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CONTENTS.

THERE is a serious loss to the country in the discontinuance of the U. S. Board for Testing Iron and Steel, which, after having equipped itself with laborious care for a very important work, has had to turn over its apparatus to the War Department, and dissolve, because Congress refused to provide for it any longer. This Testing Board was appointed by Congress and an appropriation made for it four or five years ago, on the earnest intercession of the American Society of Civil Engineers. It set about its work with great thoroughness, made some investigations and some valuable reports, but soon found that no machine was at command which was adequate for its experiments. It was a matter of difficulty to decide upon the plan of such a machine as the Board needed, and of much time and cost to construct it. The system and thoroughness of the Board outlasted the interest of a Congress which is impatient for results and sceptical of scientific deliberation. The second appropriation was made with the condition that when it was expended the Board should cease to exist, and that its equipment should revert to the Secretary of War. The Board lived long enough to complete its machine, which is now at the government arsenal at Watertown, Mass., — a machine which is a great advance on all previous testing machines, and whose delicacy, precision, and power are the wonder of all the engineers who have seen it. And now that its chief expenditure has been made, and it is ready to do its most valuable work, it has expired with the last fiscal year, ending on the 30th of June. The Engineers' Committee on Tests, at their late convention in Cleveland, reported with a justifiable melancholy this untimely end of an auspicious undertaking, and urged a renewed appeal to Congress, which we hope will be seconded by whoever has at heart the advance of sound knowledge of construction.

THAT Congress should have thus allowed the Board to die of inanition is perhaps more to be regretted than to be wondered at. To persons who, like Congressmen, did not understand the difficulties and labor of the work, or the need of the costly preparations that had to be made, it might naturally seem that the ninety thousand dollars that had been appropriated ought to be enough for any amount of testing that the Board undertook to do; and that when it had only got its machinery in order it had made very little progress. The average Congressman, for that matter, is likely to look upon the business of testing iron as one which is the concern only of a few engineers and iron workers, and it would probably be difficult to persuade him, as it would the average constituent, that it was a matter that concerned the whole people sufficiently to warrant spending much of the public money on it. Nevertheless it is, as our readers will recognize, of great importance for the right study of constructions upon which an enormous amount of money and innumerable lives are risked every day, to say nothing of its general scientific interest, and it is the more urgent for us in view of the growing tendency to press the use of iron into all kinds of construction, to intrust its use to unscientific hands, and to cut it down in using to the utmost possible tenuity.

PERHAPS after all the greatest benefit of a recognized official test to a people which needs more than anything a standard, though a benefit which would naturally elude an estimate, would be to enforce upon the popular mind a sense of the importance of precision and care in the use of material. It might do more than building laws or inspection to prevent accident and loss of life if men could learn that construction, and especially iron construction, was not to be fixed by rule of thumb, a matter in which within wide limits one thing would do as well as another, but one in which by knowledge a very definite limit could be fixed, that must on no account be passed. Even if there were a common recklessness in choosing the limit, it would be a gain to acknowledge one. The great difficulty is not so much that ordinary constructors are audacious in going near the verge of danger as that they do not know where danger is, nor that they can set any practicable bound beyond which they may know that it will lie. The common constructor does not know that there are such things as carefully calculated dimensions and a rigidly scientific use of material. If he did, we should be relieved from one of two chief causes of danger, and should have to dread, not his innocence, but only his recklessness. The example of the Government might do much to impress on his mind a sense that there could be accuracy in his work; and the interests at stake are so great and universal that an influence whose effect could hardly be traced in individual cases might be of great importance in the gross. We can hardly expect Congressmen to be alive to considerations so broad as this, so theoretical perhaps, any more than we can expect them to be statesmen; but if every one who had the knowledge would do his best to infuse into the community a sense of the importance of studying accurately the quality of our materials, we might expect it to percolate through to legislators.

THE most picturesquely striking project, for its historical associations, that we have heard of, one which is peculiarly appropriate to an age that mingles archæology and commerce, is the rehabilitation of Carthage, or rather of its port. It is a very natural corollary to the plan for restoring the inland sea that once occupied a great part of the modern (save the word!) Sahara, which is now occupying the attention of both English and French projectors, though as usual in different ways, and for which Captain Roudaire is making test-borings in the sandy shore of the Gulf of Cabes. (*American Architect*, May 20, 1876, and December 28, 1878.) If such a sea is to connect the inhabited territory of Tunis with the fertile regions of Soudan, and inland navigation is to be brought to the very gates of Timbuctoo, it is reasonable to look out for a good harbor near the mouth of the Shotts by which the communication is to be opened, and natural that the commercially enterprising Tunisians, whose Bey has taken great interest in the explorations of Captain Roudaire, should see an opportunity of increasing the importance of their city. Carthage, to be sure, whose site is only three miles from the city of Tunis, is as far from the point in the Gulf of Cabes, the Syrtis Minor of the Romans, at which it is proposed to connect the sea with the Shotts, as Boston is from New York; and the eastern spur of the Atlas Range which runs out into Cape Bon will be a barrier by land between it and the border of the new lake; but a secure and permanent harbor would be worth going some way to find on that shifting coast, and if we may trust the accounts of explorers, particularly of M. Beulé, who examined the remains of the port of Carthage, twenty years ago, there seems to be a possibility that the people of Tunis may recover in it a better port than they now possess, at less cost than that of constructing a new one.

M. BEULÉ found the two ports, connected by a neck or canal 24 metres wide and 60 long, to be 325 metres wide, and together 800 in length, giving a combined area not much smaller than that of the port of Marseilles, which will hold eleven hundred vessels. The accounts of the old historians were, according to the explorer, singularly corroborated. The perimeter of the quay of the inner (circular) port was 1,017 metres, of the island 358, making 1,375 metres of quays, and apparently dividing walls had been built out from them, all round, at every six metres, which would allow the number of docks, 220, which is traditionally ascribed to the port. The island in the centre was joined to the land by a causeway, in which was an opening as if for a draw-bridge, wide enough to allow passage for galleys of about five and a half metres beam, which accords with the width of the slips. By way of further confirmation it was found that

the Romans, in reëstablishing the harbor, had protected the outer port from the wash of the sand by a sea-wall, and had entered it by a canal of very peculiar cross-section, the walls being concave in profile, as if to follow the shape of a vessel's side, and actually narrowing in at the top. The extreme breadth of this canal is six and a half metres, so that it could only allow the passage, one at a time, of vessels of six metres beam or less, a breadth which again accords with that of the slips mentioned above. No fragments were found to indicate the character of the architecture by which the inner port was surrounded, except two drums of engaged columns which stood at the ends of the dividing walls of the warehouses, or possibly sheds, at the heads of the slips, apparently in the position of antæ in a Greek temple *in antis*. These were fluted, with fillets, and covered with fine stucco. They were forty-seven centimetres in diameter, suggesting an order perhaps eighteen feet high. At various points under the foundation the native ledge was found, indicating that the *Cothon* had been excavated from the rock itself.

The port of Carthage, as became her commercial importance, was one of the most perfect of those of antiquity, and was celebrated by the ancient historians. M. Beulé's excavations, though carried on under difficulties, were sufficient to disclose to his satisfaction the whole plan of the port, and to confirm the historic accounts, which tell of an outer harbor for merchant ships, and an inner one for the use of the navy. This inner harbor, called the *Cothon*, was entirely artificial, a round excavation entirely screened from the outer harbor by surrounding walls, and containing separate docks or slips for two hundred and twenty galleys. At the head of each slip was a warehouse, its front decorated with two Ionic columns, which apparently formed part of a continuous portico encircling the whole port. In the centre was a round island where the admiral had his station, with a high tower or other building, whence he could overlook the walls and the outer port. M. Beulé's account of his excavations, given in the second volume of his *Fouilles et Découvertes*, is interesting. The outer port was half choked with sand, upon which were houses and trees; and the inner port, though its shape and that of the central island were discernible, was occupied with villas and gardens. By permission of the authorities more than three hundred trenches were successively opened, and the foundations of what M. Beulé considered to be the original works were traced through their whole extent. Finding that as soon as he reached the tide level the sea water percolated through the sandy soil and filled his trenches with a fluent mud from which it was impossible to free them, he contented himself, since the original foundations were pretty nearly entire to the surface of the water, with digging deep enough to free their tops, his men tracing the outline by feeling with hands and feet, and leaving the muddy water in one trench to settle while the next was dug. When the water had grown clear the outlines of the masonry were destinctly seen through it. They were measured and a plan taken of them, and the trench was filled up. The excavations showed that in the destruction of Carthage by the Romans the works of the harbor had been levelled to the water's edge, and that when, under Augustus, the city was rebuilt, the rebuilding was done here on the old foundations. The characteristic Roman superstructure, of small stones thickly bedded in mortar, was clearly distinguishable from the older foundations in regularly coursed masonry of large blocks, and the junction was at or just below the water-line.

We read in the *Journal of the Society of Arts* the proposal of a member, Mr. Cresswell, for a system of sanitary rating of houses. He would have the Society appoint inspectors who should examine houses and certify to their healthfulness, rating them according to a system of classification to be fixed by the Society, in conference with architects, sanitary engineers, and builders, and analagous to the classification of ships established at Lloyd's, the expenses of the inspection being covered by the fees for examination and registration. Such a rating, he thinks, would commend itself to householders, "and command the acquiescence of speculative builders." This is quite in the vein of the proposal for a rating of warehouses and like buildings in reference to the strength of their construction proposed by a correspondent to our paper not long ago (*American Architect*, October 12, 1878). It would be very likely to do good if it could be carried out; and in the present condition of common anxiety about drainage would be more or less encouraged, doubtless, by people who wanted houses, and by those who had houses to let of whose plumbing and drainage they felt sure. We very much doubt, however, whether, in our country, such a thing would command the speculative builder's acquiescence, in the sense of inducing him to have anything to do with it; or whether the owner of an average house would incline to avail himself of the opportunity of registering it, until the average quality of plumbing and draining had risen higher than it is now. So that such a system might be of use to those who wanted the safest house they could, but would for the present be, among us at least, little help to the ordinary family in search of an ordinary house. It would, however, if efficiently maintained, fix, and keep be e people, a standard which would have an influence in favor of a general improvement, and this would be a general benefit.

The investigations and examinations which the long-suffering City Hall at Chicago is undergoing do not seem to indicate that it is near the end of its troubles. The Bedford stone which the city persisted in using for its building, or half-building, against the protest that it would make an awkward contrast to the other stone used in the county's half, does not seem to be a success. The aldermen, awakened by the stone-cutters' attack upon the building and the complaints against the stone, have visited the quarry in committee, and have found that there is great difficulty in getting stone enough from it that is suitable for the work. The stone, it appears, not only differs in color from the stone of the county building, but gives a further sub-division of hue, being itself of two tints, a blue and a yellow; and both deteriorate as the work gets further into the quarry, so that not more than two per cent of the stone got out can be used. This makes the cost of it almost prohibitory, and the contractors are said to be anxious to substitute still another stone, that of the so-called Dark Hollow quarry. The newly-appointed superintending architect, meanwhile, finds apparently that the contractors for the brickwork are even more put about than the stone contractors; for, being short of men in consequence of their late struggle with the bricklayers, they have not kept up their brick backing with the stone-work already set, so that the upper part of the stone facing stands unsupported by any backing, a condition which will possibly make it simpler for the stone contractors to take down a part of the work which he has felt obliged to condemn. The committee of experts ordered by the city council has been appointed by the mayor, General McDowell being made chairman of it, but had not at last accounts got to work.

