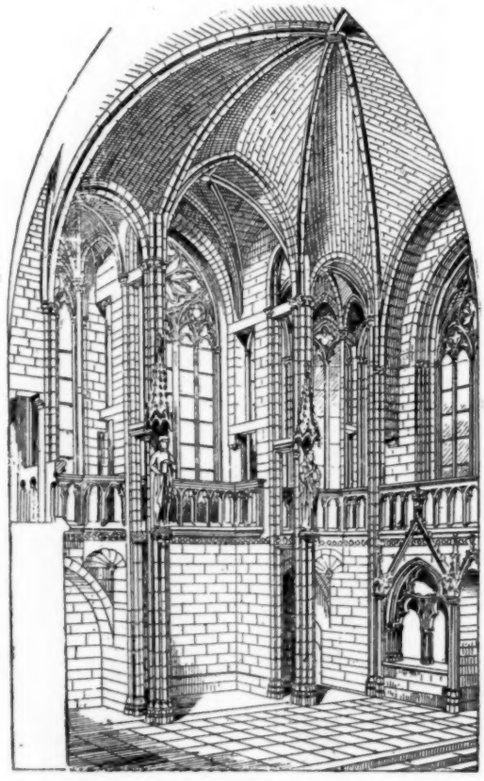


Fig. 14. Apse of the Church of Tour (Calvados).

extremity of the choir (See the plan, Fig. 13), which has no side-aisles, there are three chapels; the central one of these is larger than the others, and is rectangular in shape, while the others are polygonal; they communicate with one another in the lower part, owing to the disposition of slender piers adopted, and also at the level of the balustraded gallery extending the whole length of the choir and nave. The first piers span the entire height of the choir, bear the springing of the main vault, and receive, in addition, arches from each of the chapels, which are separately vaulted according to the plan indicated in the perspective view (Fig. 14). For the security of these delicate piers, it will be remarked that at certain well-chosen points stone lintels are very skilfully introduced, so as to act as stays, but, at the same time, in no way detract from the decorative and original effect of the *ensemble*. It is true that the conception may be charged with whimsicalness, the complexity of which was not logically called for; but, when we have made this concession, it must be granted that there is a great charm in the composition, which is most ingenious as regards the use of the stone and most harmonious in the combination of the details; the scale and forms of the latter contribute much to the general impression produced. Certainly, with a few simplifications, an architect may find here an excellent guide for the treatment of a similar case, when designing the rear of a large hall in a religious or even a civil construction. As to the exterior, although very simply shaped in comparison with the interior, it is not commonplace; it gives rise, by the sharp indication of the different bays and the broken rear wall, to the idea of the spirited character of this *chevet*.

(To be continued.)

LONDON

THE NEW BLACKWALL TUNNEL UNDER THE RIVER THAMES.

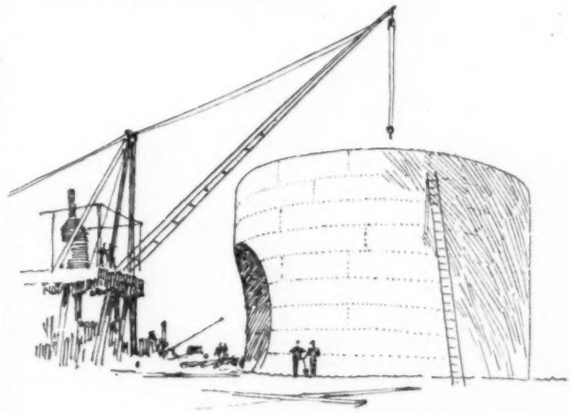
IT has often been remarked how completely the inhabitants of the eastern portion of London are cut off from one another by the absence of adequate river communication. London Bridge is, as every one knows, the bridge lowest down on the river Thames, and, until recent years, there was scarcely any method of communication between the great industrial districts of the northeast with those of the southeast. The Thames Tunnel at Wapping has, of course, been in existence for some years, but it was of no practical value for carriage traffic, and latterly has been simply a railway tunnel, and nothing more. The new Tower Bridge will relieve to a certain extent the overcrowded traffic which places London Bridge in a constant state of block, whilst the free Woolwich ferry has to a certain extent diverted some of the traffic in the extreme east. The new Blackwall Tunnel is situated about one-half mile beyond Greenwich, and will bring into direct communication Limehouse, Blackwall, Poplar and East London generally with Greenwich, Plumstead and Woolwich.

The Blackwall Tunnel has had a curious history. It was felt by the late Metropolitan Board of Works that the East End of London had been neglected, and the decision to construct the tunnel was really arrived at by the Board, not the County Council. Matters had, indeed, progressed so far that tenders were received by the Board for the work, and they actually decided to accept a tender from Messrs. Pearson & Sons within ten days of their extinction by the Local Government Act. This proposal was, however, frustrated by the Local Government Board, who advanced the date of the Board's extinction from April 1 (the date fixed by the Act) to March 21.

The County Council took up the work, but decided to put on one side most of the preparation that the Board had made, and decided to spend £10,000 in experimental work. Sir Benjamin Baker, who was then about to visit America, was consulted, and he offered to inspect the tunnels under the Hudson and St. Clair rivers. The result of this inspection was to satisfy himself that there was no doubt that it was perfectly practicable to tunnel under rivers by means of a shield and compressed air. Upon this report, the proposed experimental works were abandoned, and, after sundry alternative proposals for a ferry, etc., it was decided to proceed with the driving of a single tunnel, 23 feet internal and 27 feet external diameters. Four tenders for this were received, and Messrs. Pearson & Son were appointed contractors. The net total of the contract was £871,000, but to this should be added the additional cost of the acquisition of property and the formation of approach roads, which brings up the total cost to £1,500,000.

The actual contract work consists of three kinds. It begins on either side with an open approach leading towards the river, and descending at a gradient of 1 in 36. The roadway is lined on the sides with glazed brick. Then comes a section of "cut-and-cover" work, which is carried out by excavating from the surface, building the tunnel, and then filling-in the soil afterwards. Between the ends of these sections, on either side, comes the actual tunnel itself. From shaft No. 4, which is about one-third of a mile from the beginning of the open approach, the tunnel slopes for a length of 602 feet to shaft No. 3 on the bank of the river, where the roadway will be 78 feet below the surface and 72½ feet below high-water mark. The tunnel then proceeds on the level 1,212 feet across the river to shaft No. 2 on the edge of the Middlesex bank, and then slopes upward for a distance of 447 feet to shaft No. 1, where it again enters the "cut-and-cover." The most difficult portion of the work will be in the centre of the river, where for 150 feet there will only be seven feet between the bed of the river and the 53 feet of water overhead. From end to end, the work will be 6,200 feet, or nearly a mile and a quarter, exclusive of the new roads which are to give access to it from the districts both north and south. The tunnel itself will be of iron tubing, filled with two feet of concrete. The carriage-way will be six inches above the bottom of the tunnel and seventeen feet below the top of the arch above. It will be 16 feet wide, and will have foot-paths three feet wide on either side. Below will be an arched subway to carry water-mains, etc.

At present a considerable portion of the "cut-and-cover" work is in hand, and the four great caissons are nearing completion, one of them having already been sunk in position. The caissons are about sixty feet in diameter, and are used for ventilation and access by staircases after the tunnel is made, and to act as fixed starting-points while the tunnel is in progress. They are made of riveted iron plates five feet apart. They are open at the bottom and below the openings constructed for the tunnel to pass through they are of wrought-steel, to give rigidity and firmness as they descend into the earth, the bottom ring being a sharp-cutting edge of steel. They are built up in rings, and the earth inside gradually removed, so the caissons sink by their own weight.



Shaft No. 4 is being used as the shaft from which the shield is being worked, and, with compressed-air engines, windlasses, lifts, cranes and railways, presents a most busy appearance. The shield is not precisely the same as that used at the Hudson River by Messrs. Pearson, but it is a modification of it. I have been down this shaft, and have followed very carefully the construction of the tunnel; but such a really capital description has been given by a visitor and published in *London*, that I cannot do better than give it to you:

"Donning a suit of waterproof overalls," he writes, "I was conducted to the mouth of No. 4 shaft, from the bottom of which a confused din of strange sounds came rolling up. Across the top of the yawning iron-lined pit was rigged a substantial stage, forming the terminus of a railway, upon which small locomotives were busily drawing away train-loads of clay to the tunnel below, to be used in raising the level of approach roads half a mile away. Truck-load after truck-load came up from the dim depths in a cage, and was mechanically tilted onto wagons waiting to receive it, the empty trucks then going down to be run along the rails at the bottom of the tunnel to the place where the shield was at work. When the tunnel is somewhat longer, an electric engine will be taken down to draw the trucks along from the shield to the foot of the shaft. Descending carefully the wooden stairway leading to the foot of the shaft by long flights of about thirty steps each, mostly covered with slippery, wet clay, I arrived safely at the bottom and entered the tunnel. It is formed of iron rings two feet six inches wide, and each built of fourteen curved segments a little over six feet long. Every segment weighs a ton, being two inches thick, and having flanges along its edge by which it is bolted into place, and which then form strong iron ribs on the inside of the tunnel. Picking my way artfully along the side of the railway, I came to the shield, and gradually, in the light of the electric-lamps, formed some idea of its working.

"To understand the Greathead shield, about which so much that is unintelligible has appeared in the press, it is necessary to remember the purpose for which it has been invented. The shield does not itself dig or remove the rock and clay; neither does it force itself through like a snow-plough. It is simply a contrivance for stemming back the deluge of water which would rush in upon unprotected workers engaged upon loose strata with a river 70 feet deep overhead, and so preventing the whole operation from being swamped in water and mud. This is done by working in compressed air at a pressure of between two and three times that of the air outside. The shield is, in shape, like a huge iron drum, weighing 250 tons, and divided, honeycomb fashion, into twelve cells, each leading through from the face of the clay to the interior of the tunnel. Each cell is opened toward the clay to be removed, and affords space for a couple of men with picks and shovels to break away the dirt and shovel it back into the shield. Behind the heads of these men is an iron partition descending about a foot from the top of the cell, and farther back still another coming down about half its total height. Farther back still are two strong, air-tight walls, through which doors for the men and shoots for the dirt lead out into the tunnel. The whole of the air in the shield is kept at a pressure of about thirty pounds to the square inch at times when the work is in danger of flooding. The air-pressure is sufficient to drive back the water that might otherwise rush through. Even when the river may be only a few feet overhead, it is thus rendered unlikely that any mishap will occur, as the only part of the soil unsupported is the few inches in front of the shield, and even this is held up by compressed air. But, in case of mishap, every possible provision is made for the safety of the men. The two partitions coming partly down the cell behind them form complete diving-bells. At the first sign of danger they can step back into the first, and, if the water should enter, it cannot possibly rise higher than their shoulders. Should it come in at all, they would instantly stoop under the next partition into the second diving-bell, where the water could not come above their waists. All they would then have to do would be to pass through the doors in the two air-tight walls, closing each after them, and they would be safe in the tunnel, the water being safely dammed back by the 'shield' till the mischief could be repaired.

"When two feet six inches of earth have been dug away from the face of the shield, it has to be forced forward into the vacant space. Round its outer edge, on the face toward the rock, is a hard-steel 'cutting-edge,' like a gigantic cheese-cutter, 28 feet across. The men in the outer cells have cut a ring-like depression, into which this cutting-edge will fit. At the back, the shield projects like the sliding-shade over the object-glass of a telescope, completely encircling the last-made rings of the tunnel. It has to be pushed off these rings far enough to allow another to be built inside it, the cutting-edge in front moving into the space prepared for it. But, with a weight of 250 tons, and the outer soil resting on its top and the end of the tunnel on its bottom, the shield, naturally, does not move without pressure. This is supplied by twenty-eight hydraulic 'jacks' placed around it at the back, and pressing against the ring of the tunnel-tube which has just been built. By turning 14 taps or valves all at one point, a single person can put a pressure of 3,000 tons on the shield, and the monster is made to slide forward just far enough to make room for another ring. Its course has to be guided to a hair's breadth, and this is managed partly by digging more soil away, and so 'easing' the shield on one side if it has displayed a tendency to go wrong at the previous shift. But its direction is also regulated by the amount of pressure put on the various jacks, and it may be imagined that this is a peculiarly delicate task, though the mere handling of the taps is child's play, and all the power is supplied by the engines far above on the surface.

"The dirt coming through the shoots in the shield does not all descend to the floor of the tunnel, stages being erected at different levels, upon which trucks are loaded, then lowered in a cage to the floor and run along the rails to the bottom of the shaft.

"The building of the ring after the shield has moved would be a very difficult thing if done by hand, the hoisting of a curved plate weighing a ton to the tunnel roof, and there bolting it, being no small work. But there are two huge hydraulic elevators, or 'machine arms and hands,' as they might be called, which pick up a plate and swing it into position, holding it there until fixed. The whole operation of putting in a new ring, including the digging away of dirt, can be got through twice daily, so that full working speed means five feet of tunnel a day. A good deal of water comes through during the building of a ring, a space of about one inch being open between the inner side of the shield and the rings already made. To prevent this water from interfering with the work at the lower part, an ingenious invention of Mr. Greathead, the designer of the shield, is applied. A two-inch pipe is laid down with its mouth just where the water would collect. Inside the pipe, and directed away from its mouth, is a tiny nozzle, which delivers a pin-head stream of water at about a thousand pounds of pressure. This immediately produces a complete vacuum behind, and the pipe sucks in the water at a rate which would need pumping machinery enough to half-fill the tunnel. Before the water can settle, it is sucked-in by this handy little apparatus and shot up to the surface, so that the place is kept comparatively dry.

