THE AMERICAN ARCHITECT AND BUILDING NEWS.

VOL. XLIII Copyright, 1894, by the AMERICAN ARCHITECT AND BUILDING NEWS COMPANY, Boston, Mass. No. 951.

Entered at the Post-Office at Boston as second-class matter.

MARCH 17, 1894.

CONTENTS

SOME little progress appears to have been made toward putting the official architecture of the United States on a civilized basis, through the recent visit of the Institute Committee to Washington. Hitherto, the Treasury officials, supported, it is said, by the present Supervising Architect, have treated the plan of procuring designs for public buildings by competition, as provided by law, with supercilious contempt, characterizing the plan as impracticable, unnecessary, extravagant and so on, and suggesting that the Institute of Architects procured the passage of the law for its own purposes. Now, a change seems to have come over their sentiments, or, at least, over their expression of them. Instead of finding the provisions of the law "unnecessary," we are told by the Washington *Star* that the Treasury officials "have no disposition whatever to antagonize the desire of Congress for an improved architecture in public buildings," and that "the only reason why the statute providing for open competition in the designing and planning of such works has not been enforced is because of the conviction that enforcement of the law in its present shape is impracticable." It may be remarked that the statute does not provide for "open competition" in such cases, but for competition among not less than five architects, who may be invited as the Secretary of the Treasury shall deem proper, and it seems that this is the point in which the Treasury officials find the difficulty. "The trouble is," we are told, "as to the manner of selection. Shall he [the Secretary] be governed by the wishes of the Senators of the State, the Representatives from the district, the Governor of the State, the Mayor of the city, the Chamber of Commerce, the local political organization, the individual citizens, or the American Institute of Architects?" Besides the terror which the prospect of entertaining delegations from all these bodies, on the occasion of selecting the competing architects for every new building, inspires in the Secretary, it appears that he finds perplexity in the process by which the successful design shall be selected. "He cannot be expected," we are told, "to have a complete technical knowledge of architecture, or even a general knowledge on the subject sufficient to tell which of the many plans submitted is really the best for the purpose required"; and he discovers another difficulty in the vagueness of the law "as to where the work of the successful competing architect ends, and that of the Government architect begins," while he thinks that another objection to the bill is that it will add greatly to the expense of the work, "since the organization of the Treasury architect's office will have to be continued . . . and all the other expenses of designing and supervising will be extra."

IT is obvious enough to any one who has studied the operation of the Government Architect's office that the last two difficulties in the execution of the law could best be met by abolishing the office altogether. It is notorious that the cost of the professional work done in it is, as a rule, much greater than the cost of the same work done by a private architect, and it is not so well done, while such supervision of public building work as has been secured under the system which has controlled it for so many years, would not be tolerated for a week by any private architect of reputation. In fact, under the present system there is practically no responsibility. All the officials who control and direct public building are salaried servants, the consequences of whose incapacity and neglect the Treasury, which hires them, must bear, and does bear, to the tune of many thousand dollars every year; while a private architect, under the ordinary contract of employment, is responsible to the whole extent of his property for faithful and skilful discharge of his duty. In other countries, this responsibility secures the best professional service that it is possible to render, at a cost no greater, and generally less, than is paid by our Treasury for irresponsible and inferior service, and our architects are quite as skilful and faithful as those in other countries. The other objection, that the Secretary of the Treasury, "not having a complete technical knowledge of architecture," could not be sure of selecting the best design, can hardly be serious. The methods of obtaining the best expert advice in selecting among competing plans are as well known here as anywhere, and the pretense of being ignorant of them is simply ridiculous. Altogether, judging from the article in the *Star*, the Treasury authorities seem, through the quiet pressure which is being exerted upon them by members of Congress, and by the public press, rather than by the professional architects, to be gradually retreating into a corner, defending themselves by arguments which grow less and less substantial. Apparently, the only real hope of those who wish to perpetuate the present system lies in an attempt, under some pretext, to get the existing statute before Congress for modification, and, seizing a favorable opportunity, to bring about its repeal, or suspension, or, possibly, such change as will amount to repeal. The Committee of the American Institute of Architects would do well to look out for such attempts, and if they are averted, there seems to be a good prospect that another year will see the law reluctantly put in operation.