THE HYPÆTHRAL QUESTION.[1] IV.

If the Greek temples had been lighted by daylight, and consequently from above, the openings in the roof, by whatever manner they were effected, would have been most marked features. Yet there is not a fragment of any stone belonging to such an arrangement to be found, carefully as the sites of the buildings have been searched for indications of it. It is furthermore to be observed, that the numberless representations of temples on antique paintings and reliefs, or architectural coins, etc., show, one and all, the roof surface as complete, its ridge line as unbroken. Not once is there the semblance of any hypæthral opening whatever. Now if hypæthral temples had indeed existed, if the Parthenon, the temples of Olympia, Delphi, and Pæstum, were thus built, why did it never occur to the painter, the sculptor, or the die-cutter, to characterize these buildings by representing so peculiar a feature as a notch or as long furrows in the roof would necessarily have been? There are also numbers of ancient models fashioned like temples, often votive offerings representing some especial building. None of these show any indications of an hypæthron, characteristic as such an opening or the lids which covered it would have been. It is hardly probable that artists of the various periods and quarters of Greece combined to mystify the archæologists of another civilization by omitting to represent the opening in their temple roofs. Some stone sarcophagi shaped like temples have a socle upon their covers into which a slot is cut, which was once supposed to represent a chimney-like hypæthral opening; but it has long been made evident that these sinkings were made to receive the tenon-like foot of a portrait bust or figure, which, after the manner of the Etruscans, surmounted the ashes deposited within, — the remains of those whose earthly form the bust or figure represented.

To leave these arguments, it must not be forgotten that the most perfect monument of the Doric style, a temple which is always held to have been a representative of the hypæthral arrangement, and to which the words of Vitruvius are directly applied, was only two hundred years ago architecturally intact, and had suffered but few alter-

[1] Papers of the Harvard Art Club. No. 1.

ations. There is no reason to suppose that, at the time of the fatal explosion, the roof covering of the Parthenon was otherwise arranged than it was when first planned; no ground, certainly, for assuming that, if there had been a well-executed method of introducing light from above, it would have been closed and every vestige of it obliterated by the remodelling Christians, who, unable to make windows in the side walls, depended for their light solely on that which could fall through the apse at the eastern end. The darkness of the interior of the Parthenon is a subject of remark to all the travellers who saw it before the explosion; they recognized it as the intention of the builders of the ancient temple to exclude the light.[1] That the Parthenon roof of marble tiles was in its original completeness at the time of the bombardment is well authenticated. Tavernier, who wrote not far from the middle of the seventeenth century, speaks of the roof of the temple as "*aussi tout entier de pierres plates de marbre, tres-bien ordonnées.*"[2] A certain Major Sobiewolsky, one of the Hessian mercenaries employed at this disgraceful siege of Athens, writes at the time: "News having been brought by a deserter that the commander of the fortress had stored all his supply of powder and his valuables in the temple called that of Minerva, and that the most important personages were there assembled, as they thought the Christians would do no injury to the temple, the fire of several mortars was directed upon the building, at first without effect, principally because the roof over the ceiling (*das oberdach*) of the temple was somewhat slanting and tiled with marble, thus being well secured." There can be little doubt that these were the original Greek tiles, for the most part complete and in good condition.[3] We see from contemporary illustrations the wholeness of the roof. The portion above the naos had been rendered a little steeper than it was in antiquity, probably during repairs which had been occasioned by the decay of the wooden ceiling; possibly, though this is very uncertain, from the replacement of the flat-timbered ceiling by a barrel vault of masonry, which required a greater space between its spring from the upper interior entablature and the ridge of the slanting roof above it. The material originality of the roof is not to be doubted. Stone-work executed with the wisdom of arrangement and the precision of execution characteristic of that of the Parthenon is practically indestructible by the elements. The indolent race of Byzantine Christians and Turkish Mussulmans, who could only replace an overturned column by an unsightly mass of rubble masonry, were naturally incapable of re-covering the roof with delicately cut marble tiles. No traces of patchwork exist among its ruined remains.

It is needless to say, that the theory of the hypæthron did not exist while the upper part of a Greek temple was in such a state of preservation as in the Parthenon during the seventeenth century. Nor was it first broached by architects, or even by non-professional travellers familiar with the ruined remains of the monuments by personal observation. It was evolved from the inner consciousness of archæologists at a time when the authority of Vitruvius was considered the alpha and the omega of Greek architecture, and his work was held as a fortunately preserved oracle, which disclosed the methods by which the masterpieces of Greek architecture had been created, and might be reproduced.

But if the practical impossibilities be supposed possible, the architectural and æsthetical objections ignored, and an hypæthral opening effected, what would have been the effect of daylight in the interior? The sun's rays, changeable with every cloud, with the hours of the day, as well as with the season of the year, would have given at times a dull, at times a glaring light, mainly cast upon the hyperoon columns of the north, now slanting towards and now from the statue. Such changes of light would have been unrestful and intolerable in the sacred interior. It is natural to assume that the statue would not have stood directly beneath the orifice, but must have been sheltered from the wet under any fragment of covering which remained. Here the figure is consequently placed by all advocates of upper light. But in such a situation, under any protecting and projecting covering, the light would chiefly have fallen upon the feet and lower limbs of the figure, while the upper portion, especially the head, would have been in deep shadow, — an unfortunate position, but little calculated to show in their best aspect those masterpieces of sculpture which stood in the larger temples.

What was ideally required for the naos was not the changeable rays of the sun, but an even and steady light, gentle or brilliant, diffused or concentrated at will, such as the uncertain daylight can never give, with the best methods of introducing it. It is to be obtained by artificial illumination alone. In smaller temples, places of devotion, not of ceremonies, the contents were often little more than the artistically valueless symbolical statue. A single perpetual lamp was perhaps sufficient to fill such an interior with a twilight, which precluded an over-close examination of trivial and distracting details. Sharp and all-disclosing light is inappropriate to such a sanctuary; the low flame, of itself mystical, gives a breadth and awe-inspiring character to the place, allows a dusky half-perception and an undisturbed flight of the fancy. Thus do we to-day find the darkness of grottos and of ancient crypts broken but slightly by glimmering tapers and dimly burning perpetual lamps, at those impressive places of pilgrimage and devotion which the wise and understanding Catholic Church provides for its votaries. Even in large cathedrals, the bright daylight is in a great degree excluded by stained glass, and notably, in impressive services, by draperies and window hangings. Nocturnal ceremonies are well known as exciting religious fervor and ecstasy in the highest degree. To chant the lamentations of the Roman Passion-week in a room lighted by the sun, especially if so immediately exposed to the open air as to be practically out of doors, could not be otherwise than to render them ineffective. The scanty light of the few altar tapers, the diminution even of these by successive extinction, combine with the monotonous chanting to prepare the mind for the reception of such impressions as are produced by the music of Allegri. Similar necessities lead to similar expedients. The poetical Greek architect did not prepare without purpose such a transition from the crude and harsh exterior light as was afforded by the veil of shade given by the pteroma, — a change, a modulation from one kind of light to another. The darkness of the pronaos was the preparatory dissonance which intervened between the common and varying light without, and the soft and rich artificial illumination within. One cannot believe that he who had traversed the wildest part of the Attic landscape to offer vows to Nemesis, who had wound his way through dense Arcadian forests to supplicate at the mountain-seat of the healing Apollo, found himself at an enclosed court, lighted by the passing mood of the day, whose heat may already have oppressed, whose gloominess have saddened, the traveller; but rather at a shrine illuminated by tranquilly burning flames, separated from all outer influence, whither no excessive wind or heat, no rain or other baneful effect of nature, could penetrate, where no harsh sound of passing bird or beast, no disturbance of the outer world, could interrupt the sacred peace. The cares of the continual struggle with nature and the elements, which devolve so oppressively upon man, were excluded by the massive and enduring structure of the sanctuary he had erected.[4]

In larger temples the case was otherwise, and a brilliant and splendid illumination was often necessary. It was to the proud and elevated mind of the patriotic citizen that its heightened effects were addressed, not, as in the former case, to the suppliant praying at the silent shrine of the mystical deity. For such festive ceremonies, artificial illumination is equally adapted. Where a brilliant effect is desired in our dim daylight churches, it is best obtained at night by some such expedient as the cross of flame uplifted in certain cathedrals of Europe on the evening of Good Friday. No one who has ever seen this impressive spectacle can forget its magical light, concentrated and powerful, which no conceivable arrangement of windows could rival. The interior of the larger Greek temples must have been gorgeous beyond comparison. Here were most valuable works of art, paintings, tapestries, musical instruments, utensils of precious metal, — of the finest workmanship and the greatest splendor. Here were collected the offerings of states and families, as well as of individuals, bearing that stamp of beauty and thoughtful refinement given by the Greeks, even to the vessels of daily use.[5] Within the temples of Zeus and of Athene the prizes won by Olympian and Panathenaic victors were conferred. Hither turned the festal processions. Here, as in our theatres (which can be given as a second parallel, the offices of the Hellenic temple being to-day divided between churches and theatres, in as far as these latter are used for festive purposes), the light of day could not possibly answer the requirements. He may judge of the impressiveness and

[1] See especially Jacob Spon, *Voyage d'Italie, de Dalmatie, de Grece et du Levant fait ès Années* 1675, 1676. Lyon, 1678: De la Guilletière, *Athenes ancienne et nouvelle*, Paris, 1676; and Sir George Wheeler, *Journey into Greece*, London, 1682.

Thus the eminent antiquary, Spon, says (tome ii., p. 152): "Il faut que je vous avoue qu'étant entré dans la Mosquée [the Parthenon, then used as a mosque], je ne fus pas étonné comme d'autres, de son obscurité, quoy que j'observasse que toute la lumiere qu'elle reçoit vient du fond que les Chrêtiens avoient ouvert en faisant le chœur; et qu'ainsi du tems des Payens ce Temple n'avoit aucun jour que celuy qu'il pouvoit recevoir par la porte, et qui s'affaiblissoit en venant dans le pronaos, qui ne recevoit aussi de clarté que par le premier portail. Je ne voulus point critiquer le dessein de l'Architecte Ictinus, qui l'avoit bâti; j'aurais même été plus surpris d'y voir des fenêtres, qu'il est bien plus difficile de trouver dans les Temples anciens. Mais est-il possible qu'ils fissent leurs Temples sans jour? Ouy, sans doute." Spon goes on to enumerate other instances of temples unlighted from without: "Sans aller plus loin qu'Athenes, il y a le Temple de Thesée qui ne reçoit de jour que par deux ou trois trous, que les Grecs y ont fait dans la voûte sans aucune symmetrie, lorsqu'ils s'en sont voulu servir d'Eglise, et l'on reconnoit bien que du tems des Anciens il n'y en pouvoit venir que par le seul portail. . . . . Ils s'imaginoient sans doute que l'obscurité avoit quelque chose de plus majestueux, et qui imprimoit plus de respect à ceux qui entroient dans ces Temples. C'est apparemment de là qu'est venu l'usage des lampes dans les lieux sacrez." Spon's companion, Wheeler, in his *Journey into Greece* (London, 1682, p. 363), essentially repeats the observations of his more learned associate. He says: "When the Christians consecrated it [the Parthenon] to serve God in, they let in the light at the east end, which is all it yet hath."