"I was much interested in the strata presenting themselves to the face of the shield, as with some difficulty I clambered into one or two of the cells in which work was proceeding. All the upper part of the shield faced dark-colored, stiff clay, but to the right and low down a sloping sand-bank lay underneath. There was no confusion or mixing; as the earth broke away beneath the pick, the line between the two materials was as sharply drawn as if done with a pencil. On the surface of the sand lay an inch or so of white shells, very crumbly and fragmentary, and breaking to pieces the moment they were taken in the fingers. Here and there were patches of dark, organic vegetable matter, shiny, but not hard like coal—probably decayed seaweeds. Below lay the soft, clean sand, and above the dark, clammy clay, millions of tons of which had been deposited on the shells without so much as crushing what I could not touch with my finger without producing a breakage.

"After an hour or two in these underground studies, I returned to the surface and saw the various engines by which the power required below was produced. Four boilers 30 feet long and 7 feet 6 inches in diameter supply the steam. In the engine-room alone over £10,000 worth of plant is laid down, the largest engine being that for compressing the air to be used in the tunnel. This has a fly-wheel about eighteen feet in diameter. Great pumps are employed in raising the water in different parts of the ground, and the level of the underground water of the neighborhood has gone down thirty or forty feet [*sic.*] owing to their labors.

"When the iron tunnel is completed for a certain distance, the inside will be covered with concrete to a depth of fourteen inches, and inside this enamelled bricks will be built, giving a fine internal finish. In the 'cut-and-cover' portion, some of which is nearly completed, a layer of asphalt is placed outside the concrete, so as to make the whole absolutely water-tight without the aid of the riveted iron tunnel."

A STRIKE OF THE USUAL KIND.—THE ARCHITECT, ENGINEER AND CONTRACTOR.—AUSTRALIAN HARDWOODS FOR STREET PAVING.

Sydney, N. S. W., August 6, 1893.

THE innate stupidity of tradesmen taken collectively, has often been insisted upon; but no more forcible exemplification of the truth of the statement could well be imagined than that which is to be found in the strike of masons in Sydney, last week. The Mutual Life-Insurance Company of New York, is about to erect a large office-building at the corner of Martin Place and Pitt Street, and building operations were barely under way before a strike was threatened unless the heretofore prevailing rate of wages was maintained. A few weeks elapsed, and now the masons on this particular work have been ordered out, and the job declared "black" because, forsooth, the union directly concerned has discovered that though some of the men employed have been receiving the standard wage—eleven shillings—others were only being paid at the rate of ten shillings per day. The contractors, naturally, argued that it was unreasonable to expect them to pay all alike; that those who proved themselves to be worth eleven shillings received that amount, while others less skilled, were paid the smaller sum. As might have been expected, this apparently logical arrangement did not suit the unionist leaders, and as their demands were not complied with, they compelled the men to leave the work. Such a proceeding would seem despotic and stupid enough at any time, but at this period of unprecedented depression, it is absolutely idiotic. There are very few buildings in course of erection, and many masons and bricklayers are glad to earn five shillings a day by working as laborers; the "unemployed" difficulty is assuming such vast proportions that the Government has inaugurated a system of coöperative-labor settlements in the country districts, and on every hand there are organizations for the relief of the destitute during the winter months. And yet, in the face of all this, and while Australia is striving to shake off the effects of a great financial crisis, the unionists ordain a strike! These trades-unions have within the last few years received several severe lessons; but they have, apparently, yet to be taught that a strike to be effective must be successful.

An excellent paper was recently read before the Institute of Architects of New South Wales by Mr. George Allen Mansfield, F. R. I. B. A., on the relative position of the architect, the engineer and the contractor, in which the author replied to some of the statements of a well-known engineer, Mr. Norman Selfe, who had previously read a paper on practically the same subject at a meeting of the Institute of Civil Engineers. Both papers were well written, and the points forcibly put; and though, from an architect's point of view, Mr. Mansfield had the best of the argument, there would seem to be much to say on both sides. As was remarked when the paper was being discussed, the extensive use of iron and steel in modern buildings has upset our preconceived old-fashioned notions as to

where the duties of an architect should end and those of the engineer begin; and it would be to the common benefit of the practitioners of both arts if some amicable arrangement could be arrived at to prevent the clashing of their respective interests.

New market-buildings are about to be erected on the site of the old structure, and the Sydney Municipal Council have approved of the City Architect's design for this important work. The drawings have not yet been published, but the design is said to be an extremely fine one, of an American-Romanesque type.

Direct communication with Canada by the Vancouver route seems to be destined to open up a great trade between the Australian colonies and the Dominion; and if a little reciprocity could be brought about between Australia and the United States it would probably be to the advantage of both. At present enormous quantities of American pine are imported by us, for though Australia is exceedingly rich in hardwoods, the colonial pine is not of first-rate quality. With regard to the hardwoods, however, they are better and of more numerous variety than those of any other country. A splendid collection of these timbers was forwarded to the Chicago Exhibition where they should attract more than passing attention.

An Australian in America has lately suggested in the columns of the daily press, that a trial shipment of hardwood blocks should be forwarded to San Francisco, for if the people of the Californian State could be once persuaded to experiment with them for street-paving purposes he is certain that they would be adopted in a very large degree by the authorities of all the principal cities in the United States. When well laid they make a clean, smooth and not expensive roadway, which will last a life-time, and cost very little for repairs. The only drawback is that when slightly wet they are rather greasy and therefore somewhat treacherous for horses, but this defect is obviated here by sprinkling sand over them. It is owing to the use of these blocks that Sydney promises shortly to have the best laid streets of any city in the world.

THE ARCHITECT, THE ENGINEER, AND THE CONTRACTOR.

THE following is a paper read by Mr. G. Allen Mansfield at a meeting of the Institute of Architects of New South Wales, held during the last week of July:

There can be no doubt that in some important particulars the duties which devolve upon the architect of the present day, and the demands upon his knowledge and skill, differ from those pertaining to the architect of a generation ago. New developments have taken place in the requirements of everyday life, and new conditions have arisen which increase the scope of his field of labor. It is in the treatment of structures for business purposes that we must look for the most striking changes which have taken place within a comparatively recent period. In planning a dwelling-house, whether it is to be the lowly cot, the middle-class villa, or the lordly castle, we have to provide for the same needs of comfort, convenience, and fitness as did our predecessors of a century ago. In the details of its construction and finish there may and do enter in many modern improvements, but these are rather in the nature of appliances than integral parts of the structure which forms the home.

It is when we leave the region of domestic architecture and enter upon the field presented by the requirements of the modern warehouse, the hospital, the hotel, or the factory, that we are brought face to face with the fact that we have to deal with much that is not entirely to be expressed by the term "architecture," that we are called upon to provide for many and various mechanical appliances, and that even into the construction of the building proper there enters an application of materials which renders imperative an extension of our knowledge, and of our ability to deal with them. Of chief importance amongst these is the extensive introduction of iron and steel into most of the large buildings used for business purposes, while the requirements for lighting, heating and hoisting of goods have made indispensable the introduction of mechanism and often of motive power.

The use of iron and steel for constructive purposes, and the use of mechanism for the daily business functions of the building, are, however, not to be confounded. They form two distinct and separate items in the designing and carrying to completion of a structure such as we have under consideration. It would seem from recent discussions on the subject which forms the title of this paper that in some way — unaccountable to my mind — there has arisen a tendency to confuse the two things, a tendency to assume that the mere presence of iron or steel in a building necessarily implies the presence of an engineer; that iron and steel are materials of which engineers have of right the whole and sole monopoly; and that for an architect to encroach upon that domain is something approaching to piracy, if not to sacrilege. He must promptly be warned off that holy ground.

It is true a bard has written:

> "Ah! me, what perils do environ
> The man that meddles with cold iron."

But I do not think the context conveys the idea that the poet had in view an architect laying profane hands upon that which was consecrated to the tutelar deity of the engineer. No; if in the development of modern buildings there has come about a need for the use of these materials, the lesson to be learned is that so much the more must the architect give study to the nature of these materials and to the best methods of utilizing them. If it is necessary that he should be acquainted with the properties and uses of brick, of stone, of timber, and the thousand and one other productions of nature and art which enter into the composition of his building, equally necessary is it that his studies should be applied to iron and steel. Why, I would ask, should these two articles be singled out from all the rest as unsuited for him to deal with? Why in this instance alone should he be expected to call in the aid of some other expert to assist him in an important part of the designing and execution of his work? Why not have an adviser about brick, an adviser about stone, and so on *ad infinitum*?

Be it far from us to impose upon ourselves any such system of leading-strings. It is in my opinion of the last importance that the architect should retain the full mastery and control of his own designings. And after all, the demand made upon our acquirements for the proper mastery of this subject is not a very severe one. The problems of strengths and strains which enter into the study of the ironwork of even the largest buildings are not of a very abstruse character. The most ordinary amount of care and a moderate acquaintance with the accepted formulas of iron and steel calculations should suffice to render the chance of serious error almost infinitesimal, the more so as the necessity for extreme economy of material has practically no existence in our works. In the construction of a "Forth Bridge" it is easy to see that economy of material demands the most careful study — the enormous quantity used, and the fact that the weight of the very structure itself forms the greatest part of the strain to be provided for, render imperative the most rigid scrutiny of the scantling of every part. In ordinary building works these conditions do not prevail. The amount of material used is comparatively small, and a little excess of strength is of no great consequence. Indeed in building there is often a good deal of nonsense talked about "economy of material." The cost of the rough materials of a building bears so small a proportion to the cost of the labor bestowed upon them, that a little more or less affects in a very small degree the ultimate cost of the whole.

Indeed the general fault is that too little material is put into the work rather than too much. Flimsy structures — skimped and starved in material — are to be found in every suburb by the thousand; but where are we to look for instances of the too lavish use of that which gives substance, solidity, and durability to a building? And if in the arrangement of the ironwork of a building — if in its contrivance for use and ornament, and the calculations for its strength — the architect finds no great difficulty, neither should he in the supervision of its execution. A reasonable amount of observation and care should bring the young architect to such a knowledge of how ironwork ought to be done as to enable him to efficiently supervise the execution by the contractor of the work intrusted to him. The eyes to see, the hands to handle, and the intelligence to discriminate which serve him in his judgment upon a brick arch, a concrete foundation, or a framed timber roof, will suffice to direct him in his criticism upon the workmanship of an iron girder, or the soundness of an iron casting. In either case a certain amount of experience is presupposed, and that experience it must be his business to acquire. And here I would say a word of warning against an overstrained reliance upon formula and calculations. That these are often desirable, and sometimes indispensable, goes without saying, but the man who finds himself obliged slavishly to rely on them is not a born constructor. As there is a gift in art — as a poet is not made but born, so it is in construction. Not all the mathematics in the world will supply the place of that intuitive recognition of forces which is the gift of the born engineer. Neither will they confer the wisdom which is the outcome of experience and of long familiarity with the handling of materials. Indeed, in many cases — and more particularly in works on a small scale, calculations may be worse than useless — they may be positively misleading. In estimating the stability of a small pier or the equilibrium of a small arch, he is but a poor creature as a constructor who would not rely on the judgment of his own eye and his own innate consciousness of what is safe or unsafe rather than on all the mathematical calculations that could be crammed into a ream of foolscap.

This, however, by way of parenthesis. I take it, then, that I have indicated a clear and well-defined limit within which the special function and prerogative of the architect is not to be encroached upon, viz, the designing of the building proper in all its parts — its stone, its brick, marble, concrete, timber, iron, steel, tiles, slate, plaster, glass, are all the units of the mass — to be arranged and disposed of, and wrought into a harmonious whole by the influence of one mind and under one inspiration. I have drawn, as I think, with sufficient clearness, the line which, in every aspect of professional practice and of common-sense, must of necessity mark the boundary which divides the province of the architect from the province of the engineer. To repeat, it is summed up in the words "the design and construction of the building proper." We have now to consider the mechanical appliances which are required to fit the building for the business operations which are to be carried on therein. And here we call in and gladly welcome the coöperation of our twin brother the engineer. In the case of a large hotel we shall need passenger-elevators — baggage-lifts — driven by steam, by gas-engine, or by hydraulic power. We shall need electric-light, and possibly the motive power to produce it. Steam will be required for

cooking and for hot-water supply. Cold-storage must be provided. If it is a warehouse we are concerned with goods, and passenger-elevators will be required, and probably hydraulic-presses for packing. In the factory steam-power will almost certainly be a necessity, and soon throughout the whole range of business establishments, not even excepting those temples of Mammon known to the moderns as "banks."

To ensure the proper arrangement and successful working of all these mechanical appliances it is advisable at a very early stage of the proceedings to consult a skilled engineer. The architect should have such a general knowledge of what is likely to be wanted for these purposes as will enable him at the very earliest inception of his design to include the requisite provision of space in the general scheme of his plan.

But the sooner his general knowledge is supplemented by the more exact knowledge and experience of a properly-qualified engineer the better, the more likely he will be to save himself an infinity of worry and anxiety in the future, the more certain he will be to give satisfaction to his employers, and the fairer chance will he give to his coadjutor to do himself justice and to lay out his plans so as to ensure success. It has been said, and, I think, with some truth, that too often the engineer is not called in until the building is well forward towards completion, and that it is often found necessary to pull down a wall here and punch an opening somewhere else, and generally to pull the work about in that fashion which is so exasperating to any builder of a well-regulated mind, and after all, probably, the unfortunate engineer is cribbed, cabined and confined as to his machinery, and forced to adopt expedients which are not approved by his better judgment, but which are thrust upon him by the exigency of circumstances — circumstances which he has no right to be placed in did his brother Chip, the architect, but give him fair play from the start. It is, indeed, of the greatest importance that the engineer should have opportunity of conferring with the architect at the very outset as to the provisions necessary to meet his requirements. Having made these known as to floor-area, chimney-flues, well-sinking, etc., the architect can make all necessary preparations, and, having done this, his dealings with the machinery and his responsibility connected with it are at an end. From this point he should resign the full control thereof to the engineer, reserving to himself only the right to put a veto upon any little eccentricities which may develop themselves to the detriment of appearances or stability in his building. Working on these lines, the architect carefully maintaining a full charge and responsibility for his own proper work, and taking early into his confidence the engineer, and providing properly and sufficiently for his wants — the engineer placed in a fair position to devise and carry out his arrangements to the best advantage — working it, say, on lines such as these, the twain may well walk amicably hand-in-hand, and cooperate in the most friendly and harmonious spirit to produce the happiest results.