AN ingenious method of repairing foundation work injured by springs was recently employed on the North Sea Canal, the great water-way which connects Amsterdam with the North Sea. Of late years, the commerce of Amsterdam has rapidly increased, and the locks at the entrance of the Canal, which protect it against the influence of the tides, are no longer capacious enough to accommodate the traffic, or large enough to admit the immense steamers which would make Amsterdam their port if they could. Two years ago, it was resolved to build a new lock, of the requisite size, and the work has since been going on. The foundation of the immense lock walls is of concrete. All precautions were taken in laying the concrete, and the bed was enclosed with sheet-piling, and pumped nearly dry before the foundation was laid; but, before beginning the excavation, several borings had been made, which pierced the stratum of clay underlying the basin; and, on pumping out the excavation, the water rushed in great jets through these holes, as it would from an artesian well. The concrete was laid over these jets, but the cement was washed out of it by the water to such an extent that the skilful engineers in charge of the work, MM. Van Meren and Bekaar, resolved not to leave such doubtful spots in the foundation, but to strengthen them by some means. MM. Mortier and Thouvard, contractors, have the honor of suggesting to the Government engineers the plan which was finally adopted, and which they were employed to carry out. Briefly, their proposition was to suppress the springs by means of compressed-air, until the concrete put over them could harden sufficiently to be out of danger from them. In order to apply the compressed-air, the contractors first moulded domes of concrete, about thirty feet in diameter, but varying according to the dimensions of the spot of imperfect foundation which it was desired to make good, and with a shell three or four feet thick. In the top of each of these, an air-lock, consisting of an iron cylinder, with the necessary doors, was set, and through the air-lock the workmen passed in and out, and materials were carried. A pipe was driven through the foundation, outside the dome, to the spring beneath it, so as to give an escape for the water; and air was then forced into the dome. As there was no escape for the air, the dome being firmly cemented to the sound part of the foundation, the flow of the spring was checked, and finally reversed, the water discharging through the pipe over the surface of the firm concrete outside. Meanwhile, the workmen under the dome dug out the washed and crumbling concrete, which was passed out through the air-lock, and fresh concrete put in its place. The new concrete, being no longer exposed to washing, soon became as hard as that around it, and capable of resisting perfectly the effect of the springs. In this way all the doubtful spots were repaired, and the stone walls of the lock are now being laid, on a foundation which *Le Génie Civil* calls "irreproachable."

THE *Revue Industrielle* says that, after April 5, 1894, the Bureau of Weights and Measures at Washington will regard the Continental metre and kilogramme as the fundamental standards, and the ordinary measures in use in the United States, such as the yard, the pound, and so on, as derivatives from the metric standard. The *Revue Industrielle* says that this decision amounts to a formal adoption of the metric system of weights and measures by the Government of the United States. If so, an important step has been taken, without exciting as much public interest as it deserves. Although the use of metric weights and measures has long been legalized in the United States, the Government has done little or nothing to favor it, and, while kilograms and centimetres are now familiar measures, they have become so simply because the public demanded them. It may be imagined that people, for example, who have had to buy or sell by Apothecaries', or Avoirdupois or Troy Weight, or by Wine Measure, Dry Measure and the other kinds of measure, with their three sizes of ounces, two sorts of quarts and pints, two varieties of tons, and the other ridiculous and costly absurdities of the old system, have hailed with joy the opportunity of using a rational standard. Already, the formulas for compounding drugs and chemicals, sent out by manufacturers, are almost always given in grammes and centimetres, sometimes alone, but more usually with a translation into Troy or Avoirdupois or Apothecaries' Weight appended, for the benefit of conservative customers. The number of the latter is, however, falling off daily, and a little effort on the part of the Government officials would see Apothecaries' and Troy Weight, at least, with their "pennyweights" and "scruples" and "drachms," relegated to oblivion, to the immense relief of a large part of the public, and of the mercantile community. If we might venture a suggestion, it seems to us that a good way to begin would be, if there is to be a new tariff, to base the Custom-house weights and measures on the metric system, at least so far as goods from Continental countries are concerned. As goods from these countries are packed and invoiced by metric standards, a great deal of calculation would be saved by levying duties according to the same standard, while consumers would soon learn the advantages of following the same course.