[2] See *Les six Voyages de Jean Baptiste Tavernier, en Turquie, en Perse et aux Indes*, etc. Paris, 1679, p. 354.

[3] Major Sobiewolsky goes on to say, that "ein lüneburgischer lieutenant aber, derselbe erboste sich, *in den* Tempell Bomben einzuwerffen, welches auch geschehen in dem eine davon durch den Tempell gefallen und eben in der Türcken vorrath von Pulver." This extract from the Marschroute of Major Sobiewolsky, referred to by the Count de Laborde in his *Athènes aux XVe, XVIe et XVIIe Siècles* (Paris, 1854, tome ii., p. 151), is printed by Michaelis, *Der Parthenon*, p. 346.

The bomb probably found entrance through a hole in the roof. Wheeler, *Journey into Greece*, p. 364, says: "This Temple was covered outwardly with great Planks of Stone; of which some are fallen down, and are to be seen in the Mosque."

[4] A passage in the Life of Constantine by Eusebius has an important bearing on this question, as showing, first, that some temples were roofed, and, secondly, that their interior was dark. He says, that by the command of the emperor the roofs of some temples were destroyed, their tiles being taken off: ἑτέρων [νεῶν] δ' ἡ ἐπὶ τοῖσι ὀρόφοις στέγη, τῶν καλυπτήρων ἀφαιρουμένων, ἐφθείρετο. Elsewhere the priests were ordered to bring out the images from their dark retreats, παράγειν εἰς φῶς ἐκ σκοτίων μυχῶν. *De Vita Constantini*, lib. iii., cap. liv.

[5] The custom of dedicating valuable and finely wrought gifts is one of great antiquity. Aigisthos dedicated gold and marvellously woven stuffs, as a thank offering for his successful usurpation of the throne (*Odyss.* iii. 274). Hecuba, to avert the downfall of her unfortunate city, presented Pallas Athene with the most costly peplos in her possession (*Iliad*, vi. 269). Hercules dedicated tapestries conquered from the Amazons to the fane of Apollo, at Delphi (Eurip. *Ion*, 1141). The number and variety of the objects within the Parthenon can only be understood by a study of inscriptions which give a partial inventory. These inscriptions have been collected and illustrated by Michaelis, *Der Parthenon*, Leipsig, 1871, pp. 288-315.

splendor that alone can be lent by steady artificial light, who attends by day a full rehearsal in a theatre, however well illuminated by windows or skylights, and compares this spectacle with the performance of the evening, under flames which brighten every point, which throw a brilliant light without shade and without disturbing reflections. Even a day-lit concert has something of a dreary and prosaic character. The rich and varied contents of the naos would have seemed a confusion by cold daylight, while flames increase the pomp of a crowded interior. Draperies, which by day hang heavily, with dull color, are lustrous and glowing when viewed by the lamp; artificial light heightens the richness of interior decorations and furnishings, while admitting and demanding more of them. The fanciful though wild and confused forms of rococo ornament retained, with right, their sway longer in theatres and palace halls destined for evening use than elsewhere, and for this reason. Artificial light makes it conceivable how the Greeks found such delight in statues of ivory and gold. Ivory is a ghastly substance to stand for flesh by daylight; its sallow, corpse-like complexion and the nature of its surface are repulsive. By lamplight it is seen to its full advantage as a material for the sculptor's use. Its yellow tints undergo a change, and its absorbent and translucent surface shows with splendor. Artificial light is the ideal illumination for an interior like that of the Greek temple. Its isolation from the forms and influence of the nature which surrounded it is thereby completed. The present Roman and Eastern churches adopted this ritual observance, with various other heathen ceremonies, sometime during the second century of our era, though, from their introducing natural light into the churches or houses of assemblage, the flames lost their original purpose of illumination and became merely a conventional symbol. A perpetually burning lamp had from its necessary position in the naos become a sign of the divine presence even to the Greeks. The extinguishing of one of these lights was deemed a most inauspicious omen, and it was one of the charges against the tyrant Aristion that, during the siege of Athens by Sylla, he allowed the sacred lamp of the goddess, that is of Athene, to expire for want of oil.[1] There was the never-dying light of fire in the temple of Delphi,[2] and the fane is spoken of as being presided over by Hestia,[3] a poetical image expressive of the nature of the illumination within. Pausanias mentions many temples in which such flames burnt, among them the temple of Hera, at Mycene,[4] which was destroyed by the fire of one of the lamps igniting some wreaths while the priestess was asleep; the temple of Demeter, at Mantinea;[5] that of Pan, near Megalopolis, etc. In the Athenian Erechtheion there was a lamp of gold[6] made by Callimachus, an artist to whom later times ascribed the invention of the Corinthian capital. It had a wick of asbestos, Carpasian flax as it was called, and its flame burnt for a year's time without being replenished with oil. This lamp was provided with a funnel of wrought bronze, which passed through the ceiling and provided an escape for the heat of the flame. Such a conductor would, of course, have been useless if the apartment opened roofless to the air for its light, and it cannot be supposed that these flames burnt pale beneath an hypæthron but little above them. We may attribute to the extensive use of artificial light, and compare with the ever-recurring fires in our theatres, the fact that there were few of the Greek temples which did not at some time suffer from fire, which necessarily must have proceeded from the interior to ignite the wooden ceiling of the naos, the only readily inflammable portion of the structure.

In view of these various considerations, notwithstanding the now general belief to the contrary, I cannot but believe that the Parthenon, the temples of Olympia and Poseidonia, in short, all true Greek temples, were covered with a complete roof and ceiling, and that the light by which they were illuminated was artificial.

J. T. Clarke.

THE ILLUSTRATIONS.

COMPETITIVE DESIGN FOR THE UNION LEAGUE CLUB-HOUSE, NEW YORK. MR. S. D. HATCH, ARCHITECT, NEW YORK.

In this design the third and fourth floors are devoted to the bed-chambers and other small rooms.

SCREW SCAFFOLDING.

This plate, and the article which explains it, are copied from a late number of the *Building News*.

NOTES ON CONTRACTS.[7] I.

Perhaps this society may be interested in a little discussion of some matters relating to building contracts. No architect needs to be told that a perfectly satisfactory form of building contract which shall secure the owner against any possibility of loss through the negligence or financial incapacity of the builder, and at the same time shall be so fair to the builder himself that the architect will not be tempted to hurry himself through the reading of it so as to get his signature before he quite understands the meaning of all the conditions, is hardly to be found. Every one has his favorite form, and in general, every one finds, in emergency, that his favorite form has a vulnerable point, and some of the most essential particulars have never, within my knowledge, been so expressed as to be at once satisfactory to both parties and capable of easy enforcement.

In the general form of contracts much looseness prevails; some of the worst are those entered into for important public buildings, and many of us will think in our own minds that we are capable of drawing up as good building contracts as some that we have seen constructed by lawyers.

Perhaps, indeed, the most profound general knowledge of law may find assistance in the experience of architects, who have the deficiencies of ordinary agreements impressed upon their minds sometimes with considerable violence, but it is not less important for the practical man to understand the customs of law in regard to the enforcement of a contract, and the presumptions which will take the place of any condition omitted.

The contract itself is to be divided into two portions, the agreement and the conditions.

Though both are equally important, perhaps it is most essential that the first portion, commencing with the familiar words, "Contract for building made this blank day of blank," and ending with the covenant for payment by the party of the first part, should be absolutely clear and precise. While the subsequent conditions are generally explained more fully, the agreement is always very condensed, and every word is important. It is for this reason, probably, that in all English documents, and to some extent in our own, the agreement is written without comma or punctuation marks from beginning to end.

To be able to dispense with punctuation, a composition must be extremely clear and precise, so that it is at least a considerable help to accuracy of expression to make the first draft of an agreement without such aid; and there is a certain security in a document understood to be without stop, in that no one can surreptitiously add a comma, and so change the meaning of the instrument. Every one remembers the comma added to a certain tariff act, which cost the government and saved a small number of importers a million of dollars.

In the conditions, punctuation is generally necessary to explain the sense of the words, unless extraordinary effort is made to obtain sufficient precision to dispense with it.

The agreement being the most important part, it is well to make it include the essential provisions, such as that the work is to be substantially done, and in accordance with the plans and specifications, and completed by a given time. It is much more likely that the conditions which follow the agreement will be set aside, than the agreement itself, and to write the agreement without specifying the time of completion, and then put the time of completion in the conditions, would, perhaps, be to run the risk of not being able to enforce that portion, although if the time of completion is specified in the agreement a clause in the conditions explaining the circumstances which might modify the period allowed, or assessing the damages for delay, would be perfectly proper.

For instance, if one contracts with X. Y. to "build a house," and in consideration of such building to pay a certain sum, and afterwards adds a clause that "it is understood that the house is to be done in three months," it might not always be possible to prove that the clause was not inserted after signing, while if the agreement read, "to build a house and complete the same within the three months from date," etc., it would be unreasonable to suppose that any hiatus could have been left in that place at signing in which such words could be inserted afterwards.