It will be noted that, in considering the relations between architects and engineers, I have confined my remarks entirely to the case of an ordinary building — a building intrusted in the first instance to an architect, and in which he requires the assistance of an engineer. I have restricted my attention to this because it seems to be the phase of the question that most immediately concerns us. It is the occasion on which we are most frequently brought into contact, and, therefore, the most practicable and serviceable subject for inquiry at the present moment.

I do not forget the many cases in which our works approach each other so closely as to be not easily distinguishable, as the designing of railway-stations and engine-houses, the decorative treatment of canal-works, bridges and the like; but these of themselves form so extensive a field of discussion that I have thought it more profitable to limit my remarks to the special subject with which I undertook to deal. Before quitting altogether the subject of coöperation between architects and engineers, it may not be out of place to refer briefly to the new development of building-construction which is now going on in America, where iron and steel are made to form so large a proportion of the structure that all the rest sinks into comparative insignificance.

I admit that I have yet much to learn about the details of this new system which seems to treat the building as composed chiefly of an elaborate structure of iron framing and columns, with concrete floors, and to regard the walls as a mere skin to enclose them, but I cannot bring myself to feel that this is the spirit in which the creation of any great building should be approached. From an architectural point-of-view, it is impossible to believe that any realization of beauty, grace or grandeur can result from such a cold-blooded treatment of materials. It is certainly devoid of all poetry and of all sentiment, and to rob architecture of the poetry and the sentiment which lend a charm to so many of the triumphs is to dethrone her from her high estate, to disestablish her as an art, and to relegate her to the rank and file of the mechanical crafts.

The genius which found expression in a Corinthian order — in a Temple of Luxor, in an Alhambra, in a St. Mark's Library at Venice, a Westminster Abbey, a St. Peter's at Rome, or in any of the great examples which form the glory of our art in all its varied forms and adorn its history, is not the genius which can be evolved out of these hideous combinations of materials — these two painfully utilitarian productions of a prosaic age. They are, as I think, the outcome of a too great theoretical striving after a fireproof construction — a too complete engrafting of the work of the engineer upon the work of the architect, and as such they may serve as warnings of the danger of such a tendency — the danger that is incurred in allowing that which is supposed to be eminently practical to overshadow all that is artistic and beautiful.

We pass now to a review of the relations between the architect and the building-contractor. Here, fortunately, no difficulty presents itself, and no complications are encountered. Their separate functions are so clearly defined that it is necessary only to adhere to the most ordinary rules of everyday practice to avoid all chances of misunderstanding.

The builder is the executive charged with the duty of erecting the structure planned and contrived by the brain of the architect, and, though he acts under the general guidance and control of the architect, the ultimate success of the work depends in no small degree upon the amount of zeal, fidelity and intelligence which he brings to bear upon it. That these conditions are by no means rare amongst us is abundantly evidenced by the excellence of the workmanship and materials to be found in so many of the more important buildings in the City of Sydney and suburbs. Careful and conscientious architects make honest and trustworthy builders. I can imagine nothing more demoralizing to the building trade than for an architect to tolerate work of a character inferior to that required by his specification.

A— tenders for certain work, with an honest intention to use only materials and labor of the best, and regulates his price accordingly. B— obtains the contract at a price perhaps considerably lower, uses cheap materials and inferior workmanship, and pockets a good profit out of it. What is the lesson taught to A—? Certainly not a salutary one. Hence it follows that the more firm an architect is in requiring a faithful execution of work by the contractor, the more does he further the interests not of his client only, but of all upright and conscientious builders. It is of importance, too, that the builder should be furnished in good time with all the information necessary to enable him to proceed expeditiously and systematically with his work. Delay in the preparation of detailed drawings and in the decisions to be given by the architect upon the numerous questions that crop up from time to time means vexation to the contractor, and often a serious curtailment of his legitimate profits. Much friction and unpleasantness between architect and builder may be obviated by a timely settlement of all questions of extra cost or value of deductions as they occur during the progress of the contract. I do not for one moment suggest the abolition or the weakening in any degree of what I look upon as one of the most important prerogatives of the architect, viz, the power conferred upon him by the agreement and conditions of contract to appraise the value of extras and deductions. This I would jealously maintain as an absolute necessity of our practice. Subject as it is to the reference to arbitration, it is not a privilege likely to be abused, and, when judiciously and fairly exercised, it constitutes a healthy safeguard of the interests of our clients. Still, in the more important variations which are liable to take place in even the most carefully thought-out scheme, it is better to get the question of quantities and values settled at the time, and I have found the plan to work very smoothly.

A few words in conclusion as to the attitude of the public towards the profession. I regret that I cannot regard this as altogether satisfactory. Critics we have in abundance and to spare, but of those who can appreciate good work and value it at its true worth the number, I fear, is very limited. This arises in no small degree from the absence of a satisfactory education by the press. It is, perhaps, too much to expect that a highly-cultured criticism of our works should be provided by the daily newspaper; the high pressure under which it is produced may not admit of this, but it cannot be said that the ordinary reporter's descriptions which appear from time to time do much to educate the popular mind. But a cause more potent than this lies at the root of the evil. It is the preponderance of the commercial spirit over the artistic. Possibly this is natural in a young country where art has not yet had time to take a strong hold on the people — where competition is keen, and where the man is most highly esteemed who can get the most for his money. This it is which often exercises an undue influence on the architect, who would fain do good work, but who is too tightly restricted in the purse to give him the opportunity he longs for. This it is that induces men to give their work directly to a builder, without employing an architect at all, hoping and believing that they thereby save his commission. This it is that leads men to make hard bargains with their architects, and to fall a prey to the two-and-one-half-per-cent practitioner, under the mistaken idea that they are doing a smart thing. I do not say that this is the rule. There are many, and I acknowledge it with satisfaction, who extend a generous support to our profession, many whom it is a pleasure to serve with all one's heart; but the fact remains that there are enough of the baser sort to exercise a very pernicious influence on the rising generation of architects.

Some there are who dispense with the services of an architect from that stupid, and, I trust, wellnigh exploded, idea that they do better by placing themselves in the hands of what they are pleased to call "the practical man," meaning thereby the mechanic; as if, of all men on the face of the earth, the architect or engineer who is worth his salt was not out and out the most "practical man"; as if his whole life was not spent in the practical work of reducing the creations of his brain into concrete form and substance.

I yield to none in a hearty liking and respect for the honest and capable tradesman — for the mechanic who takes a pride and a pleasure in his work. He plays his part, and that right well, in every building that passes through our hands, and I cheerfully accord him the fullest meed of praise for the intelligent and faithful discharge of his duties; but I also know with a certainty that admits of no doubt how absolutely necessary it is that he should have the guidance and correction of a properly-trained architect.

For some cause difficult to explain, it does seem to me that an architect here does not derive the fame or reputation from his works that attach to them in the older countries of the world. It would be interesting to know how this arises, but that it is the case can, I think, hardly be disputed. I should be glad to be convinced to the contrary. Posibly the fault rests in some measure with ourselves. Whether this be so or not, let us do what in us lies to amend the evil. Let us gird up our loins and strive for still better and nobler results from our labors; strive to put such heart and such power into our work as will compel the respect of our fellowmen, and place our beloved art on the same proud pedestal in this Australian world as she occupies in the European world.

DISCUSSION.

AN adjourned meeting of the Institute of Architects of New South Wales was held at their chambers, O'Connell Street, August 4. The purpose of the meeting was to open a discussion on Mr. Mansfield's paper on "The Architect, Engineer and Builder."

Mr. Norman Selfe read the following paper in reply to Mr. Mansfield: As the Council of the Engineering Association of New South Wales invited the leading architects of Sydney to take part in discussing a paper on the relative position of the architect, the engineer and the builder in modern works, read by me at their June meeting, Mr. Mansfield's paper on precisely the same subject has presumably been written to present the matter from the architect's point of view. My thanks are therefore due to the Council of the Institute of Architects for their courteous invitation to take part in this discussion. In the first place, it is only just to Mr. Mansfield to compliment him on the general tone and high literary character of his paper. Much of it no doubt is so true as to be beyond controversy, but many things which might almost be looked upon as platitudes are clothed in such elegant and forcible language as to come upon us with the effect of new truths. Now that the public has had an opportunity of reading them in the columns of the daily press it is to be hoped that they will be pondered over by a large section of the intelligent community. Mr. Mansfield's paper deals rather more in generalities than is usual in papers read by members of learned bodies, and it certainly seems a pity that he entirely omitted to refer to any of those real vital points affecting the relation of the architect and engineer in the construction of buildings which were raised at the Engineering meetings, where they were clearly and specifically put forth for discussion. Mr. Mansfield has, moreover, with much that is good, committed himself to some sentiments and statements which will hardly be reciprocated by engineers, and it will be as well to quote them clearly before attempting to show how and why they are open to question. Mr. Mansfield says: "From recent discussions on the subject forming the title of the paper" (referring presumably to the Engineering Association) "there has arisen a tendency to assume that the mere presence of iron or steel in a building necessarily implies the presence of an engineer"; "that iron and steel are materials of which engineers have of right the sole monopoly"; and further on he asks: "Why should iron and steel be singled out and be treated differently to brick, stone and timber?" The reply to this is that Mr. Mansfield has quite misunderstood the discussion at the Engineering Association, for having taken copious notes of what was said for the purpose of reply enables me to state positively that not one speaker there intimated that he considered architects should not use iron or steel in a building at all without the advice of an engineer. Of course hundreds or even thousands of tons of metal might be built in as plates, bonds, ties, or in many other ways to a structure without coming under the head of engineering, just as thousands of cubic feet of marble could be used in a building without coming under the head of sculpture. What really was assumed was this: First, the presence of complicated engineering structures of iron or steel in a building should imply the presence of an engineer somewhere in connection with it; and secondly, demands it, if there is not to be a great waste of the client's money. If a building is to be adorned with sculpture, no architect dreams of sending to the marble mason or statuary for a group to fill a given space so many feet long, wide and high; but the sculptor prepares the model before the statuary sets to work upon the block, if a work of art is wanted. In like manner, if a scientifically-constructed piece of girder work is wanted (and properly designed girders are scientifically constructed) then accurate detail drawings showing the position of every "butt" and "rivet" should be prepared, and nothing should be left to the workman to design. It is not the question (as seems to be argued) whether an architect could learn to design girders, because it is certain he could do so if it was worth his while. The fact brought to the every-day notice of engineers is that he does not do so, and the dreadful character of some of the girders used in Sydney buildings has been clearly shown by recent speakers. The reason for this is not far to seek. When a young man aspiring to be an architect has served a term of years to a builder in order to learn the practical part of his business, and then has served his articles in a regular architect's office, and then, after having been entrusted with responsibilities, both as draughtsman and clerk-of-works, he has travelled on a sketching tour to further qualify himself to commence practice on his own account — he has already sacrificed sufficient of the best years of his life, and has got enough irons in the fire, without going-in for a course of applied mechanics, construction in iron, and workshop practice, to enable him to grasp questions which may only present themselves to him at long intervals. When he sees that he has brother professionals around him who are specialists in such matters, he will probably realize that such a game is not worth the candle. Mr. Mansfield says further: "In building there is often a good deal of nonsense talked about economy of material . . . . a little more or less affects in a very small degree the ultimate cost." And again he asks: "Why should iron and steel be treated differently to brick, stone and timber?" He also warns us against "relying too much on formulas and calculations," thinks a constructor a poor creature who could not estimate the stability of a pier or the equilibrium of an arch, by the judgment of his eye and his innate consciousness of what is safe, "better than by mathematical calculation." Now nothing in Mr. Mansfield's whole paper is more interesting, as showing the mighty, great gulf which exists between the engineer and the architect, than the foregoing extracts. With regard to his idea of throwing iron or steel into a building, and treating it in the same way as brick or stone, it seems to have been quite forgotten that while a few cubic yards of brickwork more than is necessary is neither here nor there, as it will only cost from 30*s.* to 40*s.* a yard, the price of the best girder-work may be put down at ten thousand per cent higher, because a cubic yard of finished girder-work often costs £150. It has been already shown that there are cases in Sydney where clients have had to pay thousands of pounds for totally unnecessary cubic yards of iron or steel in their girders, and no doubt this fact of the utter dissimilarity to brick and stone being lost sight of by architects has had much to do with it. Had calculations been adopted instead of "trusting to the eye" and "treating all materials alike," no doubt the money would have been saved. As for "ignoring formulas," no man should use a formula he does not understand, and then he will only use it like any other tool — to expedite his work. There certainly are cases where arches and piers are used for which there is no formula, and in which the architect must rely on his "innate consciousness," such as in the arches of double curvature which are so common at street corners on the rounded angles of buildings. These constructions, of course, are not arches at all, except in name, and it is doubtful if one of them was ever built by an engineer; but the experience of the architect in the cohesion of his mortar, and his trust in his materials, enables him to erect such works with confidence, and often to adorn them with a curved pediment or other enrichment more or less elaborate. With regard to the employment of machinery in a building, Mr. Mansfield advocates the calling in of a "properly-qualified engineer at an early period," but he does not make it at all clear whether he advocates the practice which now prevails to some extent in Sydney of an architect placing himself or his client in the hands of the contractor who is to supply the machinery, and of adopting such contractor's views, instead of himself or a competent engineer supplying plans for the sontractors to tender on. There seems to be no difference whatever in principle between the former course and the practice which Mr. Mansfield so deplores when he says, "some there are who dispense with the services of an architect from the stupid, and, I trust, wellnigh exploded idea that they do better by placing themselves in the hands of what they are pleased to call the practical man." "As if, of all men on the face of the earth, the architect or engineer who is worth his salt was not out and out the practical man." Just so: and if people are stupid for going to a building contractor without the intervention of an architect, are they wise for going to a machinery contractor without the advice of an expert engineer? It would be most interesting if Mr. Mansfield in his reply could speak out clearly as to whether he justifies the latter practice while he deplores the former, and if so on what grounds, because it appears to me (without going at all into the question that in such cases the plans which are paid for are not prepared, and other grave objections to the practice) that if architects are justified in undertaking works of mechanical engineering for their clients, then engineers who have made such work their special study for years will be justified in entering into competition as architects for the whole building. It would grieve me much to see such a competition arise, and it is to be hoped that the dignity of the two sister professions may be upheld by the members of each walking in their own special paths, and that a good understanding between the leading practitioners on each side, such as now exists may be maintained. In such a case we should find that "professional men's services would not be so frequently dispensed with" as they are now, and "they would reap more of that fame and reputation" which Mr. Mansfield refers to at the end of his paper. With the noble sentiments of his concluding paragraph one must fully agree, and as one who has travelled far and studied a long time, that he might not only see, but understand and appreciate the works of the great architects of past ages, the members of this architectural institute of New South Wales may depend upon me, a member of the sister profession of engineers, to do all in my power to help to exalt their noble art in this city, and (using Mr. Mansfield's own words) put it "on the

same proud pedestal in this Australian land as she occupies in the European world." Mr. Dawes, of Melbourne, spoke on the part of the engineers; Mr. John White, Mr. Jones, Mr. Carpenter, Mr. McIntyre, Mr. Prichard and Mr. Davy for the builders.