M. ANTONY WABLE, in *La Semaine des Constructeurs*, makes a novel proposition, which is certainly worth considering. Speaking of the small exhibitions of pictures, those of the various artistic clubs and societies, which have become much more fashionable than the Salon exhibitions, with their interminable thousands of works of all sorts, he suggests that, as the public goes to see things in the "Petits Salons" which would be neglected in the great ones, the architects, whose section in the official exhibition rarely excites any interest, might imitate the proceedings of the painters, and, instead of collecting a great mass of miscellaneous elevations, restorations, plans and details, divide what they have to show into small, separate groups of works with a common purpose, or, possibly, a common æsthetic idea. For instance, as he says, the enthusiastic young architects who feel themselves capable of inventing a new style might unite their forces in bringing before the public a comparative view of their notions of twentieth-century architecture; while others might excite interest by showing their ideas of a given problem of the day; and there would be a place, even, for a collection of what he calls the "dreams" of architects. The last proposition, particularly, has a good deal to recommend it. Architects do not find much encouragement in their daily practice for indulging in dreams, but it would certainly favor their artistic development to be able to do so occasionally, and a small annual exhibition of designs for things never to be built would enable, and, perhaps, encourage them to spend a few hours occasionally in purely artistic imagining. Among us, Mr. H. P. Kirby, with Mr. Schladermundt, and, perhaps, one or two others, are among the few who have shown the results of such exercises, but the enthusiasm with which their work has been received in the profession indicates that there is a real appreciation among us of the high artistic qualities necessary for producing it. What, however, Mr. Kirby has done with his picturesque groups in late French Gothic, others might do in Spanish Renaissance, or the pure Classical styles, and, while no exercise would bring out better the artist in an architect, nothing would show more quickly than such an exhibition the difference between the real artists and the judicious copyists.

A GREAT archæological as well as engineering work has been accomplished, in the draining of Lake Copais, in Bœotia. The ancient legend is that this lake was formed by Hercules, who flooded the plain by diverting or checking the river Alpheus; and in the bed of the lake may actually be seen, not only a system of aqueducts, but the traces of a town, with remains of a palace, which, in plan, resembles that of Tiryns. As the water of the lake has prevented any interference with the place since the time, if not of Hercules, at least of the earliest history, it may be expected that archæology will find a rich treasure. According to the *Builder*, the remains should belong to the period of the Minyæ, the people who were driven out of Greece by the Pelasgi, themselves a race of almost fabulous antiquity. Twenty-five hundred years ago, the Greeks spoke of the Pelasgi, the traditional race which had inhabited the country a thousand years previously, as "the Ancients"; yet, if the *Builder's* theory is correct, the ruins in the Lake Copais were old before the time of the Pelasgi, and belonged to people of whom the Greeks knew nothing except that their king was the son of the Sea and the Storm-wind's daughter, and that his three daughters ate a child, and were afterwards changed into bats.

TWO chemists of Hamburg, MM. Forster and Nijland, have published some studies on the cholera infection, from which it appears that soap is one of the best known sterilizers of water suspected of infection. For a long time after the cholera epidemic of last summer, the people of Hamburg were afraid even to bathe themselves with Elbe water, but MM. Forster and Nijland show that ordinary toilet soap, added at the rate of an ounce to about twelve quarts of water, will kill the cholera bacilli in ten minutes. This would be a large proportion of soap to use in a bath, but, as most people, instead of dissolving soap in the bath-water, apply it to the skin with a sponge, it is probable that the water actually brought in contact with the skin is generally soapy enough to be harmless. If, however, it is desired to obtain greater security, a soap containing a small quantity of corrosive sublimate may be used. Many "complexion washes" contain this drug, which is said to have a beneficial effect on the skin, however dangerous it may be internally, so that no hesitation need be felt in employing soaps medicated with it, and a very small quantity is sufficient. With a soap containing one per cent of corrosive sublimate, added at the rate of a quarter of an ounce of soap to sixty quarts of water, all the cholera bacilli will be killed in one minute, and half the dose will kill them all in ten minutes; while the sublimate alone is still more active, an ounce being sufficient to destroy, in five minutes, all the cholera microbes in about a million quarts of water.