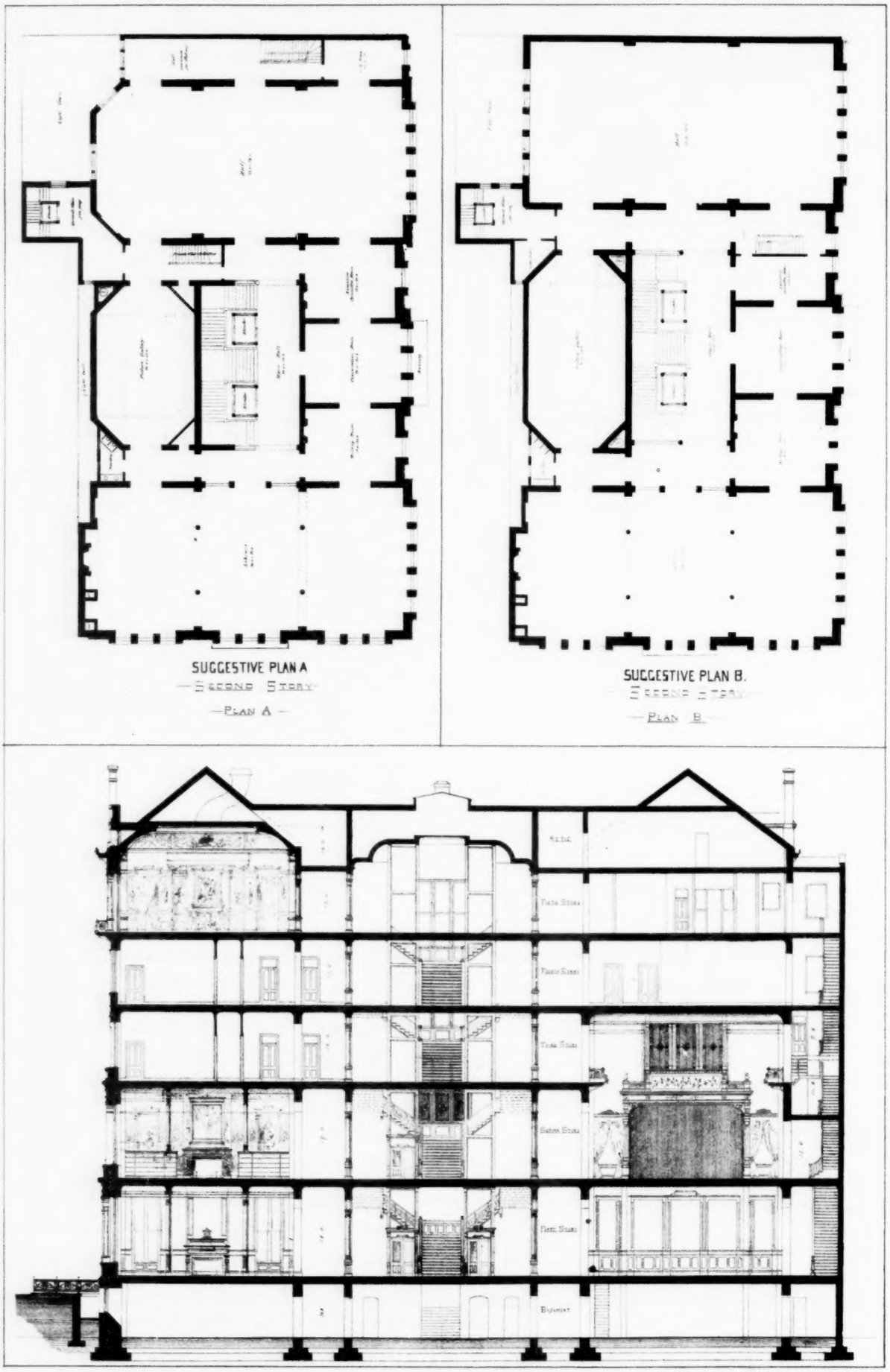
Another custom among lawyers is to require that the agreement shall always mention the consideration. Of course an agreement without a consideration is void, but if a contract reads, "A. B. agrees to build a house, and in consideration thereof C. D. promises to pay him a thousand dollars," it seems as if all was said that is necessary; but I think lawyers prefer to state the fact a little more clearly, that "for the consideration hereinafter mentioned A. B. agrees with C. D. to build him a house, and in consideration thereof C. D. covenants to pay A. B. one thousand dollars."

I have a printed form of building contract from a law stationer in Boston which omits to mention the consideration in the first clause, but it is doubtful if that is the best way.

In the same printed contract, the structure is required "to be built agreeably to the draught, plans, explanations, or specifications furnished or to be furnished to said —— by ——." This will be seen to be at once too sweeping and too inadequate; too sweeping, because it binds the builder to work according to plans and specifications to be furnished at some future time, and inadequate, because it omits that important point, that the work shall not only be done subject to the directions, but to the satisfaction of the architect, and a subsequent clause in the conditions will not have the force that these words would in this place.

No intelligent builder would sign a contract for important work binding him to execute whatever future plans and specifications the architect might furnish, and if he did, it is doubtful whether the contract could be enforced. I have an impression that a contract worded in this way has been declared void by a court, but do not know the circumstances.

[1] Plutarch, *Life of Sylla*.
[2] Aeschyl. *Choeph.* 1018.
[3] Hymn. Hom. xxiii. in Vest.
[4] Paus. ii. 17.
[5] Paus. viii. 9.
[6] Paus. i. 26, and Strabo, ix. 1.
[7] A Paper read before the Boston Chapter of the American Institute of Architects, by Mr. T M. Clark, Fellow, Boston.

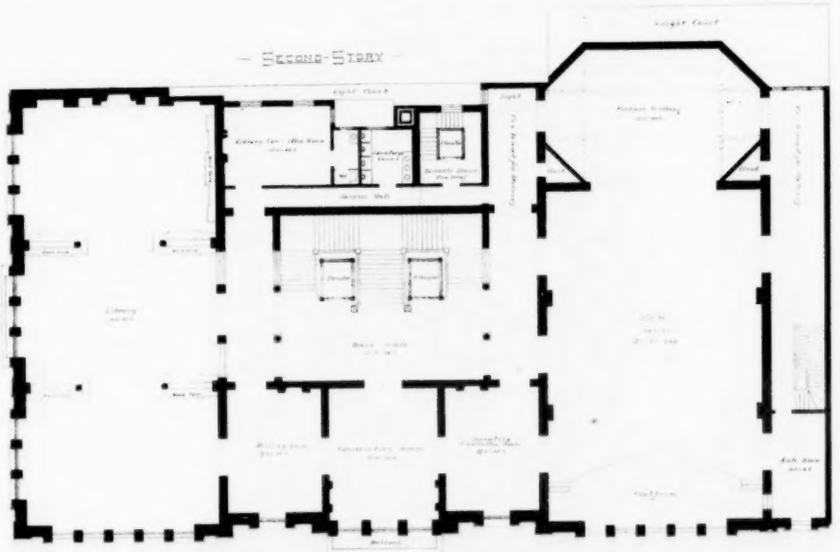


DESIGN FOR UNION LEAGUE CLUB-HOUSE.

S. D. HATCH, ARCHITECT.

AMERICAN ARCHITECT AND BUILDING NEWS JULY 12, 1879.
No. 135.

SECOND STORY



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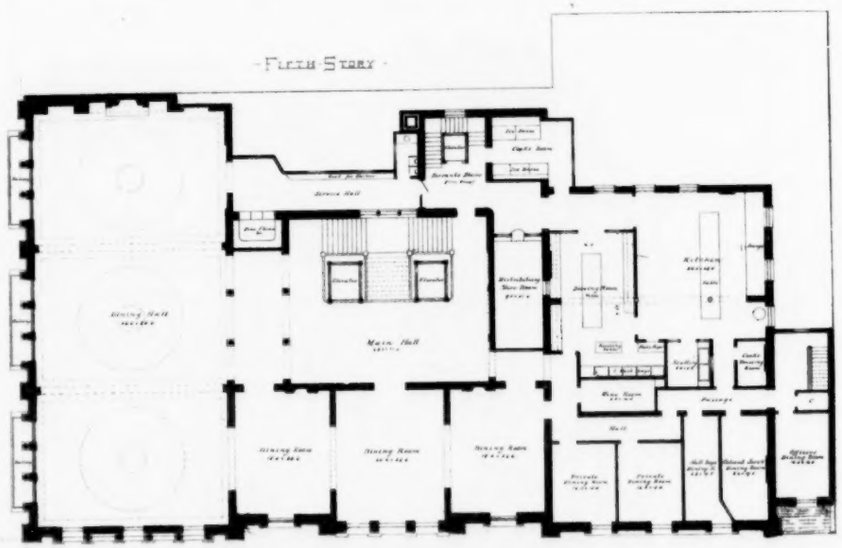