THE CHICAGO EXHIBITION AND ITS SUCCESSOR.

VIEWED from the standpoint of art, and regarding architecture exclusively as a fine art, the outer aspect of the Exposition has disappointed every one in being grander, more harmonious and in every way appealing more fully to the sense of fitness to its distinctive purpose than had been anticipated. That distinctive purpose was, however, limited to an exhibition or display of what has been accomplished in all branches of work. This show is arranged without much regard to the progress of each art, and little or no effort has been made to present the historic and systematic development of each branch of industry so as to make it as instructive to the student of social science as it is interesting and entertaining to the everyday visitor who comes only to witness the wonders which have been achieved.

The distinction which is intended is witnessed in the largest building, devoted to manufactures and to the liberal arts.

The section which is devoted to manufactures is a great bazaar, lacking only the element of sales and purchases in its resemblance to a huge salesroom. As such it is admirable and effective, but one who desires to study the development of manufactures must search long and wearily, and even then will get a very incomplete conception of how the work is done by researches both in this or in the Machinery Building.

On the other hand, the department of the liberal arts contains a very complete and systematic exhibition of the processes and methods of education from the kindergarten to the university included. A true industrial exhibition would show every step in the process of conversion of the fibre from the field through the factory to the bazaar for the display of the fabrics; every step in the conversion of ores and coal through the furnace, the mill and the machine-shop into the tool or the machine.

It is true that one already informed may make such a research on many lines, but there are very few examples of systematic and complete development in the processes necessary to the production of any one group of important products, so arranged that the progress of the art can be readily comprehended. . . .

One of the exceptions may be found in the exhibit of the Baltimore and Ohio Railroad Company, which is historically complete. In fact, the Transportation Building, its appliances and its contents, may be almost wholly excepted from the criticisms which are submitted on most of the other principal structures.

The Fisheries Building, of which the sole purpose is to mark the present stage of science in its application to the work, may also be named as one of which the motive of the architect has been wholly consistent with its purpose. . . .

On the other hand, it must, I think, be admitted that, so far as the construction of the most of the principal buildings are concerned, admirable, successful and satisfactory as they are for the limited purposes of display which have been named, there is only here and there a single and somewhat inconspicuous building from which any lesson can be learned that can be applied in practice outside the purposes of an exhibition of this kind. The art is there, the artist is there, the purposes of a great show are fully met in a high sense, and not in a low one, but that is the end of the matter. Aside from a few elements of construction, especially in the trussed arches of the Manufactures and Liberal Arts Building and a very few of the less conspicuous buildings, there is hardly a building in the grounds from which any lesson can be drawn for application in the common arts of life.

It may happen, perhaps, that some of the best lessons in architecture which will be derived from the Exhibition may be learned by a study of the little two-story brick house to which very few of the common sight-seers give any attention, which has been set up as a model dwelling-house for persons of small income by the people of Philadelphia, or from the workman's cottage, built of wood, which forms a part of the New York State exhibition.

The Machinery Building, for instance, is a superb building; it covers-in and shelters from the weather a wonderful miscellaneous exhibit of machinery; yet the building has no relation to its contents, and there is no typical machine-shop or factory building within the grounds. No one visiting the Machinery Building would learn from that how to construct a machine-shop or a factory in which machinery is to be operated. The art displayed in this building has no relation to its purpose, and is wholly unsuitable as an object-lesson in industrial construction. In modern practice, the building is a part of the mechanism, and art cannot be fully and truly exhibited except in a building which is developed from the interior motive of the branch of industry that is to be conducted in it.

It may be held that the great fault of the architecture of this country, especially manifested in this Exposition, is that the æsthetic conception of the architect is not governed by the motive of the building itself. The whole architectural display is wonderful, beautiful and satisfactory within the limits of its purpose. It may be wholly justified because its scope was limited, yet how little there is in this grand display of architectural skill that can be carried away from the gates of the Park for application to any purpose whatever except a similar show.

There are typical examples of American architecture so far as such term has any application in some of the State buildings — some very good, some very bad. May not the reason, perhaps, be that we have no national school of architecture, that we have not yet emerged from the condition of being copyists of other types developed under totally different conditions from our own. Even in copying we have only succeeded in rare instances in developing true art, especially in industrial buildings. In city warehouses greater progress has been made, but more remains to be done than has yet been accomplished.

Leaving this exterior aspect of the Exposition, we may now deal with its real motive, and seek to define the great forces from which it has, in fact, been developed, although perhaps not on the lines on which the next International Exposition will be established. These underlying material forces, of which Chicago itself is but an expression, are food, fuel, timber and metal. The immaterial force, without which all these elements of life would go for naught, is the common school. To the student of social order, the exhibition of these underlying forces, the Columbian Exposition, leaves nothing to be desired. Wherever one goes these factors in human welfare are present.

After one who desires to comprehend the inner secret of this exhibition has taken the first impression of all the buildings from various points, it is better to begin a closer investigation in some of the State buildings. None can be selected more suitable than the building erected by the State of Washington, one of the youngest in our group of States.

On approaching it, the flag-staff of a single stick of fir over three hundred feet high will call attention to the foundations, which consist of the timber of Puget Sound, the source from which nearly the whole supply of useful timber for all countries that border upon, and and of all the islands or continents within the Pacific Ocean must derive their supply, the timber of the tropics and southern hemisphere being, as a rule, either too hard to work for ordinary purposes or too soft for common use.

Passing up the steps of the annex, one enters rooms in which an exhibit is made of the public schools of this young State, from the kindergarten to the high-school, inclusive, marking a development of free education among the people which cannot yet be equalled in Great Britain. Passing from that to the central room of the building, one witnesses a wealth of products, especially grain in all varieties, that cannot be excelled even under the most scientific system of high farming in any other country, the first conspicuous exhibit being a pyramid of bags of wheat containing in all one hundred and one bushels, with a fraction over, certified to have been the product of a single acre of land. Passing by the artistic model of a Washington farm in the centre of the room, showing all its appliances and all the elements of mechanism that are made use of, one finds in the next annex a display of ore and coal which will prepare him in some measure for what will be examined later in the Mining Building.

Bearing in mind the growing scarcity and increasing cost of coal in European countries, the student will not fail to remark the single lump of coal, wrought out in one piece from a Washington mine, weighing over fifty thousand pounds. It may seem extravagant to say that the resources of this country in fuel, as compared to all others, bear the ratio which that lump of coal bears to the ordinary fragment quarried from the mine, and yet that would not be a very extravagant statement of the fact. This great display of coal and coke is flanked on every side by equally abundant and excellent examples of ores of iron and of timber in its secondary forms that cannot be excelled.

The pictures upon the walls, not, perhaps, great in artistic merit, yet bear witness to the wonderful variety in the views of the forests, the glaciers and the mountains of the State.

Passing on from the Washington State Building to those of Iowa and Illinois, one finds again the grains and grasses made use of for decorative purposes in such profusion as to confuse the mind, coupled again with examples of deposits of coal and ore of every useful kind — sometimes many varieties from one State, at least one variety in abundance from nearly every great Western State which is known chiefly as a grain-growing State. Fortunately for the welfare of these agricultural States, in which the truly precious metals are found in such abundance, mines of gold and silver are not within their limits; they are confined to a few of the States and Territories that have not yet held an important place in agriculture, with the exception of California.

The great productive grain-growing States have nearly all of them been saved from the speculative and gambling phase which has led to so much waste of capital and to so many misfortunes in the mining States, while their products of grain combined so much exceed in value the relatively insignificant products of gold and silver as to make the comparison almost ludicrous. There are many grain-growing States in which the value of a single crop of that one State exceeds the product of the whole country in gold and silver. To the superficial mind, the glittering display of gold and silver ores and of their products, occupying some part of the State exhibits in many buildings, will be very attractive. To the mind of the student of social science, they are as rubbish compared with the display of food, timber, coal and iron.

Passing from the consideration of these great products in their crude forms, one may follow them through all their transformations; he may witness in complete and well-arranged exhibits in the Transportation Building the work of the engineer, by which distance has been sunk into a fraction of a cent a ton a mile. In the Agricultural Building he will find very numerous examples of the machinery by which the actual cost of human labor in the production of wheat, of which the four-pound or quartern loaf serves as the measure of the daily bread of the workingman and his family in England, has been reduced to so insignificant a fraction in terms of money that there is not a coin in Great Britain small enough to serve as the measure of the quantity of labor in a quartern loaf — not even the farthing. . . .

When the next exhibition shall be established at a tithe of the cost of the one now open at Chicago, less in area, but far greater in its influence and its impressiveness, it may not open a vision in its first aspect of what one of my friends called an "Hellenic dream," but it will be something yet more grand. It may happen that the architect of the future will be not only artist, but engineer, as he must be in order to be a master of his profession. On the lines of peace, good-will and plenty he will develop great examples of architecture corresponding to those of Michael Angelo, Leonardo da Vinci, Brunelleschi and others, whose works are immortal, although they were inspired only by a religion which has become superstition, and which found its expression in buildings of which the cost was largely met by the sale of indulgences. . . .

In laying the foundations of the next exhibition, the engineer, the craftsman and the student of social science will alike be called to the aid of the architect before the plans are determined.

It may be assumed that in the year 1900, or before, another exhibition may be called for. It is probable that before we reach that period the art will have been perfected of converting materials of low cost into a true artificial stone, of which the "staff" made use of at Chicago is but a beginning. The age of clay and of cohesive tiles will have been reached. We may then have exhausted the age of timber, of iron and of steel in the art of construction. A fireproof building will then be within reach at as low a cost as the slow-burning building is at the present time, at far less cost than the so-called fireproof buildings are now constructed, which so often betray the confidence of those who have trusted them. The art of combustible architecture, as commonly practised at the present time, consisting of a cellular tissue of wooden flues covered-in by a sham of stone, iron or brick on the outside, will then, I trust, have become a lost art, buried deep in the ashes of property consumed by fire at the present rate of nearly $150,000,000 a year, which may be mainly attributed to its practice.

A place for the next exhibition may be secured in the neighborhood of some great city where the visitors can be housed and fed, and towards which improvement is tending. An area equal to the requirements of a model town will be laid out, not with a view to the construction of buildings that will vanish like an "Hellenic dream," but with a view to laying out a true centre of industry, in which every building, as well as its contents, will mark the progress of science and invention in the useful arts.

It may happen that by that time, or sooner, it will have become safe to call upon the professional architect to aid the engineer in putting up industrial buildings, to the end that they may no longer be examples of all that is dreary, commonplace and ugly in construction. The true architect may then have learned to subordinate or to develop his artistic sense so as to render it consistent with the motive of the building which he is called upon to plan.

Within buildings thus constructed with a view to permanence, among which dwelling-houses may be mingled for the purpose of exhibiting progress in domestic architecture, and in the fitting of houses with simplicity and good taste, all the arts on which modern life rests for its comfort and welfare may be exhibited from the beginnings to the present stage in the progress of their development.

The building devoted to manufactures will not be a great bazaar or show-place; it will be a factory glorified by the imagination of the architect who can conceive of all the services that are rendered by him who builds and those who work in the factory, and in that conception may find inspiration. It will be constructed at far less cost in ratio to the space provided than almost any building in Jackson Park. It will possess the factors of light, air and ventilation, in which many of these buildings are wanting in fullest measure. It may be readily warmed in winter; yet more, it may be easily cooled in summer; it will be consistent with the setting up and permanent operation of every machine that is to be exhibited within its walls. While in use for purposes of exhibition, it may contain every type of textile art and practice thas has ever existed since the historic world began. . . .

Yet grand in conception and in construction as the Exhibition of 1900 may be, it will bear little resemblance to the present exhibition at Chicago. There is nothing constant but change. Of all that was exhibited in the first World's Fair of 1851, scarce anything but the idea and motive remains. The form and substance in which that motive was then cast have been thrown aside; nearly all the mechanism has become waste iron, steel and copper. Scarcely anything of that which was exhibited in the Centennial of 1876 now possesses any value for use in the form in which it was then constructed. Nearly every machine, every process and every form of art and industry that is now on exhibition in Jackson Park will in a single generation have vanished like the "Hellenic dream" that will disappear when the existing buildings are removed, never to be repeated.