ONE of the most eccentric artists in England, though, in his way, a very good one, has been rewarded for his talent in a rather curious way by being created a baronet, under the title of Sir E. Burne-Jones. It is not that a title is an unusual reward for meritorious artists in England, but it seems quite natural to think of Sir Frederick Leighton, or Sir John Millais, in connection with the types of high-bred English character which they understand and represent so well; while Mr. Burne-Jones's mermaids and things will hardly know what to make of him with his coronet and red hand.

OFFICE-HELP FOR ARCHITECTS.[1]—XXVI.

CHAPTER IX. — FLOORS.

§ 323. Distribution of Material: — Chapter III treated of the strength of the members of which a floor should be composed; but it is not alone necessary that the floor should be strong enough or stiff enough; we should go farther and know that it is the most economical that can be built. In frame construction, the spans are usually restricted to 20′ 0″ or 25′ 0″. For the best results it should always be made 20′ 0″ or under, as that gives a size of floor-beam most easily obtained. If steel I-beams are two cents a pound, it is cheaper to use them than wood for girders in spans of 20′ 0″ or more. In fireproof construction, especially where it is desired to support the floors largely by means of columns, the distribution of the columns has a marked effect on the economy. Taking into account the elements of sizes of columns, size of openings, relation between r and l, size of floor-beams, size

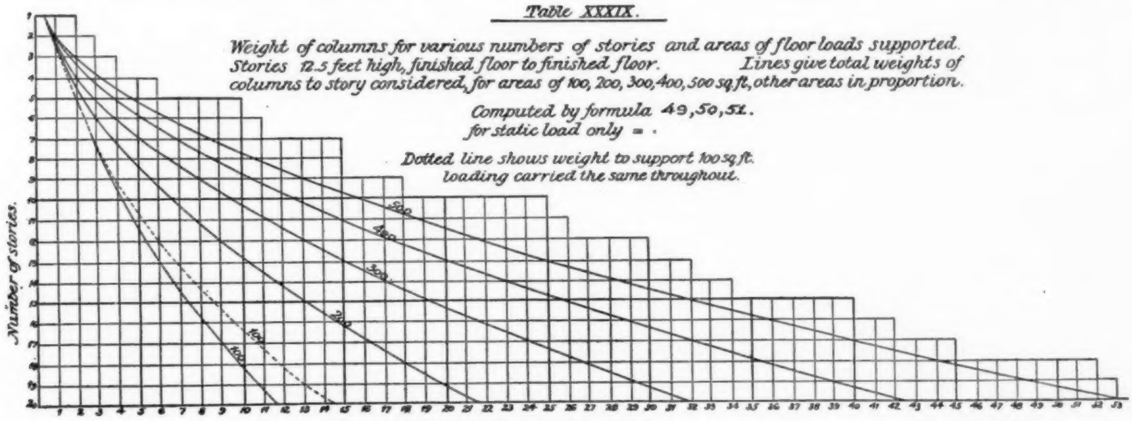
TABLE XXXVIII.

DATA RE FIREPROOF FLOOR FRAMING.