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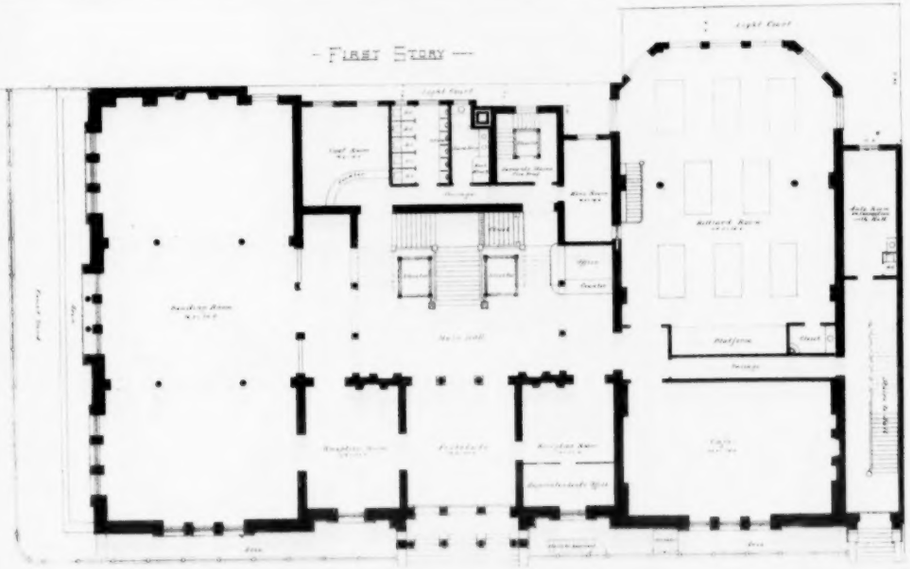
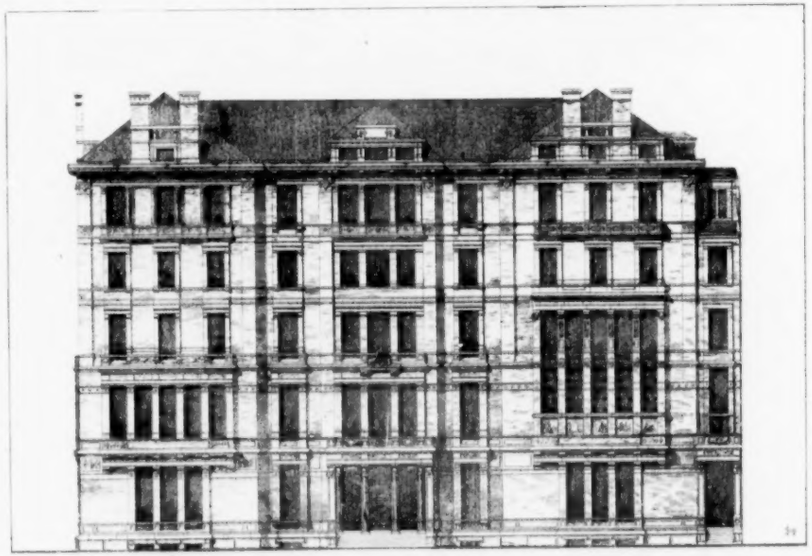
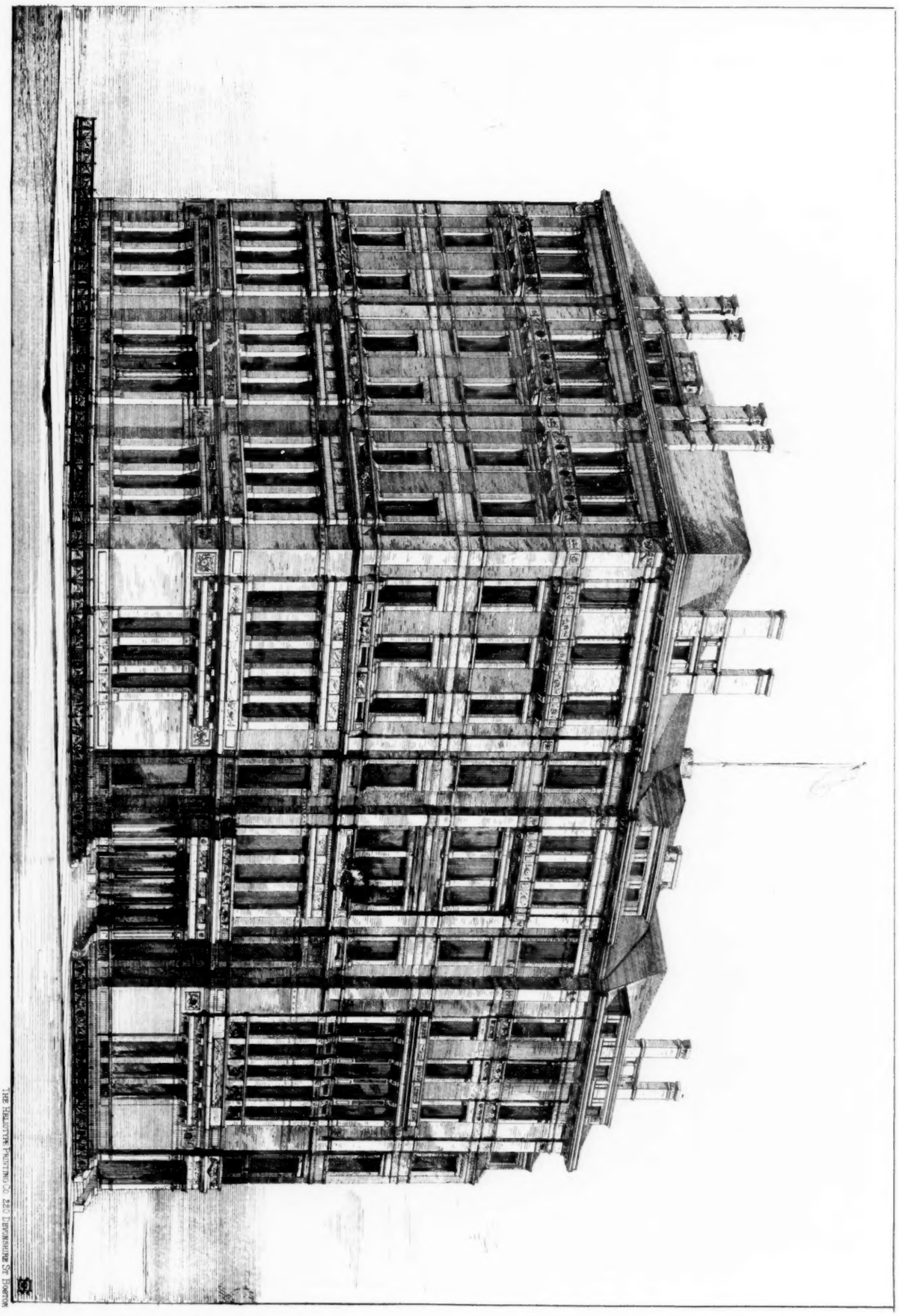




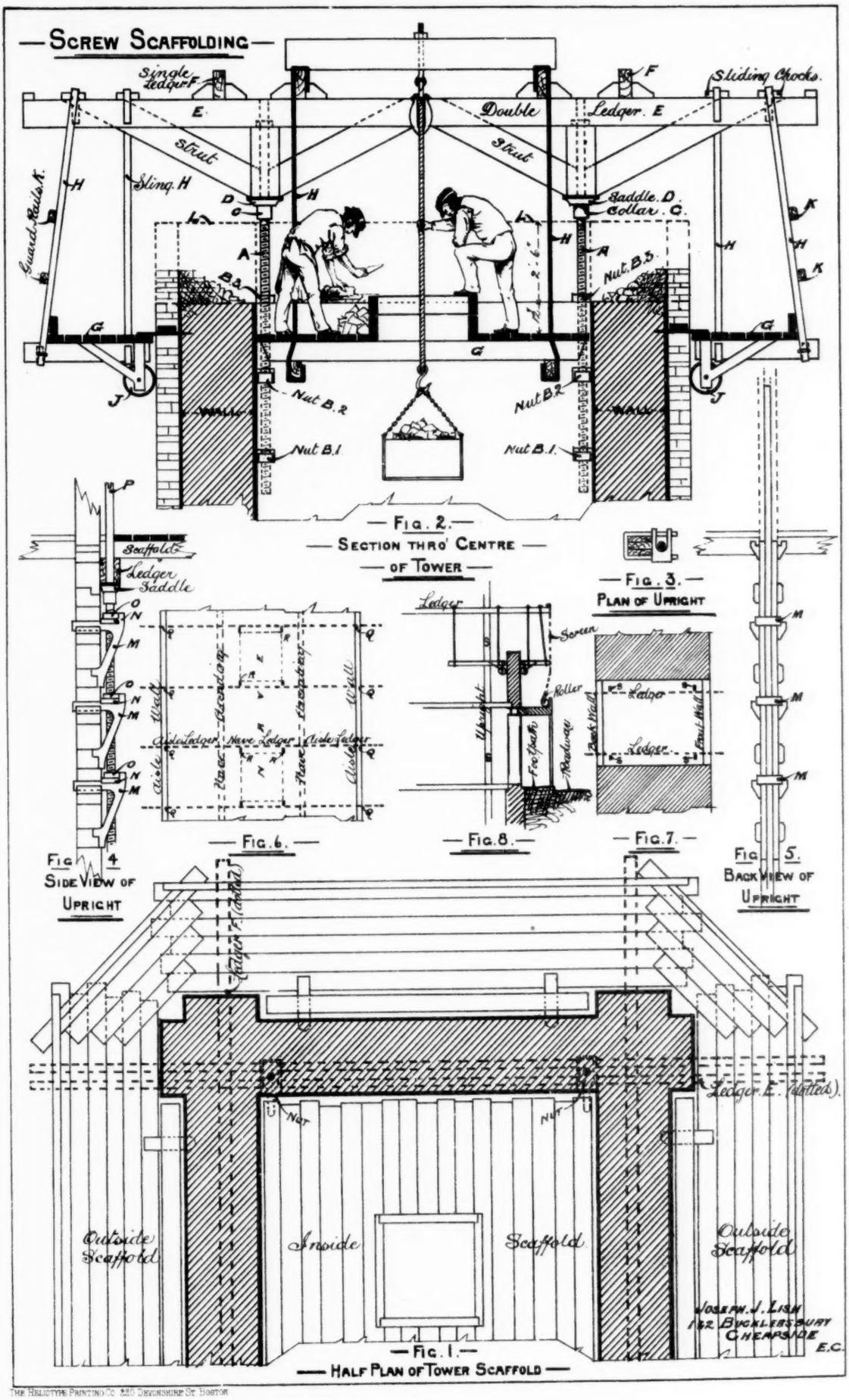
THE HELIOTYPE PRINTING CO. 220 DEVONSHIRE ST. BOSTON.



DESIGN FOR UNION LEAGUE CLUB-HOUSE

S. D. HAYCH, ARCHITECT.

THE HERALTYPE PRINTING CO. 232 DEVONSHIRE ST. BOSTON.



THE HELIOTYPE PRINTING CO. 220 DEVONSHIRE ST. BOSTON

In Sir Edmund Beckett's Book on Building, a variation on the accustomed formula is suggested, thus: "The contractor is to execute the work according to the drawings and specifications, and including all things which in the opinion of the architect may fairly be inferred from such drawings and specifications, although the same be not therein specifically expressed, subject to the directions from time to time and to the satisfaction of the architect." It will be seen that this, while making the agreement refer to definite, existing plans and specifications, does not at all exclude the use of future detail drawings to explain the contract drawings, while it would exclude, as is perfectly right, details which contradicted or varied materially from the contract drawings, if the builder did not choose to accept them, and it sets forth plainly and makes part of the agreement the principle which multitudes of laws have established, that the architect is the proper judge of what he meant by his own drawings. Nothing is so important in an agreement as to have every indefinite point, about which there might, in the future, be a difference of opinion, brought to the light, and fixed by the consent of both parties. I have never known a builder make any objection to this little sentence, and it removes the occasion for a host of quarrels, arbitrations, suits, and bitter feelings on the part of architect, owner, and contractor.

However small an affair the subject matter of the agreement may be, it is best to pay due attention to the clear expression of all the conditions. I had once, in the early days of my professional life, the care of a large building under construction by days' work, and I had to make bargains for all kinds of materials and work which would generally be taken care of by the contractor. The agent who managed the estate was a very experienced lawyer, and looked after my transactions with a sharp eye. Under his instructions I made contracts for everything, even to ten dollars' worth of soap-stone for a fire-place, often drawing up and witnessing three or four such agreements a day. They were very short, always beginning "For the consideration mentioned below," or "hereinafter mentioned," then specifying the work to be done, and the time of completion, or "to be done as soon as practicable," and ending with the amount of the payment.

After all, the trouble which the making and signing of such papers gave was inconsiderable, and the feeling of security against future misunderstandings and extra charges was of much value.

It takes so little formality to make a binding contract that we need to be on our guard not to find ourselves involved in one without intending it. It is well established that a bid tendered by a builder for a job, and a written acceptance, or acceptance before witnesses of the bid, constitute a valid contract, and the owner may find himself committed to an agreement in which the time of completion, the terms of payment, or other conditions on which he desired to insist, are left out, and the builder can refuse to have any such conditions imposed upon him beyond what a jury, probably composed of his friends and dependents, may consider reasonable. The proper precaution against such mishaps is to accept bids always with the condition that the bidder shall sign a satisfactory contract. A conditional acceptance of this kind is always allowable, and a builder is likely to be much more tractable in regard to the stipulations of the contract under such circumstances than when he knows that the owner is already bound by a contract in which the advantage is mostly on his side, and any conditions he may submit to are merely polite concessions on his part.

But if a duty and the consideration therefor, expressed in the simplest terms, constitute a good contract, no promise, though entered into with the most solemn sanctions, is valid without a consideration, or with the consideration omitted from the document in question, except by a special device, — that of the seal. The seal, in the language of the books, "imports a consideration," and while a contract in due form, with the agreement and the consideration expressed, needs no seal, and gains nothing by having seals attached, a bond or similar promise to do a certain thing without consideration is not valid without one.