The form and substance of the Exhibition of 1900 will then be another passing change, subject again to reproduction in another generation, when every form of capital will have become more perfect, and the rule of social order which is now being so rapidly developed will govern all who have any faith in the Higher Power which makes for righteousness. That rule is that, in proportion to the increase or to the effectiveness of capital, the share of the annual product that falls to the capitalist is increased absolutely, but is diminished relatively to the product. On the other hand, the share which falls to those who do the actual work in the operation of the machines and tools which form a part of our capital is augmented both absolutely and relatively to the end that, as time goes on, all the benefits of science and invention are distributed among the great mass of the population, justifying their application to productive industry by the development of common welfare as well as of individual wealth.

It may happen, however, that although the buildings that may be constructed for the Exhibition of 1900 will themselves be subject to displacement in one or two generations, yet at the time, and for many years after the exhibition has ended, they may remain in use as examples of the best types of science and invention and of architecture that had been attained at that period.

When these model structures are all built on unoccupied ground in the neighborhood of some great city, at a tithe of the cost of those which now excite our admiration at Chicago, and when they are connected by examples of the best highway and railway construction with that neighboring city, will such a collection of buildings vanish in a day like the "Hellenic dream"? Far from it. It will have become the model town in which many of those who have joined in the exhibition will desire to remain and to continue to practise the arts of which the historic development has already been brought into view. The best and most modern type of every example of mechanism and every process, having secured a standing in that model town, will stay there, giving value in use to the grounds and to the buildings far greater than their cost.

If this is a vision, may there not be men either near Chicago, where so much has already been accomplished, or next some other great centre in this country by whom this vision may be brought into solid substance, completing the work of which the Columbian Exposition, grand and beautiful as it is, is itself but the shadow? — *Edward Atkinson in the New York World.*

THE MIDWAY PLAISANCE AND ITS ATTRACTIONS.

THERE is one part of the Fair which has given rise to a greater number of opinions, more controversy, and, in fact, more expression of excited feelings, than all the rest of it put together. This part is that known as the Midway Plaisance, and here, at the outset, in the very pronunciation of the name, two distinct parties spring up. The word, in the old charts of the park grounds, is most certainly spelled "Plaisance," and is supposed to be the French word, as our English word of that spelling, according to the "*Century Dictionary*," is an obsolete one, the present form of which is pleasance, pronounced "plézans." There is, naturally, a large majority of uneducated people, who, glorying in the unusual luxury of a French word, bring out the good English Midway with indifference and the Plaisance with all the glory of the z sound in the middle, and the accent on the last syllable, which becomes with them an exaggerated *aunce*. There are, of course, many educated people who follow the general custom without much thought, while opposed to them is a feeble minority, who maintain that Midway should be coupled with a word as English as itself, and insist upon walking in a pleasance, as their ancestors have done before them for many a long year in Merry England.

And here controversy does not stop. The Midway (thus do we avoid the mooted question when feelings are too keen on the subject) consists, as every one knows, of one long street, opening upon which is a large collection of most interesting side-shows, made by the various more or less civilized nations from all over the globe. Their modes of living, their pleasures, their costumes and customs and their dwellings are all depicted. Though, of course, these shows savor somewhat of the catch-penny order, they are extremely interesting. In some of the less civilized nations they do not exactly harmonize with either our or Anthony Comstock's ideas of conventionality and propriety, so the Lady-managers, during the lulls in their internecine war, have flown to arms, and have uttered the warning note that such immorality as our youths had never dreamed

of was being laid out in attractive form before them. Of course, after such a declaration, no power on earth could keep the said youth away from the place, and the attractions must, therefore, cease. One enterprise, the Persian Theatre, they successfully battled with, but the rest of the theatres, dance-houses, etc., are still enjoying their merry existence, so the architectural student who would study some of the quaint and curious buildings in which the Midway abounds must run the chance of being overcome by the charms of some Dahomeyan amazon or flabby Oriental, unless he be fortunate enough to possess a friend among the Lady-managers who may be willing to *chaperone* him. But, be it said in all seriousness, to the architectural student who is desirous for and unable to attain to a sketching-trip abroad, this comparatively small section, the Midway, will afford more varied and unusual subjects than he would find in a long and expensive journey. There are, indeed, here, in this somewhat scorned and rejected portion of the Fair, more subjects for quaint and curious architectural sketches than in all the rest of the exhibition put together. It is really a pity that some serious work cannot be enjoyed in this place from models that have evidently had so much time and thought spent on them.

On entering the Midway, one of the first shows one comes to is the Irish village, where Blarney Castle rises above the low buildings. The cottages are of staff, treated with a rough surface, and when thatched roofs are used, as they are in a few, are rather picturesque, though the introduction of shingles on many of them causes them to lose their distinctive character. A beautiful feature, though, of course, a small one, is a really fine Gaelic cross on the village-green, where Patsie Flannigan daily dances an Irish jig, and sings "Kathleen Mavourneen" and the "Low-backed Car." If you avoid the time of these entertainments, as far as the crowd is concerned, there might be a chance here in even this, one of the least picturesque of the shows, for one or two good sketches. At one corner of the place is the cloister of Muckross Abbey, and, if we can believe the exclamation of one Hibernian lady, "Oh, Mary, if this *isn't* Muckross Abbey!" must be a very good reproduction of the original.

Across the main street from this Irish village is a little panorama of the Alps, the only architectural feature of which is a curious little proscenium-arch evidently used for some miracle-play in the Old Country. This show is, however, strictly moral, even the ladies who yodel and sing "Du Bergen lebe wohl" to the strains of the zither are kept *behind* the curtain.

Close to this the Libby Glass Company makes a very interesting display, one of the features of which is the spinning of glass-thread and subsequently the weaving of it into a most brilliant textile. This cloth, if so it may be called, is used for tapestrying the walls of one of the small show-rooms and would make a really beautiful substance for the treatment of the walls of some state drawing-room, if used in the place of satin or brocade. It seems quite flexible, and can be plaited or laid smooth, and would not seem as likely to be harmed by dust and smoke as silk. Its chief drawback would be its cost.

In the Murano Glass-works, nearly opposite to the Libby, one part of the working-exhibit consists of the production of mosaics, the subjects being old Venetian reproductions or modern designs, treated in about the same style.

The first of the villages where one feels far away from European civilization is that of Java. The houses in which the natives seem to live are not only thatched, but the walls are formed of prettily woven straw-matting. The houses are raised from the ground on posts more after the manner of the Siamese houses, though not so high as these, and the thatched roof slopes down over the little porch which seems to be at the front of each house. The outlines of the houses are very pretty and a decorative effect is further gained by the ridge-poles being twisted with some dark brown or black fibre, and by their terminating in spreading horns twisted in the same way. Some quite large structures are built in this same manner, the only difference between them and the more modest edifices being that of size.

Next in Midway attractions of any great importance is that known as the German village. This is most carefully carried out and affords several very charming examples of German mediæval open-timber construction, notably the "Hessian Town-hall" and the "Westphalian House." The "Black Forest House" is especially picturesque with its long sloping thatched roof, and its irregularity of eaves' line and façade. It contains in its upper floor an old Gothic room from the Tyrolean Alps of the time of the middle of the fifteenth century, and another from the southern slope of the Black Forest of two centuries later. An Upper Bavarian house, with its quaint ornamental devices of a semi-religious nature, is another attractive building of the place. A quite valuable museum is housed in a moated castle of mediæval times, while the restaurant which is established in the back part of this building is in quaint and attractive rooms. The castle is, of course, of staff, and where the wall touches the rush-bordered moat, the plaster is beginning to fall off. The design, however, of the whole building is striking and characteristic and would, as well as the other buildings mentioned, make really charming and suggestive sketches if one could give to them the time for such work. You enter the castle over a drawbridge where an ancient German *Ritter* condescends to receive your quarter-of-a-dollar.

Still farther to the west of the German village on the same side of the thoroughfare is the Street of Cairo, and here the Oriental illusion is quite complete. Here the donkey-boys and their wise-looking little beasts flourish in true Eastern vigor, here the camels swing their ponderous bulk up and down the narrow street, here you meet Nubians with their greased locks and dirty draperies, Soudanese with their tinkling goat-hoof belts, Arabs, Turks and Jews. For the artist the Eastern atmosphere is doubtless wanting, but to the architectural student these latticed windows and narrow doorways, these white minarets and picturesque walls, uneven in form and color, afford most excellent subjects for study and sketching. The old Moorish windows of natural unpainted wood in which the street abounds are especially attractive. To sketch, it would be necessary to visit early this most popular corner of the Midway to find a spot quiet enough for work. In nearly all of the other places, hasty, and perhaps, in some, even more leisurely sketching, would be quite possible. The winding street at Cairo is closed at its western end with an Egyptian temple covered with bright-colored hieroglyphics and although in this structure one hardly gets the dignity of the rock-hewn pile at Ipsanboul, for instance, still the shutting out of an Occidental feature that might arise on the outside is a good one, and the illusion is made more complete.

Next to Cairo stands the Algerian bazaar. The central feature of this is the theatre, while from either side of this are two arcades laid out in semicircles. The arcades are formed of Moorish arches, all of white staff, with blue and green tiles introduced, and form a very pleasing feature of the Midway.

"Old Vienna" is the name given to what would probably answer as well for any other old German walled-town of the Middle Ages. The theme is very carefully studied, and the result, both from the central street of the Midway and the interior court of "Old Vienna" itself, is very successful. Gabled and high-peaked roofs, decorated walls and the picturesque eccentricities of Mediæval German work here abound.

As we approach Old Vienna we pass the huge Ferris wheel, too well-known to need any comment here, and upon leaving Old Vienna we approach the settlements of more of the less civilized tribes. In the Samoan show the houses of the natives are not devoid of interest. They are round, hut-like structures, built on circular posts, the conical thatched roofs of which start at about four feet from the ground. A kind of straw-matting is rolled up at the eaves evidently to be let down in case of rain. The utmost peak of the roof must be about eighteen or twenty feet high. The entire finishing of the interior consists of a hole hollowed out in the ground for fire. The structure as well as the heavy wooden boat of the natives is entirely held together by means of a tough vegetable fibre.

Still farther down in the grade of comfort are the huts of the Dahomeyans, inasmuch that these admit of little light and air. They are straw huts, both as to roofs and sides, and are only interesting as being characteristic of the primitive people.

FOUNDATIONS.

PROBABLY of all the various systems employed for putting in the foundations of bridges, the pneumatic method is the least exposed to accidental interruptions. Even when the site can be laid bare by means of a coffer-dam, serious leaks may occur at any moment, and there is also the risk of floods, so that the engineer in charge has an anxious time of it till the masonry has been raised above water-level. By suitable precautions these risks can, no doubt, be minimized, and where the water is comparatively shallow, and one is not tied for room, the use of a coffer-dam will usually be the most economical plan that can be adopted. Much of the trouble experienced with such works is due to an insufficient allowance of room inside the dam. The inside dimensions should be, where possible, at least six feet more than the extreme dimensions of the foundation plus an amount equal to depth of excavation below the river-bed. Where as much space as this cannot be afforded, it is a good plan, after pumping out the dam, to drive stout sheet-piling around the exact site of the foundation. By means of walings and poling boards, the foundation can then be sunk to firm ground without fear of slips, which might endanger the safety of the dam. In such cases the foundation up to the river bed is conveniently made entirely of concrete, as then there is no necessity to remove the timbering supporting the sheet-piling, and it may accordingly be left in place.

Pile foundations are also often economical, but too frequently the piles are ruined by over-driving. It is far better to drive such piles to a moderate penetration, and use more of them. The cost of the extra piles will be largely made up by the less cost of driving. The practice of driving them to "refusal" cannot, as a rule, be too strongly deprecated, as a bass broom makes a poor sort of column, however efficient it may be as a sweeping implement. When drawn, as they occasionally are, over-driven piles are found to be split, bent, their ends crushed, and to have cast their shoes. In soft strata, piles will drive straighter and easier if they are not pointed or shod. When brought to a point, as is usual, it is impossible to keep them straight should a boulder or tree trunk be encountered when driving. In such cases, unless the point strikes the obstruction perfectly fair and square, it is sure to be deflected, whereas with a square-ended pile there is less risk of this. In compact sand it is impossible to drive piles to any depth by blows, but by the use of the water-jet they can easily be sunk any required distance. The safe load on piles under these conditions is difficult to estimate. They are held

in place partly by the friction of the sand against their sides, and partly by the upward pressure at the point. If we adopt Rankine's theory of earth pressure, the resistance of the pile should then be

$$R = A\,w\,x\left(\frac{1+\sin\phi}{1-\sin\phi}\right)^2 + \frac{S\,f\,w\,x}{2}\left(\frac{1-\sin\phi}{1+\sin\phi}\right),$$

where

A = effective area of cross-section of pile.
w = weight per cubic foot of material into which it is driven.
x = depth in feet to which it is driven.
ϕ = angle of repose of the material.
S = surface of pile exposed to friction.
f = coefficient of friction.

The first term is that due to upward pressure on the bottom of the pile, and denotes the load which can be placed on any area without settlement, when the surrounding area is loaded with $w\,x$ tons per square foot. If this load is exceeded, the foundation sinks, and the surrounding earth rises. In the case of a pile, however, the friction of the earth against the sides of the pile tends to prevent this rise of the surrounding material, and the practical effect is to increase the area of the base of the foundation. In addition to this, the friction on the sides tends of course to support the pile directly, as indicated by the second term of the above formula. The most uncertain element in this formula is the angle of repose ϕ. The less this is, the greater is the frictional resistance of the pile, and the greater the effective area of the pile, but the smaller is the factor

$$\left(\frac{1+\sin\phi}{1-\sin\phi}\right)^2.$$

These two considerations tend more or less to balance one another. The whole question is, however, beset with difficulties, but we do know that the resistance of piles driven into soft strata is often very remarkable. Thus piles driven thirty feet into such soft material that they went down from ten inches to twenty inches at the final blow, have safely carried the heaviest railway traffic for years, the load amounting to about seven or eight tons per pile. In fact, on testing some of these piles after they had been in place some months, they could not be moved further with the heaviest drivers available. Had the load been calculated from the last penetration of the pile when originally driven, the piles would have been loaded with considerably less than one ton. From these considerations it is obviously, in important work, advisable to determine the true bearing-power of a few piles by direct loading, the experiment being made some days, or, still better, some weeks after the driving. Where the strata is fairly firm, this great increase in bearing-power does not seem to take place, and the safe load can be calculated from the penetrations in the original driving.