Beams. $S = 12,500$		Depth	6″	6″	7″	7″	8″	8″	9″	9″	10″	10″	12″	12″	15″	15″
		Weight per foot, lbs.	13	16	15.5	20	18	22	21	27	25.5	33	32	40	41	50
		Length of span l	10′0″	10′0″	11′8″	11′8″	13′0″	13′0″	15′0″	15′0″	16′8″	16′8″	20′0″	20′0″	25′0″	25′0″
		Spacing on centres (a)	3′9″	4′0″	3′10″	4′6″	4′0″	5′0″	3′11″	5′3″	4′3″	5′6″	4′5″	5′7″	4′4″	5′4″
		Weight of beam, lbs. per sq. ft.[1]	3.5	4.0	4.0	4.5	4.5	4.4	5.3	5.2	6.0	6.0	7.2	7.1	10.6	10.7
		L in thousands of lbs.[2]	6.56	7.00	7.85	9.17	9.10	11.37	10.28	13.75	12.4	16.0	15.4	19.5	18.92	23.3
Girders. $S = 16,000$	$l = 3a$	Depth	9″	10″	10″	10″	10″	12″	10″	15″	12″	15″	15″	15″	15″	15″
		Weight per ft., lbs.	21	25.5	25.5	31	28	36	31	41	33	48	41	60	44	65
		Weight of girder, lbs. per sq. ft.[1]	2.10	2.55	2.18	2.66	2.15	2.77	2.06	2.74	1.98	2.88	2.04	3.00	1.76	2.61
		l	11′3″	12′0″	11′6″	13′6″	12′0″	15′0″	11′9″	15′9″	12′9″	16′6″	13′3″	16′9″	13′0″	16′0″
	$l = 4a$	Depth	12″	15″	12″	15″	15″	15″	15″	15″	15″	15″	15″	15″	15″	15″
		Weight per ft., lbs.	32	41	40	46	41	60	44	82	55	96	80	120	91	140
		Weight of girder, lbs. per sq. ft.[1]	3.20	4.10	3.42	3.94	3.16	4.62	2.81	5.47	3.30	5.77	3.97	6.00	3.65	5.60
		l	15′0″	16′0″	15′4″	18′0″	16′0″	20′0″	15′8″	21′0″	17′0″	22′0″	17′8″	22′4″	17′4″	21′4″
	$l = 5a$	Depth	15″	15″	15″	15″	15″	15″	12″	15″	15″	20″	15″	20″	15″	20″
		Weight per ft., lbs.	41	48	49	70	60	91	80	120	91	128	110	140	140	160
		Weight of girder, lbs. per sq. ft.[1]	4.10	4.80	4.20	6.00	4.62	7.00	5.33	8.00	5.47	7.68	5.50	6.98	5.60	6.40
		l	18′9″	20′0″	19′2″	22′6″	20′0″	25′0″	19′7″	26′3″	21′3″	27′6″	22′1″	27′11″	21′8″	26′8″
Arch Blocks. Old style, Form (a)		Minimum depth of	6″	6″	6″	7″	6″	7″	6″	8″	7″	8″	7″	8″	7″	8″
		Weight of block per sq. ft.	29	29	29	33	29	33	29	37	33	37	33	37	33	37
		Weight of filling per sq. ft.	5	5	15	5	25	15	35	15	35	25	55	45	85	75
		Weight of total per sq. ft.	34	34	44	38	54	48	64	52	68	62	88	82	118	112
		Safe general live-load per sq. ft.[3]	250	250	240	250	230	230	220	230	220	230	200	200	190	190
		Cost of block and filling, cents per sq. ft.	15	15	18	17	21	21	24	23	26	26	32	32	41	41
		Maximum depth of	6″	6″	7″	7″	8″	8″	9″	9″	10″	10″	12″	12″	12″	12″
		Weight of block per sq. ft.	29	29	33	33	37	37	40	40	43″	43	48	48	48	48
		Weight of filling per sq. ft.	5	5	5	5	5	5	5	5	7	7	10	10	30	30
		Weight of total per sq. ft.	34	34	38	38	42	42	45	45	50	50	58	58	78	78
		Safe general live-load per sq. ft.[3]	250	250	250	250	250	240	240	240	230	230	230	230	210	210
		Cost of block and filling, cents per sq. ft.	15	15	17	17	20	20	22	22	24	24	28	28	34	34

[1] Based on area supported.
[2] Based on 175 pounds per square foot, total dead and live load.
[3] Limited to an area of arch that will give the stated fibre strain.