Still, building contracts are frequently sealed under legal advice, and perhaps a distinction may be made that where an adequate consideration is mentioned for all the things which the builder agrees to do, no seal is needed, but where conditions are inserted, such as that the "materials shall become the property of the party of the first part as soon as they are delivered on the ground," or similar stipulations, where the thing to be done is such that it has not a pecuniary value, or one that cannot be estimated, and yet its enforcement is desirable, it may be necessary to affix seals to the signatures to cover such conditions. At least, the addition of the seal can do no harm in such cases.

One very common clause in contracts, which is far better omitted, is that providing that all differences shall be settled by arbitration, the manner of appointing the arbitrators being minutely described. Builders sometimes insist on this clause, and with reason, for its operation is commonly in their favor, but it is very wrong to suppose that just settlement of disputes cannot be obtained without the cumbrous and uncertain process of arbitration. No one who has gone through a contract with a bad-tempered builder, and endured his constant demands to "leave it out" whenever the owner ventured to resist his absurd claims, will wish to subject himself to similar annoyance if his contracts can be as well enforced without the arbitration clause, and it seems certain that they can.

Every one does not know that this same arbitration clause is not even binding. No matter how strictly any one agrees to decide his disputes without recourse to law, all such agreements are void, under the principle that no covenant can be made to "oust the courts of their jurisdiction," or, as one judge says, "no one can waive his right to have his suits determined at the courts provided by the laws of his country."

If, therefore, either party in a dispute refuses to submit the case to arbitration, the law will sustain him, no matter what the wording of the contract may be. But this refusal, it is important to observe, must be made before the difference is actually submitted to arbitrators, otherwise the courts will probably refuse to interfere, and when the award is made will enforce it, unless there is evidence of fraud or incapacity on the part of the arbitrators.

In general, arbitrations are unsatisfactory to either party. The temptation to "split the difference" between the disputants is very strong, and this is sure to displease both; and the arbitrators have by law the right to collect pay and expenses for themselves out of the subject matter of the dispute before dividing the residue between the parties; so that any expectation that arbitration will be cheaper than a lawsuit is very likely to be disappointed, especially if the case is a difficult one.

For greater facility in obtaining damages for breach of the contract in any particular, the parties bind themselves in the penal sum of so many dollars, usually about a third of the amount of the contract. This, instead of being a sum which the builder shall forfeit if he does not finish the work on the appointed day, as I have known them imagine, is the amount to which the parties agree that each shall be held responsible, in case of a breach of any of the conditions.

If the builder neglects to cover in the walls, in bad weather, when required by the contract or the accompanying specification to do so, and the work suffers damage, it is much more simple to take the contract into court and say, "This party agrees here over his own signature to pay for any breach of the conditions up to one thousand dollars, and I have therefore a right to pay myself for the damage out of that sum," than to begin from the first principles, and show that one has been damaged, that the builder was the cause of the damage, and that although he did not say anything about paying for losses of the kind in the contract, where he would have been expected to do so, still he ought to be held liable, to which there might be several defences.

SCREW SCAFFOLDING.

THE following is a description of the scaffolding referred to in my letter on "Building Machinery," which appeared in the *Building News* of April 25: Fig. 1 (see illustration) is a half-plan of, and Fig. 2 a section through, the centre of tower, showing the screw scaffolding in position. A A are four scaffold screws, which bear the whole scaffolding of tower, one being placed in each angle of wall. Each screw is shown to work (see Fig. 2) through three nuts, B1, B2, and B3, and has a collar C, carrying a saddle D for the support of the ledgers E F and framing, from which the workmen's platforms, or scaffolds, G, are suspended by wrought-iron slings, H. The wheels J of the bearers to outside scaffold travel up the face of the wall as the scaffold rises. Guard rails, K, are fixed where required, to insure the safety of the workmen employed.

In proceeding to fix the scaffolding, where the scaffold screws are to work in the wall, all that is necessary is to place the screws A A in their proper position in the wall whilst the foundations are being put in, then plumb and build round them, clasping two of the nuts, B1 and B2, on each screw at the same level, and at the required distances apart. If 2′ 6″ of wall are to be built for each lift of scaffold, the nuts will require to be placed every 2′ 6″ in height. The screws should next be turned until all the saddles, D D, are standing on the same level; the overhead framing, ledgers, and platforms should now be placed in position, the nut B3 clasped on where shown, and the work of building from the scaffold begun.

If the platforms G G are placed about 12 inches below the top of the wall then built, sufficient space will be left between the top nut, B3, and the collar C to allow of building up to the line of L, as required before raising the scaffold. The scaffold platforms will then be standing at about the best height for effective work, as the workman will, by such an arrangement, always be walling from just below his knee to about the level of his elbow, thus avoiding undue stooping and over-reaching.

When the 2′ 6″ of wall has been built all round, the workmen, whilst standing on their scaffolds, turn the screws A A (by a simple arrangement at the collar C), and raise the scaffolding, walling materials, and themselves as well, a height of 2′ 6″. The foot of the scaffold screw will then have passed the bottom nut, B1, leaving it lying loose in the wall. This nut must then be drawn out of the wall (a hole opening to the inside being left for this purpose), and clasped on to the scaffold screw at the level of L, making it thus a top nut. When, after the next lift of scaffold, the foot of screw has passed up through nut B2, this nut, in its turn, is lifted up and made a top nut; and so on successively until the full height of wall has been built. It will thus be seen that a screw never rests in less than two nuts. As the screw by this system travels up with its scaffold, the same screws will do for any height of wall. There is no necessity to clear the

platforms previous to raising. Before commencing to plaster, the nut holes in the body of the walls are filled up, and the holes left by the screws are well grouted.

For "cleaning down" the work the outside platforms can be lowered as required from the projecting ends of ledgers.

The scaffolding screws can be used in three separate ways: —

1st. Working in the body of the wall.

2d. Against one of the faces of the wall.

3d. Independent of the wall.

Figs. 1 and 2 show the first method, where the screws are seen to work through the body of the wall.

By the second method the screws are supported on iron elbows projecting from one of the faces of wall, somewhat after the manner of No. 3 arrangement.

Figs. 3, 4, and 5 are a plan and side and back views respectively of uprights for supporting the scaffolds independent of the wall, as per third method. These uprights are made of three thicknesses of deal (bolted together from time to time as the scaffold rises), half lapping as shown. When the scaffold platform has been raised to about the position indicated on Fig. 5, the upright is heightened by bolting on fresh lengths, as shown by dotted lines. M M are iron elbows bearing nut rests, N N, which carry and keep the nuts, O O, firmly in position. When the scaffold has been screwed up the bottom elbow, with its nut-rest and nut, is taken off and raised to a higher part of upright, and so on, as in the case of screws working in the walls. The screws, in this case, can be turned by applying a handle to the top of screw, at P, by the workmen standing on the scaffold.

In the church where this system of scaffolding was employed, screws were placed in the aisle walls, Q Q (see Fig. 6), for the support of one end of aisle ledgers, the other end of ledgers, together with the whole of nave scaffolding, being supported by uprights, R R, fixed about 3′ from nave arcading, to allow of working-space between the upright and the nave wall. When the walls of aisles had been built to their full height, the aisle ledgers were detached from the nave ledgers, and the nave scaffolding screwed up, stage by stage, for the construction of the nave arcading, clerestory walls, and gables. When no longer required for walling and roof-fixing purposes, this nave scaffolding was used by the plasterer and the decorator. After first coating the ceiling, all that was necessary was to screw down the scaffold platforms, stage by stage, whilst the walls were being first coated, and screw them up again for the second and finishing coats of plaster.

Figs. 7 and 8 indicate how this system may be applied in the case of an ordinary building in a thoroughfare. S S are uprights for four screws, which, in this case, carry the whole scaffolding. Where the screws are placed at long distances apart, it may be necessary to truss the ledgers or scaffold-bearers, and where the builder wishes to work with a minimum number of screws, trussed bearers will naturally suggest themselves. To prevent the possibility of brickbats and building débris flying out into the roadway, I have shown a screen along the front of the building suspended from the scaffolding. This screen, which may be a kind of rope netting, will uncoil as the scaffold rises (see Fig. 8). If the whole of the material for a work of this kind is raised in the interior of the building, and the outside scaffold platforms used for the purposes of setters merely (and not for walling materials), there need be but slight inconvenience, and little or no danger, experienced by the street traffic whilst building operations are carried on.

As to the covering-in of these scaffolds, reference to the sections will show that all that the builder requires to do for this purpose is to stretch tarpaulins or covers over such portions of the ledgers as will afford the necessary protection to the working platforms and walls. These coverings may be placed in position when the scaffolding is first fixed, as they add but little to the weight, interfere in no way with the raising operations, and go up with the scaffold without further attention or alteration.

There is no valid reason why the whole operation of building should not be carried on under cover, and the "waller" be placed in as good a position for doing his work as the "stone-dresser."

The arrangement here applied to scaffolding could be made available for the extension of existing buildings by raising the roofs entire, and adding to the walls as the roof rose, in place of the tentative methods now resorted to when "roof-raising" is practised. — *Joseph J. Lish.*

SLOW-BURNING CONSTRUCTION.

To the Editor of the American Architect:

Sir, — Before replying to the last communication of C. may it not be well again to define the issue between us?

My first letter was in reply to the allegation made by yourself, that the underwriters were "hostile" to architects, and I then took exception to the work of many who are called architects, as exhibited in the construction of city warehouses, churches, school-houses, and hotels, in respect to which structures there is admitted to be an opportunity to apply some of the methods by which cotton and woollen mills have been made exceptionally safe.

Whether the factory mode of slow-burning construction can be imported into the building of dwelling-houses is a matter which I am not competent to decide. I can only say that one of the most experienced mill constructors has built his own house of wood according to the solid or slow-burning method, and finds it suitable.

The same absolute necessity, however, does not exist in respect to dwelling-houses that applies to other buildings; they are protected by the watchful care of their occupants and are good risks to insure. Yet even in them some bad losses and sad accidents have occurred from the spread of fire inside the concealed spaces of the walls furred off from brickwork with wood in the ordinary combustible way. Surely the frightful losses of life in. and the frequent combustion of, hotels ought to forbid the use of any but the safest method of building them.

I will now endeavor to reply to the criticisms of yourself and the questions of C.

In respect to your own comments, one requires proof. Have you any evidence that enclosing timber in common plastering will cause dry-rot? That would be a new fact to us. It is seldom that any timber in a factory is absolutely ceiled up in plaster, but sometimes it is, and we have no knowledge of dry-rot ensuing. Our attention has often been called to dry-rot speedily ensuing from *painting* or *varnishing* heavy timbers too soon, and from enclosing the ends closely in the brickwork, without leaving a small space for ventilation; but we suppose good plastering to be somewhat porous and rather to act as a protection to timber than otherwise.

In answer to C., I must admit a valid defence on his part, if our city school-houses are not built by architects. But how are we to know who is who in the profession? Well-known names are used in connection with buildings to which many of our objections as underwriters apply. A large public school-house but lately completed in this vicinity is open to all the objections that I have named. A large office building within my knowledge has steam-heating pipes in the concealed space between floor and ceiling in actual contact with the wood-work. A bank building has an opening over the stairway, well adapted to conduct the flame from the varnish on the wood-work into the hollow space between the false ceiling and the flat roof. If C. admits that such faults disqualify those who permit them to be called architects, then have I done grave injustice to the profession in using the title of architect in connection with them, but the men who planned these buildings claim the name and it is usually admitted.