The great danger to which pile foundations are subject is scour. One method of protecting them against this is to sink a cast or wrought iron cylinder round them to a depth below which no scour is to be feared. The space between the piles and the cylinder is filled up with concrete, and the group is thus effectively braced together. This plan is often cheaper than sinking the whole cylinder to a firm stratum by dredging. The piers thus formed are usually small in diameter, and have not much transverse stability. Hence for railroad bridges, where considerable longitudinal forces may come into play by the action of the brakes, they should be adopted with caution. In the case of ordinary road bridges, however, this point is of less importance, as such bridges are not exposed to longitudinal strains. The principal transverse stresses on the piers are then due to wind-pressure, which is easily provided for by bracing a couple of the cylinders together in the usual way. These cylinder piers have very considerable advantages in many cases, though in England they are not supported on piling, but are carried down to a firm stratum by dredging. If obstructions are met with, a diver can be sent down, or if the matter is more serious, it is easy to close-in the open top and complete the work on the pneumatic system.

Where larger piers are required in fresh water, there is much to be said in favor of the American system of building the under-water portion of the pier largely of wood. Much ingenuity has been expended, both in England and on the Continent, with a view to reducing the amount of metal left permanently in large piers sunk by the pneumatic or Indian well system. All the iron left in such piers is practically dead loss. Its supporting power is not taken into account, as it is necessary to fill the caissons with concrete, practically as much of this being required as if the metal were absent. True, it protects the iron inside it for very many years from injury, but it can hardly be expected to do so indefinitely, as in the long run rust must tell its tale. Timber, on the other hand, is practically indestructible when kept completely immersed in fresh water. It softens somewhat, it is true, but its strength remains ample for any load likely to come on it. As regards speed and ease of construction, there is no comparison between the use of iron and wood. The latter is incontestably superior. The material is brought to the site in convenient sizes, and worked-up into the pier with practically no other tools than augers and saws. Stone or concrete is built up with the wood, so that the buoyancy may not be too great, and when ready it is floated out to its site, without any such special arrangements as are needed with iron. When there it is grounded by weighting it with gravel or concrete, and the remainder of the sinking completed by the open dredging or pneumatic methods. — *Engineering.*

SOME CONSTRUCTIONS IN LINEAR PERSPECTIVE.

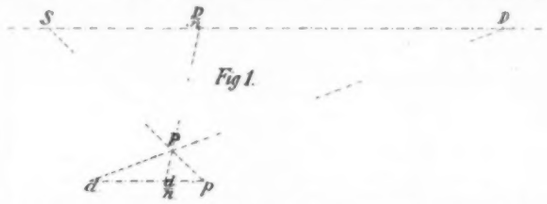


Fig 1.

IN the preparation of this paper it is assumed that the reader has some knowledge of the principles of Perspective. It explains a few simple constructions which will facilitate the operations of the draughtsman by avoiding the use of vanishing-points which fall beyond the frame of the picture, and thus enable him to do his work wholly within the limits of the plate or canvas.

Recalling the most elementary construction in Linear Perspective, let p (Fig. 1), be the projection on the picture-plane of a point in space which is situated a given distance d from the picture-plane. Let S and D be respectively the points of sight and distance. From p draw $p\,d$ parallel to the horizon and equal to the distance d from the point to the picture-plane. Draw $p\,S$ and $d\,D$. These lines intersect at P the perspective of the given point.

The same result may be obtained as follows: from S lay off on the horizon a distance $S - \frac{D}{n}$ equal to any n^{th} part of the distance from S to D; also from p lay off a distance $p - \frac{d}{n}$ equal to the same n^{th} part of the distance from p to d. From $\frac{d}{n}$ draw $\frac{d}{n} - \frac{D}{n}$ intersecting $p\,S$ at the same point P.

From an inspection of the geometry of Figure 1, we see that any fractional part of the distance $S - D$ may be laid off on the horizon provided the same fractional part of the distance $P\,d$ be laid off on this line.

The application of this construction to drawing the perspective of a solid situated at any distance from the picture-plane becomes a simple matter.

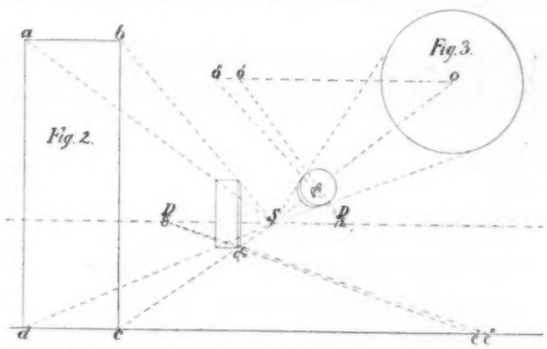
The points of distance are supposed to be three feet from S.

Example 1. — *To draw the perspective of a prism whose base is* 4″ *square and altitude* 12″; *the solid to be ten feet from the picture-plane; the rectangle* $a\,b\,c\,d$ (12″ × 4″), *Figure* 2 *being its projection on the picture-plane.*

From each of the points a, b, c and d draw lines to S. Lay off on the horizon a distance $S - \frac{D}{8}$ equal to one-eighth of three feet = 4½″. Lay off cc' one-eighth of ten feet = 15″; and $c'\,c''$ one-eighth of 4″ = ½″. From c' and c'' respectively draw $c' - \frac{D}{8}$ and $c'' - \frac{D}{8}$ intersecting $c\,S$ at $c_{,}$ and $c_{,,}$. Having obtained these points the draughtsman will readily complete the figure.

Example 2. — *To draw the perspective of a cylinder whose projection on the picture-plane is Figure* 3; *the diameter is* 6″; *length* = 12″. *The solid is to be nine feet from the picture-plane.*

Lay off from S to $\frac{D}{12}$ one-twelfth of 3′ = 3″. Through o the centre of the circle, draw $o\,o''$ parallel to the horizon. From o lay off $o\,o'$ and $o'\,o''$ respectively 9″, and 1″, *i. e.*, one-twelfth of nine feet and

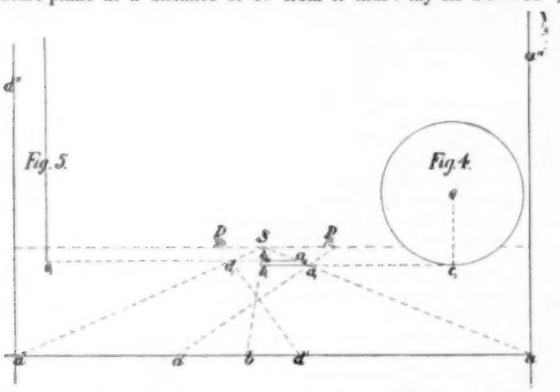


one-twelfth of 12″. From o draw $o\,S$, and from o' and o'' draw $o' - \frac{D}{12}$ and $o'' - \frac{D}{12}$ intersecting $o\,S$ respectively at $o_{,}$ and $o_{,,}$, the centres

of the perspective circles — the radii of which the draughtsman will readily determine by an inspection of the figure.

Example 3. — *To draw the perspective of a circle* (*Fig.* 4) *one foot and a half radius, the plane of the circle being parallel to the picture-plane, and situated at a distance of* 15′ *from it; the projection of the centre falling* 3′ *beyond the limits of the paper and* $1\frac{1}{2}'$ *above the horizontal plane.*

Draw a line $a, b,$ 12″ long in the horizontal plane parallel to the picture-plane at a distance of 15′ from it thus: lay off $a\,b = 12''$;



draw $a\,S$ and $b\,S$. Find a point $a,$ on $a\,S$ at a distance of 15′ from the picture-plane as follows: lay off $S - \frac{D}{12} = 3''$; also $a - a' = \frac{15'}{12} = 15''$. Draw $a' - \frac{D}{12}$ intersecting $a\,S$ at $a,$. Draw $a, b,$ parallel to $a\,b$; $a, b,$ is the perspective of the line, and may be employed as a 12″ scale, from which measurements may be laid off on lines situated at a distance of 15′ from the picture-plane.

We will suppose that $a\,a'$ represents the limit of the drawing-paper. Draw $a\,S$. Produce $b, a,$ and lay off $a, c, = 3'$; erect the perpendicular c, o and make it equal to the height of the centre of the circle above the horizontal plane *i. e.*, $1\frac{1}{2}'$. With o as a centre and a radius $= o\,c,$ describe the perspective circle Figure 4. All of these measurements are taken from $a, b,$ which may be called *the perspective scale*. The accuracy of the drawing may be tested.

The length of the line $a, b,$ should be equal to its true length (= 12″) multiplied by the fraction whose numerator is equal to the distance from S to D (= 3′), and denominator equal to the distance from the line to the picture-plane increased by the distance from S to D (= 15′ + 3′). The fraction is then $\frac{3}{15+3} = \frac{1}{6}$. Therefore the length of $a, b,$ 12″ $\times \frac{1}{6} = 2''$.

Example 4. — *To draw the perspective of a perpendicular line* (*Fig.* 5) 6′ *long and* 20′ *from the picture-plane, the projection falling* 5′ *beyond the limits of the paper.*

Let $d\,d''$ represent the limit of the paper. Draw $d\,S$. Find a point $d,$ 20′ from the picture-plane — thus: lay off $S - \frac{D}{20} = 1.8''$; also $d - d' = 12''$ or one-twentieth of twenty feet. Draw $d' - \frac{D}{20}$ intersecting $d\,S$ at $d,$. From $d,$ draw $d, e,$ parallel to the horizon. This line contains the foot of the perpendicular $e,$, whose distance from $d,$ will be equal to 5′ multiplied by the fraction $\frac{3}{20+3}\left(=\frac{3}{23}\right)$; *i. e.*, $5 \times \frac{3}{23} = 7.83''$. The length of the line (Fig. 5) is equal to 6′ multiplied by the same fraction *i. e.*, $6' \times \frac{3}{23} = 9.4''$. F. R. H.

THE ILLUSTRATIONS

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

ILLINOIS STATE BUILDING AND SURROUNDING STRUCTURES. MR. W. W. BOYINGTON, ARCHITECT, CHICAGO, ILL.

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

CHURCH OF THE HOLY SEPULCHRE, JERUSALEM.

IF the building in Jerusalem most revered by Moslems be the Mosque of Omar, the one most reverenced by Christians is the Church of the Holy Sepulchre. It is an enormous edifice with but very little claim to architectural beauty, founded about 300 years after Christ by the Empress Helena, mother of Constantine, first of the Christian emperors. In one sense it can hardly be called a church at all; it is rather a sacred exhibition building. Beneath its enormous roof are many chapels, altars, shrines, hills, caves, valleys and monuments commemorating all the localities mentioned in the Bible which can by any possibility be situated in Jerusalem. Among the places supposed to be identified within the limits of this church, are the Sepulchre of Christ; the summit of Mount Calvary; the places where Christ was scourged, crowned with thorns and annointed for burial; the spot where the true cross was found; the point where Jesus appeared to Mary Magdalen; the place where the Centurion stood during the crucifixion, and the grave of Adam. All these are the property of various Christian sects: Greeks, Latins, Armenians, Copts, Syrians and Abyssinians — all more or less jealous of each other and distrustful of each other's relics. Opinions of course differ as to the authenticity of these localities. But genuine or not, there is no doubt that the site of the Sepulchre itself has influenced the fate of nations more than any other spot on earth. It caused the greatest event of the Middle Ages (the Crusades) and for its possession and defence the best and bravest blood of Christendom has freely been shed.

BUSINESS BUILDING FOR JOHN SILVEY & CO., ATLANTA, GA. MR. G. L. NORRMAN, ARCHITECT, ATLANTA, GA.

THIS building, now under course of construction, is designed on the slow-burning principle with steel frame, solid wood floors and asphalt roof. The materials for the exterior are Georgia granite, Roman buff-brick and terra-cotta finish.

BUILDING FOR THE PROVIDENCE TELEPHONE COMPANY, PROVIDENCE, R. I. MESSRS. STONE, CARPENTER & WILLSON, ARCHITECTS, PROVIDENCE, R. I.

HIGHLAND INN, YORK, PA. MR. J. A. DEMPWOLF, ARCHITECT, YORK, PA.

THE BRITISH GOVERNMENT BUILDING AT THE WORLD'S FAIR, CHICAGO, ILL. MR. R. W. EDIS, ARCHITECT.

[Additional Illustrations in the International Edition.]

THE FINE ARTS GALLERY, WORLD'S FAIR, CHICAGO, ILL. MR. CHARLES B. ATWOOD, ARCHITECT, CHICAGO, ILL.

[Gelatine Print.]

NORTHWEST PAVILION OF THE AGRICULTURE BUILDING, WORLD'S FAIR, CHICAGO, ILL. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

[Gelatine Print.]

THE GUILDHALL, CAMBRIDGE, ENG. MR. W. M. FAWCETT, ARCHITECT, CAMBRIDGE, ENG.

THE Cambridge Town Council have long been much pressed for want of proper court and office accommodation, and have now resolved to make additions to the Guildhall which will supply new council-chamber, mayor's and councillors' rooms, police-court and county-court, with all the rooms wanted in connection with them. They propose also to build offices for town-clerk, town-surveyor, medical and other officers, so as to centralize the work of the town. The council-chamber and mayor's and councillors' rooms occupy the first floor to the front and the two courts face the side street, the offices being chiefly on the ground-floor. The basement has just been completed and tenders are being taken for the courts, so that they may be completed before the block they now occupy is pulled down. The original drawing was exhibited this year at the Royal Academy.

BIRMINGHAM MUNICIPAL TECHNICAL SCHOOL, BIRMINGHAM, ENG.: PLANS. MESSRS. ESSEX, NICOL & GOODMAN, ARCHITECTS.