Table XXXIX.



Total weight of columns in thousands of pounds.

[1] By George Hill, Consulting Engineer. Continued from No. 947, page 76.

ABBREVIATIONS AND SYMBOLS.

= equal to.	∴ therefore.
‖ parallel to.	□′ square feet.
÷ divided by.	□″ square inches.
× multiplied by.	8# read 8 pounds per lineal foot.
+ added to.	[channel bar.
a^2 a multiplied by itself.	I I-beam.
$a > b$: — a greater than b.	T T-iron.
$a < b$: — a less than b.	L angle iron.
$\frac{a}{b}$: — a divided by b.	⊥ deck beam.
	● round section.

I ton = 2,000 pounds as this is the conventional ton, the legal ton is 2,240 pounds, but is rarely used.
l = the length between supports of any beam or girder or height of any column, always in feet.
b = breadth of any beam or girder, always in inches.
d = depth of any beam or girder, or the least transverse dimension of any column, always in inches.
L = total load uniformly distributed coming on any piece in pounds.
$L^{\square'}$ = " " " " per square foot in pounds.
W = concentrated load on any piece in pounds.
s = span of any arch or truss between centres of end pins in feet, or spread of footing courses.
A = area of any section in square inches.
M = maximum bending-moment in inch pounds.
n = distance of centre of gravity of section from either top or bottom edge in inches.
I = moment of inertia, neutral axis through centre of gravity.
R = moment of resistance of section.
r = radius of gyration, in inches.
Sc = safe compressive strain in pounds per square inch.
St = " tensile " " " " " "
Ss = " shearing " " " " " "
S = strain per square inch in extreme fibre.
P_e = upward reaction of support at left-hand end of beam.
P_f = " " " " " right " " " "
e = distance of centre of gravity of load from left hand of beam.
f = " " " " " " " " right " " "

of girders, thickness of floor-arch and the cost of the various parts, it will be found that the most economical spacing of columns will be not to exceed 10′ 0″ in one direction, by 11′ 3″ in the other. This is for the usual case; but in order

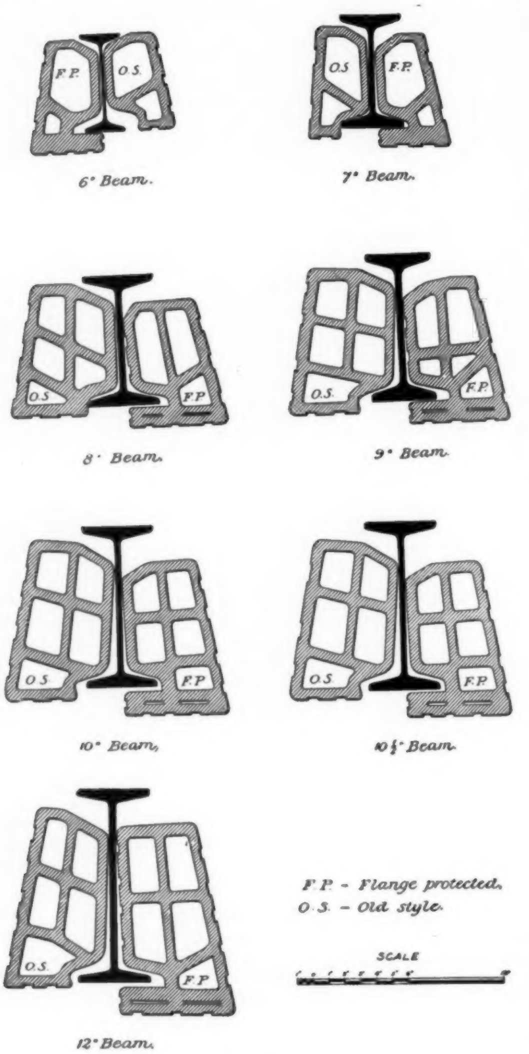


Fig. 125.

to meet the requirements of the shape of the lot, uses of the building and other features which are controlled directly or indirectly by the use, it is necessary that a lay-out should be made for purposes of trial so as to determine that disposition of the columns which for the given case is the best, and for this purpose Table XXXVIII will give the weights of the floor-framing, sizes of the arches necessary to use, the dead-load by reason thereof and other data relative to the floors, and Table XXXIX gives the actual weight of columns for the average height of story of 12′ 6″ and for usual conditions of load as explained in Chapter VII, using Formulas 49, 50 and 51. With this data the architect can compute the total weight of framing required, for any disposition of the floor-beams and columns with relative exactitude, and within 10% of the actual amount.