In respect to hollow walls, it is possible that dampness might penetrate those tied with bricks so as to preclude fine decorations or paper being used, but we should infer from the dryness of factory walls laid in half cement mortar that there would be no such difficulty.

The thickness of the plank floors and roof *is* essential to the slow-burning principle, especially in respect to the roof, where it is apt to be most neglected, but *rough* plank and timber are not used; the planks are mill-planed, and the timbers are smoothed and the corners chamfered off. If necessary or expedient for yet greater safety, the ceilings can be plastered between the timbers on dove-tailed cleats, or with wire lath nailed close to the plank without furring or with only the thickness of a common lath for a furring. Surely the open timber gives opportunity for decoration in carving or in color; in a shop may not the open timbers be screened by mirrors set a little off and at an angle, so as to reflect the light from distant windows down upon the goods below?

In respect to the upper stories of warehouses used only for storage, I beg to ask C. which is the better way: to use double timbers, eight feet apart planed and chamfered, with a floor upon them of three-inch plank laid flat, planed, tongued, grooved, and beaded at the joints on the under side, or the ordinary construction, of rough plank for support twelve or fourteen inches on centres, covered with thin rough plank and a top floor of boards? What would be the difference in cost? Which is the best roof, open timbers and two and one half inch plank laid flat outside, or plank set edgewise twelve inches on centres boarded outside and ceiled inside, with a space the depth of the plank between? If the habit were changed and the methods of cutting the lumber changed with it, would not the factory method be as cheap as the present common and treacherous method?

C. says that partitions such as I have described would buckle under the weight of the floors unless very thick or interrupted by posts. Am I to infer that C. would consider it fit to depend upon a hollow combustible partition as a support for a hotel or tenement-house floor? If this is within the limits of good architecture I submit that there is reason for a mill constructor or an underwriter to be even "hostile" to architects.

In answer to the query of C. in regard to wire lathing and the method of using it, the letter sent herewith will suffice: —

Office Clinton Wire Cloth Company,
Clinton, Mass., June 27, 1879.

E. A., Esq.:

Dear Sir, — I note in the *American Architect* of the 21st current the request of the contributor C. for more information of the merits of wire lath; as our company has applied many acres of this lath to all kinds of buildings, I take this opportunity to say that we claim for such lath as meritorious qualities the following: —

It is not costly. It is fire-proof when covered with mortar. The mortar cannot be detached from the lath by any reasonable treatment, and any thickness of mortar that may be deemed advisable may be applied to it with the assurance that it will remain in place. It is easily and cheaply put in place, however uneven the surface, by the average mechanic. Ceilings or walls made with this lath will not crack if the superstructure remains in place. It stands the test of time better than any lath known. It will not corrode in any form of lime mortar, and also has many other qualities which we will not enumerate here.

C. in his communication gives to iron lath a quality which it does not possess, namely, "the rapid corrosion of the wire, if the mortar should be for any reason gauged high enough with plaster of Paris to give it an acid reaction," etc.; and my reply to this will apply also to Mr. Wight, who, in his very able address made at Syracuse, said, "It is also liable to decay through the action of sulphate of lime in gauged mortar."

In order that this question may be settled intelligently let us examine the chemical constitution of plaster of Paris.

The plaster of Paris of commerce is invariably made from gypsum; gypsum consists of the neutral salt, sulphate of lime, and water; sulphate of lime is a natural combination of lime and sulphuric acid in fixed proportions, and the compound is in no sense acidulous or corrosive, the acid being perfectly neutralized and rendered inactive by its combination or union with the lime; but if it were possible — which it is not — for the sulphate of lime to be acidulous and corrosive to iron, the presence of even the smallest portion of the lime in the mortar used for gauging would be abundantly sufficient to neutralize the acidity and prevent any corrosion through the aid of its alkaline properties; it is the special quality of lime to neutralize and prevent any acid action by its presence in such mixtures; in fact, it is a chemical impossibility that the presence of plaster of Paris in "gauged mortar" can work as a corrosive on iron. So much for the chemistry of the case. In practice, we find the ceiling of the auditorium of the Boston Theatre, made by pouring liquid grout of plaster of Paris over the first coat of lime mortar, after a lapse of twenty-six years in perfect condition; such is the testimony of Mr. E. C. Cabot, the well-known architect, of Boston.

For partitions we have used this lath in many ways; in mills where we desire to get thorough fire-proofing, with a solid plank partition, covered on either side with the lath, and three fourths to one inch of mortar; in dwelling-houses with the common studding covered with wire lath instead of wood, the same lath being cut in between the studs and plastered as often as desirable, thus making a cut-off from currents of air, and consequently of fire; as also a *sure* protection against rats, at a much less cost than with bricks and mortar.

I hardly think that C. measured the full force of his statement when he said "the combustion of the lath would be slow as compared with that of the studding."

The universal testimony of firemen is to the effect that they find nothing so combustible as partitions made with wood lath, and nothing so troublesome for the reason that they never know where a fire in such partition may break out.

I fear I am making this too long for publication, but I shall be glad to give C. any further information on this subject.

Very truly yours, C. H. WATERS, V. P.

The difficulties in the way of architects submitting designs for factories, as stated by C., may perhaps be subject to a rejoinder. It is assumed by yourself and by C., that before any design can be had, a call for plans must be made by some one intending to build a factory, who is ready to pay for plans. How can such a call be expected when C. admits that much study would be needed even by the best architects before the simple requirements and advantages of a one-story factory could be comprehended, and that "such a plan would put a man *hors de concours* before a professional tribunal," lest the operations in the central portion of such a building should lack light and air? I beg to state for C.'s information that one of the conspicuous merits of the building under consideration is the great abundance of light in the centre and its admirable ventilation.

In other branches of business it is not customary for the one who assumes the charge to learn the elementary principles while conducting the work, and it could hardly be expected that the charge of constructing a great factory should be given to gentlemen of great ability in decorative art, but who would have studied the necessity of industrial architecture so little as to be likely to condemn a plan as wanting the very qualities which are among its greatest merits. If good architectural effect is wanting in our factories and workshops, may it not be for lack of the kind of study that would fit the professional architect to undertake them? And are there not some of the enterprising but younger members of the profession who can prove their capacity by submitting designs for your paper?

May it not be suggested that in most of the constructions of the professional architects, with a few conspicuous exceptions, the decorative art has been borrowed from styles and countries with which our necessary work and our climate have no analogy? Is there not a reason for the want of consideration exhibited by the mill-owner for the architect, in the fact that no truly national art or architecture has as yet been developed in the profession that is in any way adapted to the necessity of our work, to our materials used in building, or to the changeful conditions of our climate?

I can assure C. and yourself, Mr. Editor, that there are many mill-owners waiting for the men who will relieve our factories and workshops of their dreariness, and he who can give architectural effect without impairing the use of the buildings will be most welcome. When the discussions in your journal, the teaching in your schools, and the pictures in your pages give evidence that there are students who are qualifying themselves in this line, I am sure you will not be able to impute any "hostility," even on the part of underwriters, to them.

You say rightly that the open-timber roofs and the solid and honest work of some of our churches are due to the architect; but you must also admit that this method of construction had been adopted by the mill-owners at the instance of the underwriters as the common rule, long before there was a single example elsewhere.

I beg leave to submit a suggestion, taken from our experience, which may enable architects to stop fire and vermin from circulating in the common lath and plaster partitions of houses or hotels, at little cost: —

A compound consisting of four parts coal ashes sifted through a quarter-inch mesh, one part calcined plaster of Paris, one part sour flour, mixed in the same manner as common mortar, hardens into a very light, strong, and extremely porous substance, a most excellent non-conductor. For use on steam-pipes a little common hair is added to give tenacity. Such a mixture rises like a dough, and if placed between studs in a partition the expansion of the mass would force it into every crack. I do not know that it has ever been used for this purpose. I have a brick made in this way, and we are about to try some other compounds. The secret lies in the fermentation of the sour flour.

A compound of coarse sawdust and sour flour has great merit as a non-conductor of heat, and may be useful in many places, as it is almost incombustible. The use of loose sawdust as a packing should be avoided, if there is the least possible danger of oil and moisture being mixed with it, such a compound being very liable to spontaneous combustion. E. A.

P. S. The losses by fire in the month of May in the United States were $8,283,700. There were 695 fires among the risks that are classed as "specials." As usual, hotels head the list, the fires therein in May numbering 53, in one of which there was a considerable loss of life. E. A.

[The danger of dry-rot to wood imbedded in anything which cuts off access of air is one of the traditions of building which are not investigated nowadays because they have ceased to be questioned. It is noticed in all careful works on construction, and architects prefer accepting it as real to exposing their work to it for experiment's sake. Good authorities say that while it is generally dangerous to enclose wood entirely, as by bedding it inside a wall, it is most dangerous of all to enclose it in mortar, and safest in metal, as in the iron shoe at the end of a truss. The reason of this is not far to seek. Dry-rot, so-called, is not a different process from other decay; and is the result, not of absolute dryness, but of a small amount of moisture, either native or absorbed, from which the wood is not relieved by circulation of air. Anything which envelopes the wood closely, and can transmit this small amount of moisture to it, is likely to make it decay. The extreme case is that of a wooden post, which rots below ground while the exposed part of it is sound. Wood may even dry-rot from being enclosed in itself, if it is thick enough and does not crack, like the heart-wood of an old tree, or sometimes the middle of a large log.

A coating of plaster is porous, as E. A. asserts; enough so to transmit moisture, but not enough to allow a circulation of air through it unless there is a marked atmospheric pressure on one side, — from a wind, for instance. When the wood is as thin as a lath and exposed to the slow circulation of dry air which goes on in the interior of an ordinary partition, it is kept so dry as to avoid the danger. A close-fitting iron shoe, on the other hand, is absolutely impervious to moisture, and so may even protect the end of a timber, once securely dried. If E. A. does not like to trust the authorities on this point, we fancy that personal investigation will convince him, if he has opportunity for it. Should he know of trials which have lasted long enough to be tests, and which lead to different conclusions from the received ones, we should be glad to hear of them. The most apposite example which we remember in our own experience was the floor of a house which we once had occasion to examine, twenty years after it was built. The house was a costly one, and the upper boarding of the ground floor had been bedded in mortar, apparently as a protection against dampness from the cellar. The under side of the boarding was thoroughly rotted away, while the exposed side looked fair. It is quite possible that where one could insure a thoroughly dry air at all times it might be safe to bed wood in mortar; but mortar is very hygroscopic, and we should be shy of trying the experiment.

The other points of E. A.'s communication are addressed chiefly to C., and we will not forestall his answer. — EDS. AM. ARCHITECT.]

NOTES OF EXPERIENCE AND INEXPERIENCE.