ST. OMER, STRASBOURG, AFTER A DRAWING BY SAMUEL PROUT.

COMMUNICATIONS

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

CONSULTING EXPERT ADVISERS.

BOSTON, MASS., September 1, 1893.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — May I be allowed some space in your columns to call the attention of your professional readers to a matter, which, I think, will bear discussion, namely, the employment of experts for special work?

It will, I believe, be generally admitted that one of the chief duties of the architect after he has made designs for a building is to guard the interests of his client, and to see that he gets good honest value for his money, not only in the quality of the materials used in his building, but also in the manner in which they are used. To do this thoroughly and conscientiously in this age of "modern improvements," requires a large amount of experience and knowledge outside the limits of ordinary architectural practice.

Very few architects will, I think, claim to have a *thorough* knowledge of plumbing, heating and ventilation, or electric-lighting as applied to buildings of large size. Such subjects require not only special training and practical experience, but a different class of mind, a different temperament from the artistic and architectural, and moreover life is too short for any but a very exceptional man to master thoroughly more than one profession.

Some one may contend that all these specialties are included in the education of a well-equipped architect, and it is true that he should and generally does, have some knowledge of them, but a little knowledge — when it is made to do the work of a lot — is decidedly dangerous, and very few architects of any experience have the temerity to design large plants of the character mentioned, without assistance from outside.

Now comes the point I wish to call attention to: Where do they get this assistance? What is the usual method of architects when confronted with these problems?

Very often the matter is left till the last moment, perhaps till the walls of the building are up, and it is costly if not impossible to make modifications in the construction, no matter how desirable they may be. Then the plans are given out to several different contractors who are asked to submit schemes and proposals.

Sometimes the advice of a favored contractor is asked at an earlier stage in the proceedings, and the architect lays out the scheme, and makes the specifications practically under his directions. Now, are either of these methods — or the numerous modifications of them — in the interests of the client?

I contend that they most decidedly are not, and the reasons are so apparent, that I hardly feel justified in taking up your space to state them.

When a number of contractors are competing for a job, each making his own plans and specifications they realize the fact that only one of their number can be successful, that the chances are six or eight to one that any time they spend in studying the problem will have to be charged to profit and loss and that, inasmuch as no two contractors figure on the same basis, lowness of price is likely to have more weight with the architect and owner than real merit of design, quality of materials, efficiency, or economy in operation.

Is it reasonable to suppose under these circumstances that the client will get good honest value for his money? Sometimes, of course, he may do so, but it is a case of good luck rather than of good management.

With regard to a contractor acting as advising engineer, I contend that from a client's point of view, there are very serious objections to it. Contractors almost without exception are pecuniarily interested either as manufacturers or agents in from one to a score of different systems, devices, or patents, and it is part of their business to introduce these things regardless of whether they are really the best, safest and most economical for the particular work in hand. In saying this I do not wish to attack the honesty of contractors, but obviously, if a man has something to sell he is not an unbiassed judge of its merits, and he is not very likely to specify something else in its place. Only a few days ago I heard a leading contractor in this city, state that, if a man know his business, he can get an advantage of fifteen to twenty per cent if he be allowed to make the plans and specifications for a job. This, of course, is the reason why contracting firms are so ready to give engineering advice for nothing — even if they should by mistake lose the contract, they are sure of a profit on some part of the materials used.

Now why is it that architects so generally lend themselves to one or other of these methods? It is not because competent specialists in these departments are not to be found, but rather because architects feel they cannot afford to pay for such work out of their own pockets, and naturally take advantage of the contractor's offer to do it for nothing.

Possibly it appears to some architects doubtful policy to advise their clients to employ an expert lest their own commission on that part of the work be cut off, but such a fear only indicates that they do not really feel entitled to it — and perhaps they are not. Yet it is certainly more to the advantage of the client than of the architect to employ a specialist and therefore it seems as if the former should be willing to pay for it.

The views of some of your professional readers on the ethics of this question would be interesting, and I hope you will hear from them.

Yours truly,

K.

[SHARING to some degree the views of our correspondent, we sought a few years ago to bring about an alleviation of the present imperfect methods by bringing architects into communication with experts and so established a department for the advertising of "Consulting Experts." It flourished for a short while and then died a natural death. We will ask our correspondent, since he himself seeks occasion to give expert advice, how he hopes to find the opportunity if he do not avow himself? — EDS. AMERICAN ARCHITECT.]

A QUESTION OF COMMISSION FURTHER DISCUSSED.

NEW YORK, N. Y., August 30, 1893.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Your answer to my second letter first assumes that the agreement between my client and me was mutually understood to be proper compensation. Such was never the case. I plainly spoke of its inadequacy, and he understood my views and knew my usual customary rates.

It also assumes that all architects' work is on a par in percentage value, whereas there are parts of a building that can be planned with rich profit at one per cent, while other parts of intricate detail or long study would not pay at ten or twenty per cent.

I say this to show how inapplicable is your converse illustration of five and two per cent, and how the law of contracts for extra work — "Compensation at a fair and reasonable valuation" — so far from not applying at all, does apply even more to an architect than to the builder.

The architect virtually *never* furnishes the same thing twice, and to estimate his time or labor by some other labor he did once before would be the wildest inaccuracy. So with the tower in question. Much time was spent in study — many drawings were made and laid aside before final success in meeting the client's views. Then, too, like monument or decorative designing, it virtually came under a far different status or heading than the original contract. Your answer reduces all this work to the *pro-rata* that had covered walls, floors, etc., where the architect's commission runs up, but there is not much for him to do or expend; and you allow nothing for time spent in study to produce a success of what was virtually monument work!

I doubt whether your readers will not side with me that, despite precedent or any other argument thus far given, the "reasonable and fair valuation" is the only possible basis of proper compensation.

Very truly yours,

X.

[WE have read this carefully over several times, but, although there is a good deal of reason in it, we do not, on the whole, think that there is enough to make us change our opinion — that, in the absence of express notice, before the architect began to work on the extra tower, that the charge would be at a higher rate, the client was entitled to suppose that he would have to pay only the same percentage that was agreed upon for the original work. As to the claim that some portions of an architect's work are unremunerative at the usual percentage, while others would pay well at a smaller one, it must be remembered that, although this is true enough, it is the custom of the profession in all countries to leave this out of account, and to charge for all the work involved in ordinary building operations at a certain percentage, which, taking everything together, gives a reasonable average remuneration; and it would seem as strange to architects as to clients to have a bill for professional services made out by items — so much for designing the tower, so much for planning the foundations, and so much for the roof. Although such itemized charges might represent more truly the real value of the architect's work than a fixed five-per-cent charge for everything, long experience has shown that a fixed average charge is, on the whole, best for architects as well as clients, and we imagine that "X" would be as little pleased to have a client demand a reduction from a five-per-cent bill, on the ground that the building contained an unusual amount of plain brickwork, as his client would be to have an extra charge appended to it for "time spent in study to make a success of the tower." It must be understood in all this that we do not advocate a blind adherence to the Schedule, without any regard to the character and amount of work actually done, such as some architects profess. Every architect does many fragmentary pieces of work, such as making sketches too rough to be even called preliminary, partial plans, suggestions or improvements on existing designs, to which the Schedule cannot reasonably be applied, and, in order that the charge for such services may be fairly made, we think, and have often said, that a time-book should be kept, and the bill made out by reference to it, rather than by torturing the Schedule to cover the case, or allowing the inspiration of the moment to fix the amount. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

THE SOAPSTONE INDUSTRY OF CHINA. — The British Consul at Wênchow in his last report gives some interesting details respecting the manufacture of steatite or soapstone ornaments in China. The mines are distant 42 miles from Wênchow, and are reached by a boat journey of 35 miles up the river, followed by a land journey of 7 miles over rough ground. The hills containing steatite are owned by 20 to 30 families, who in some cases work the mines themselves, in others engage miners to do it on their account. The galleries are driven into the sides of the hills and are often nearly a mile in length. The composition of the hills is soft, and the shafts require to be propped up by supports of timber; for the same reason the floors are full of mire and clay, so that the miners wear special clothing, made principally of rhea fibre. They lead a hard life, living in straw huts on the hillside. The stone when first extracted is soft, hardening on exposure to the air. It is brought out of the mine in shovels, and is sold at the pit mouth to the carvers at a uniform price of about ½d. per lb. This would be when the purchaser buys it in gross, without first selecting it in any way. When picked over, the mineral varies very considerably in value — according to the size of the lump, its shape, and above all its colors. The colors are given as purple, red, mottled red, black, dark blue, light blue, gray, white, egg-shell white, "jade," beeswax, and "frozen." Of these "jade" (the white variety, not the green) and "frozen" are the most valuable. Indeed, so valuable is the latter that good specimens of it are said to fetch more than real jade itself. The industry finds

employment at the present time for some 2,000 miners and carvers. A great impetus was given to it by the opening of Wênchow to foreign trade. Previous to that event the chief purchasers of soapstone were officials and literary men, and the article most often carved was a stamp or seal. When it was discovered that foreigners admired the stone, articles were produced to meet what was supposed to be their taste. Such were landscapes in low or high relief, flower-vases, plates, card-trays, fruit-dishes, cups, teapots and pagodas. If left to his own devices the native carver proceeds first to examine his stone, much as a cameo cutter would do, to discover how best he can take advantage of its shape and shades of color. There is for this reason room for wide difference in artistic quality, apart altogether from the intrinsic value of the mineral, and carved pieces vary in price from a few cents to $10 and upwards. And among the more purely native articles produced are, besides the seals, writing material, as trays for pens, slabs for rubbing ink, and the like; flower-vases, square, round, or hexagonal; boxes for sealing vermilion, incense-boxes of all kinds, but chiefly having the character for "long life," in open-work, on the cover; small sandal-wood burners, flower-baskets, and balls, candlesticks, chess-men (or, as we should regard them, draughts), cups, bowls and lamps; idols, as the Star of Longevity, the Eight Genii, Goddess of Mercy; lions, monkeys and other animals. Less ambitious workmen content themselves with polishing the stone and cutting in relief certain common emblems, as the sun, moon, clouds, mist, the lute, chess-board, books, scrolls; or the characters for happiness, promotion, old age and posterity. It is said to be a peculiarity of the retail business that these goods are to be purchased more cheaply from house-to-house peddlers than at the mines. The reason given is that the excessive weight of the material makes the peddler glad to dispose of it at any price. But the facts may be quite otherwise, and the story an ingenious concoction in the interests of the peddlers. — *London Times.*

Mr. Gladstone on Architecture. — "I pass from it to the case of architecture, which is one of the fine arts associated with direct and immediate utility. One of the groups in this exhibition is connected with the building trade. Buildings are many, various and large. Every member of each of these trades may rise to be himself a builder, and if he has brains adequate to the work he may rise to be an architect. Why is it that architecture is placed among the fine arts? The question is worth asking and worth answering. It is because, although different from painting and sculpture in its close association with immediate utility, the results of that art are among the noblest and grandest things in the world. What is there in this country nobler than our cathedrals, which draw from America her most distinguished sons to make cathedral tours in England, going from one cathedral to another and feeding their hearts and souls upon all the great conceptions they suggest and upon the contemplation of those noble monuments of genius and devotion which they embody? A very distinguished writer, Mme. de Staël, in describing St. Peter's, uses an extraordinary expression, which sounds a little exaggerated, but in my opinion is not exaggeration. She says: 'The mind of an intelligent person cannot fail to receive from the interior of St. Peter's the suggestion that such a work cannot be merely human, but must be superhuman.' The road for the builders of this country to become architects is an open road. They want gifts which many of them possess. They want more diligence and fortitude, but it is an open road. Architecture is an art in which we may learn lessons from the past. There is this great peculiarity in the remains of early Christian architecture. In those remains beauty is not supplementary and occasional, but uniform and invariable. I am not now speaking of the works which were produced in the later Middle Ages, but of those works which present most of all the character of simplicity as their main characteristic. If you travel in Ireland, on no account fail to examine the Glendalough churches. I do not suppose there is one of those churches which is fifty feet long. You might build any one of them for £500. But every line of every one of these churches is instinct with beauty, which the rudest and most untutored can hardly fail to recognize. There is a circumstance in architecture which terrifies me, and that is the tendency which appears to prevail in modern domestic architecture. I am speaking of their exteriors, and I refer to their redundant ornamentation. There are a great number of new buildings in London — I hope I am not treading on any one's toes — with regard to which, if you look at them, you will find that the architect had either a horror or a dread of leaving bare a single square foot of wall, as if there were something indecent in leaving bare a square foot of wall. Why do you not wage a war against this excess of ornamentation? Excess of ornamentation is of all things the most hostile to a due appreciation of proportion, because it is in proportion to the perception of breadth and beauty and line and in the adjustment of lines to one another that the essence of the art lies, and in that you will find the hope of attaining high excellence in great works. I will go one step farther; I will mention to you the case of the exterior of Salisbury Cathedral. The man who wants to know what is beauty in stone, beauty not produced by ornamentation, should visit Salisbury, for there he will see less ornamentation on the exterior of the building than in any cathedral and, I believe, in a great many domestic houses in London. But if you want to see what can be done by simple beauty of outline, which is the foundation of all beauty, take a look at the exterior of Salisbury Cathedral. It is a model for all ages and for all countries." — *From a Speech at the National Workmen's Exhibition.*

Looking-glasses in Coffins. — One of the ancient customs connected with Swedish funerals was to place a small looking-glass in the coffin of an unmarried female, so that when the last trump sounds she might be able to arrange her tresses. It was the practice for Scandinavian maidens to wear their hair flowing loosely, while the matrons wore it bound about the head and generally covered with some form of cap. Hence the unmarried woman was imagined as awakening at the judgment day with more untidy locks than her wedded sisters and more in need of a glass. — *The Westminster Review.*