BRICK-TIED HOLLOW WALLS. — In the issue of the *American Architect* for June 21, 1879, your correspondent C. desires that if any one knows a way to keep brick-tied hollow walls dry, he would describe the process. In reply allow me to suggest the following method, which, I think, will be found effectual. Instead of using brick ties to bind the walls together, let slate bricks or slabs of sufficient length and section to tie the walls thoroughly be substituted. As slate is a non-conductor of moisture, the desired dryness will be effectually secured. At any rate the undersigned has been accustomed to use a course of slate at about two and a half to three feet above the ground, to prevent the dampness from the earth rising in the walls, and has successfully prevented the same by this means.

CC.

NOTES AND CLIPPINGS.

Hospital Ventilation. — It is said that Dr. John Swinburne, formerly Health Officer of the port of New York, has applied successfully to the Childrens' Hospital at Albany a novel method of ventilation. The wards run east and west, and the location is such that they are fully exposed to north, northeast, and east winds, and, to a degree, to winds from the northwest. The window openings are of unusual size, one third of the space being devoted to the ordinary glazed sashes, the remaining two thirds being fitted with several sets of sliding frames, on which is stretched moderately thin unbleached muslin. One or more of these frames, which are two or three inches apart, can be drawn before the opening so that the amount of air and light admitted can be regulated, and the temperature of the wards can be kept well under control.

Artesian Wells in San Francisco. — San Francisco is largely supplied with water by artesian wells, of which it is said there are not less than two hundred in the city. While in London and elsewhere it has been observed that the supply of each well decreased in proportion to the increase in the number of wells, such an effect has not been observed in San Francisco. In some of them the water is reached at a very small depth. One of the hotels is supplied by a well thirty-eight feet deep. Another has a well sixty feet deep, furnishing 6,000 gallons of water per day. A candle factory has a well one hundred and sixty-eight feet deep, which gives a supply of 10,000 gallons per hour. The *Chronicle* has been putting up a building, for which a new well is being bored, which is expected to supply 8,000 gallons per day. One reason for the large number of artesian wells in the city has been the extortionate rate charged for water by the corporations through which the city has received its supply. Like nearly all the corporations of California, these water companies have manifested an intolerably insolent and rapacious disposition. — *Exchange.*

Effect of the Electric Light on Color. — Professor Cohn, of Breslau, has just made a series of experiments on a large number of persons in order to determine in what degree their appreciation of color was affected by the electric light. He ascertained that as a rule the sensation of yellow is sixty times more vivid when the object is seen by the electric light than when seen by daylight, while red is six times and blue and green are about twice as vivid.

The New Episcopal Cathedral in Edinburgh. — The new Episcopal cathedral in Edinburgh is thought to be the most important specimen of Gothic architecture attempted in Scotland since the Reformation. It was the last, and many persons believe it to be the greatest, work of the late Sir Gilbert Scott. Its length is 278 feet (56 feet less than St. Patrick's Cathedral in New York), and its breadth 98 feet 6 inches (78 feet less than St. Patrick's), while the central towers, when completed, will be 300 feet high, and the two towers which flank the west front will be 209 feet 9 inches. In picturesque Edinburgh a more commanding site could not have been chosen, and the completed towers will form striking objects from all parts of the city. The portal is modelled after what remains of the splendid doorway of Holyrood Abbey, and the front as a whole will be, it is said, the most splendid Gothic façade in Scotland. Already the building has cost $800,000, and the entire cathedral, aside from the towers, will be ready for use at the end of the present year. Meanwhile the Church of Scotland, not to be outdone by the Episcopalians, is restoring the historic Cathedral of St. Giles, the original parish church of Edinburgh. Since the Reformation this structure has undergone many radical changes; a part of it having been used at various times as a place of merchandise, a prison, a council chamber, and a police office. Within its walls John Knox was accustomed to preach; indeed, his last sermon was preached there, and only a little way from it he lies buried. This national monument is associated with many incidents in the history of Scotland, among them the Solemn League and Covenant, sworn there by parliament, the assembly, and the English commissioners.

Monument at Fehrbellin. — This is the age of monuments. Germany will soon have written all her history in stone. On the 2d of September next, the anniversary of Sedan, now one of the great national festivals of Germany, a column will be erected at Fehrbellin in commemoration of the battle fought there on the 28th of June, 1679, when the great Elector overthrew the Swedes under Waldemar Wrangel. — *London Times.*

Temple Bar. — On the night of the 13th of June, 1879, the last vestige of Temple Bar was taken away by the contractors, and by this time the southern footway which joins the Strand and Fleet Street has doubtless been perfectly cleared of obstruction and (the boarding round Child's Bank, the rebuilding of which is nearly completed, having also been removed) there is on both sides of the great thoroughfare an unobstructed footpath. The south pier and arch were allowed to remain standing till the bank had been taken down, then the pick was laid to the foundations of the gate, which had been doomed since in August, 1874, an architect while walking cityward "perceived that the keystone of the arch had dropped and that the whole structure had sidled out of the perpendicular." The stones have been deposited on a vacant lot, awaiting the decision of the authorities as to their ultimate disposal.

Origin of Springs. — M. Zweifel, in the *Bulletin de la Société Industrielle*, combats the idea that springs owe their origin to rain-water. He shows, by the observations at many important stations, that the annual evaporation is largely in excess of the annual rain-fall, and that the earth, even in the most absorbent soils, is rarely moistened by the heaviest showers to a greater depth than forty or fifty centimetres (15.75 to 19.69 in.). Air, however, under the pressure of fifteen pounds to the square inch, can penetrate to much greater depths, and if we suppose that the saturation of the subterraneous air varies in the same manner as that of the superficial layers, the condensation of its vapor may account for all subterranean waters. The rapid increase in the amount of precipitation as we approach the earth's surface lends some confirmation to these views.

Effect of Steam Heat on Woodwork. — A correspondent of the *Northwestern Lumberman* makes a statement which has a bearing on all buildings in which steam-heating pipes are laid near woodwork, as well as on the dry-kilns with which he was interested more particularly. He says: "A few days ago, opportunity presenting, I made a careful examination of a dry-kiln, heated by steam-pipes, which has been in operation for the past three years. Cutting slivers from the ceiling and inside walls I found, in each case, that the wood had lost all tenacity of fiber, and was simply a mass of white charcoal. Holding a piece fully a half inch square in the blaze of a match it burned more freely than the match itself. On closely examining it I came to the conclusion that the resinous qualities of the wood were dried to such extent as to become a portion of the mass, and were thoroughly distributed through it, while the fibre was so thoroughly disintegrated, that on rolling the wood between the thumb and forefinger it rolled up into punk, and this punk flashed almost before it came in actual contact with flame. I am persuaded that under favorable conditions dry steam heat in its effect upon lumber but places it in proper condition for ignition under the sultry and piercing rays of a summer sun. A piece of glass upon the roof supplies at once the lens, which, concentrating the sun's rays upon a particular spot, will produce combustion almost at the instant. I have two suggestions to make, although so slightly skilled in chemistry, that I do not consider myself competent to enter into the subject to any extent: There are paints manufactured with a base of silica. I have seen buildings covered with this paint resist a conflagration which, having eaten up two blocks of houses in a village, found no barrier to its progress until the walls covered by this silica paint were reached, when its resisting quality manifested itself in stopping the onward progress of the flames. Could not the inner walls and roofs of dry-kilns be thoroughly treated at intervals with this preparation — the cost would be very trifling — and thus obviate the risk from fire? It is worth a trial. A friend who has a somewhat extended intimacy with the dry-kiln question has suggested an experiment once tried by him, the results of which were, to my mind, extraordinary. Its application, however, was confined to the roof. After putting up his walls he placed 6 x 8 joists across, from side to side, upon the upper surface of which he nailed laths about one inch apart; upon these he placed another tier of joists, 2 x 6, upon which he laid a floor; upon this floor he placed a layer of common earth, from the prairie, to the depth of six or eight inches; the roof was then put on about twelve inches clear above the earth, and with the natural slope. No matter what heat was maintained in the kiln, the under side of the roof was at all times coated with moisture, and this of itself would obviate the possibility of the resin in the wood of the roof becoming albumenized or carbonized."

Colored Photographs. — M. Cros prepares three photographic impressions of any object by sifting the light through solutions which will respectively arrest the green rays, the yellow rays, and the violet rays. The impression from which the green has been excluded, if developed under green light, will appear intensely green at points where the original was the greenest, and pale green or black at the green points where the green was mingled with other colors or was entirely absent. By combining the three negatives, and superposing the images by the help of reflecting prisms, he obtains an approximate solution of the fixation of colors by photography. — *La Nature.*

A Belgian Pantheon. — Next year, at the celebration of the fiftieth anniversary of Belgian independence, it is proposed to erect on one of the heights of the neighborhood of Brussels what a Belgian paper calls "a huge Pantheon, after the style of Westminster Abbey, to contain the portraits and statues of the great men, statesmen, generals, artists, writers, and philanthropists of that country."

The German Cast Iron Forts. — The new solid iron fortifications at the mouth of the Weser, in the north of Germany, have just been finished. There are three forts, containing nine 21-centimetre guns and ten revolving turrets, accommodating fifteen guns of 15 and 28 centimetre calibre. These solid iron structures have a total weight of seven thousand six hundred and fifty tons, present convex and oval fronts to the enemy, and are able to resist the heaviest artillery known. The loop-holes open at the moment of firing, being ordinarily protected by oval valves of the same solid material. Both batteries and turrets are provided with ventilating apparatus and hydraulic engines for working the guns. — *Iron Age.*

The Channel Tunnel. — A despatch states that the boring near Sangatte, in order to ascertain the depth necessary for the Channel tunnel, has been suspended for three months, on account of the quantity of fresh water encountered. The soil is clayey and very hard.

Ploughing by Electricity. — At a recent meeting of the Paris Academy of Sciences, M. Tresca gave an account of some experiments in ploughing by electricity which he witnessed at Sermaise, in the Marne. A Gramme machine, making 1,200 revolutions per minute, and driven by a steam engine, was connected to a second Gramme at a distance of 440 yards, and caused the latter to revolve at the rate of 1,140 revolutions to the minute, the electricity produced by the first machine being thus converted into work. The second machine was connected to a third at a distance of 219 yards, and these two worked cables attached to a double Brabant plough. According to M. Tresca, the experiment was very successful, the work accomplished representing the equivalent of three horse-power, while one half of the motive power obtained from the steam-engine was really transferred to a distance of more than one thousand yards from the furnace. — *New York Tribune.*

Scepticism in Art-Criticism. — The general tendency of art-criticism of late years, observes the *Saturday Review*, has been toward scepticism; more careful investigation has shown that the duration of human life is in many cases inadequate to the labors ascribed to the old masters. Accordingly many of the multitudinous frescoes long passing under the name of Giotto are transferred to his school or epoch; and in like manner Raphael is no longer credited with handiwork that is worthy only of his scholars. The wholesale manufacture carried on by Rubens is too notorious to require comment.