A Frenchman's Impression of Chicago Itself. — "The negro who made my bed invited me to occupy it. And as sleep was stealing over me I remember briefly the three weeks so quickly passed in Chicago, and I found that the World's Fair had left no sensible trace, no truly durable imprint on my memory. But that which did come to the surface, that which hastened to precipitate itself upon the condensation of my thought and memory, on the sensitive plate of my mind, was the vision of this redoubtable city, built upon a mud flat on the shore of a sombre, verdureless lake; it was the noisy, furious, impulsive, brutal life which there manœuvres its battalions — a life without soul and ideal, with its interminable dinners with their ranks of champagne bottles circulating among the evening coats, its drunkenness without gayety, its hypocritical luxury, its vulgar courtesies, its celebrations in which there is more flare than intelligence, and chiefly what struck me was the great press of business, that power of a modern Theomacus defying the impossible disturbing the horizon. Business! Business! Business! Is this not the real burden of the raven in Poe's poem? The next morning, raising the shade of my compartment, I saw behind the glass a smiling country unroll itself — a country composed of pretty fields, of picturesque mountains, of forests filled with flowering trees, of primitive farms, of radiant ponds peopled with wild birds. Before nature thus peaceful, in sight of these light mists, these mosses, these flowers opening in the sun, I forgot the frightful nightmare of the departure from Chicago, that Gordian city, so excessive, so satanic, whose life is too inclement for the singing, dreamy soul of the Latin races."—*Octave Uzanne in the Paris Figaro.*

A Photograph Seven Feet by Fifty Inches. — It is seven feet long and fifty inches high, and is a photograph of a relief map of the United States showing the oil-bearing districts. Photographers stand before the colored transparency in the north gallery of the Mines Building and declare it to be the biggest thing in the Exposition, and so it is, from their standpoint. J. K. Hillers of the United States Geological Survey is the man who made the wonderful photograph. The model relief map was started three years ago. It is made of wood veneers, one thirty-second of an inch thick, each thickness representing 100 feet of elevation. The map was built up of these veneers, and then carved in relief and a plaster cast taken. With the light striking it from the northwest it was photographed, the lights and shadows giving it a beautiful tone. When the negative was transferred to paper, the States, lakes, and names were drawn in, and a negative was taken from it twenty inches square. This negative was enlarged to the size of the transparency, 84 inches by 50 inches. No ordinary camera could do the work, so the photographer made a camera of a room twelve by fifteen feet in size. The room was blackened inside, and made light and even air tight. The shutter was placed in the window and the lens in the shutter. Mr. Hillers had three expert photograhers assisting him. The work was focussed on a ground-glass plate the same size as the photograph. This was done by three men holding the plate and moving it back and forth until the proper focus was secured. Then the sensitive plate was made ready. This was a piece of American plate-glass, three-eighths of an inch thick, made and polished for this particular picture. The photographers had to wait two months for proper conditions of light and temperature. A work of this nature had never before been attempted on such a large scale. Mr. Hillers was obliged to feel his way, for he did not know just how long the plate should be exposed. A test was first made with a small plate, and this gave him an approximate measure of time. With rare good fortune, the first exposure of the new plate was a success, and a beautiful photograph was secured. Then a specially arranged hose was turned against the big plate to wash away the chemicals. It took an hour to do this. After the toning process came the matter of varnish. This was the critical phase of the operation. The plate was laid on four rubber balls, one at each corner, and Photographer Hillers tilted it while an assistant poured on half a gallon of varnish. Success still remained with him, and the transparency was ready for its colors. It took four months from the beginning, when the first negative of the map was taken, to finish the transparency. It is valued at $5,000. — *Chicago Record.*

The Willow: Its Place in the Improvement Work on the Mississippi. — People who are unfamiliar with the Mississippi River are tempted to wonder when they first see it why so many thousands of acres of willows grow along its borders and islands and what they are good for. The United States Government, it is safe to say, would not be half as far along with the improvement of the Mississippi as it is if it had not had the humble and seemingly-useless willow. It is of no account for building, it cannot be construed as firewood by any but the most active imagination, and it is of no use in the arts, beyond the making of whistles, but when it comes to building a dam the engineers find nothing that fills the bill half as well as the humble willow. It lines the shores and can be easily reached from the barges whereon it is transported, and it is so soft that it is easily cut and handled. It is woven into a great, long, continuous mat. One end of this is anchored to the shore on one side of the chute that is to be dammed, and the process of weaving is thence carried on straight across the stretch of water on a peculiarly-shaped boat called a grasshopper. As fast as the mat is woven on the grasshopper it slides into the water at the lower end of the inclined weaving rack, and it is laden with rocks and carried straight to the botton, and this is continued till the opposite shore is reached. The mat is then covered to the proper depth, 12 to 15 inches, with rock, and then another mat, made in the same way, is woven and laid down on top of the first, and similarly weighted down, and this work is continued till the dam has risen as high as it is intended to stand; the finishing being always a heavy coating of rock that covers the willow and all. The willow, always covered with water and the mud that inevitably lodges among the rocks of the dam, is kept sealed air-tight, and of course does not decay. It binds the rocks together and prevents the dam being shoved out of place by ice or disturbed by the pressure of the current at high water. It is good for no other purpose save to hold a shore that is washing away with its roots, and for dam construction it is superlatively the thing. — *Davenport (Iowa) Democrat.*

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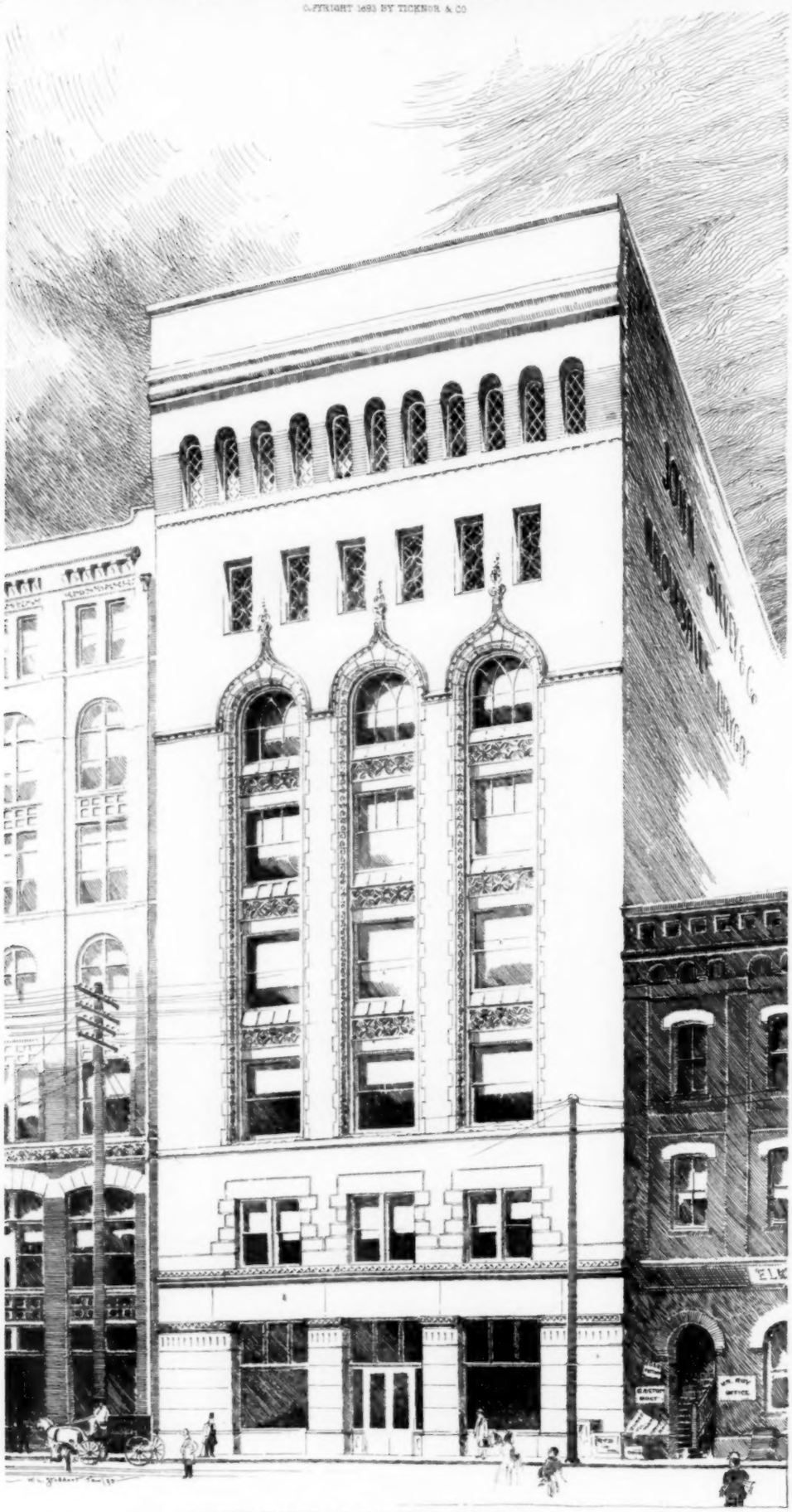

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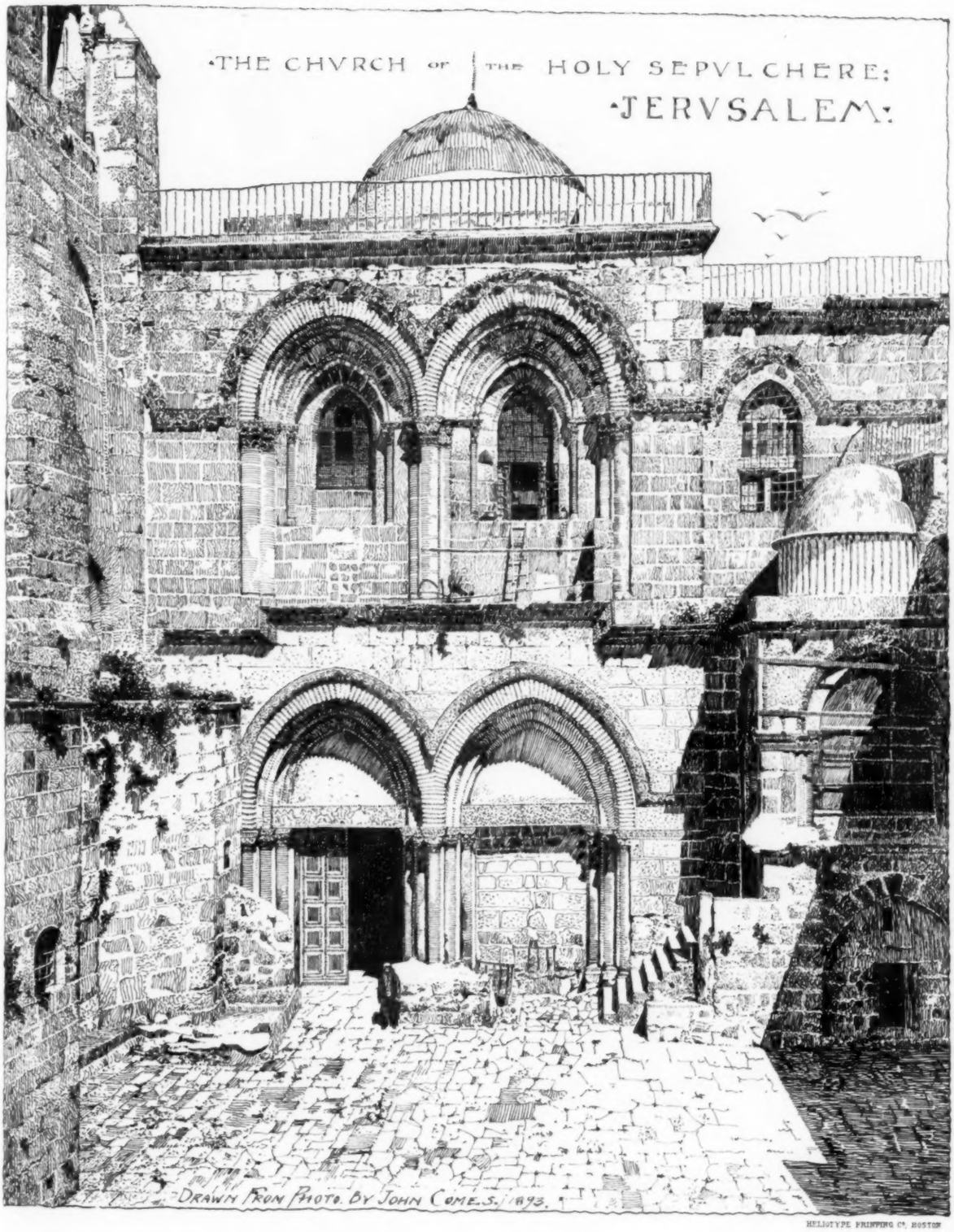

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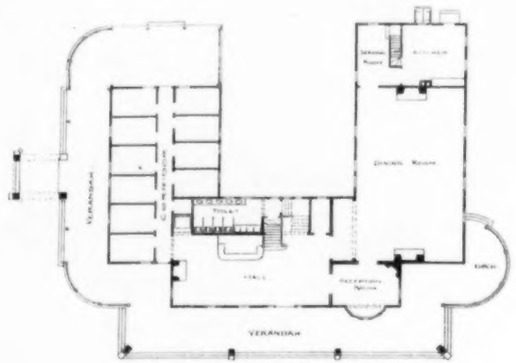

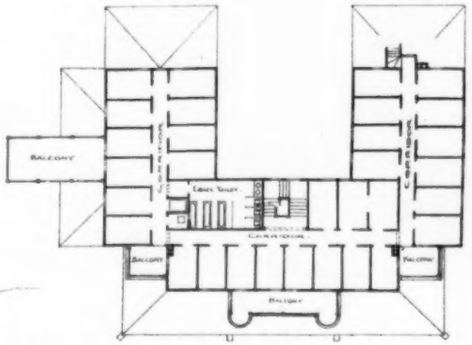

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