The weight of columns for floor-areas differing from those given can be determined by a simple proportion; while for a greater number of stories, the architect must determine the weight by successive increments, as heretofore explained.

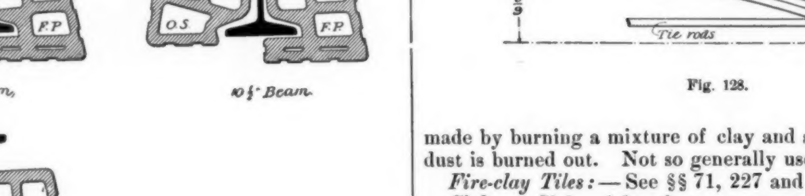


Fig. 126.

SECTION I. — FIREPROOF CONSTRUCTION.

§ 324. Filling-in: *Materials: — Hollow fire-clay flat arches* are made in two general forms: (*a*) as shown in Figure 125, in which the bearing ribs are horizontal with jointing surfaces at right angles to the line of thrust and continuous, and with the voids of the blocks running parallel with the supporting beams. These blocks are made with two types of skew-backs, one designated "Old Style," and the other with the terra-cotta projecting back underneath the flange of the beams, called the "Flange-protecting Skew-back." These blocks are made with the skew-backs in a number of different forms, some of which are shown in Figure 126. The arches are generally made with whole or half voussiors, which are respectively about 4″ and 8″ long, spilts which are 1″ long, with various sizes of key-blocks, the skew-back blocks remaining always the same. (*b*) End construction in which the voids run at right angles to the beams; the bearing ribs are all vertical, the top and bottom surfaces only being horizontal. Two varieties of these blocks are shown in Figure 127. Very exhaustive tests were made as to the relative strength of the two types of blocks, and it was found that the Lee arch withstood very much higher loads and more severe tests than did the ordinary style of arch. In practical work, however, the excess in strength is without value, while the difficulty of securing satisfactory joints oftentimes leads to trouble, and where this is overcome, as is the case in the Maurer block, the defects incidental to the flat arch are reintroduced, in part.

Porous Terra-cotta: — Or terra-cotta lumber, practically follows the form of fire-clay arches, above described, and is

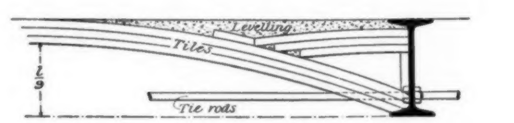


Fig. 128.

made by burning a mixture of clay and sawdust until the sawdust is burned out. Not so generally used as the fire-clay.

Fire-clay Tiles: — See §§ 71, 227 and 228. (Fig. 60.)

Slabs: — Slabs of fire-clay or porous terra-cotta in two forms as shown in Figure 129 are sometimes used. Each block should be clamped to the beam in case the underside is to be plastered on, as the weight of the block is not sufficient to resist the upward thrust when rubbing on the mortar. These blocks should be set in gauged mortar.

Concrete: — Every year sees some new form suggested. None should be used for ordinary building-operations.

Iron and Concrete: — Corrugated-iron sheets bent to an arch form and filled-in over the top with concrete, may be used, but are not recommended. For light floors, corrugated-iron sheets may be laid down, levelled-up with concrete and given a concrete wearing surface with but little loss of time, but this floor will require to be very thoroughly painted in order to avoid very annoying condensation on the under surface. Such a floor will fail when attacked by fire.

§ 325. Proportions: — These can only be determined by computation. The use of Table XXXVIII will facilitate the preliminary studies. The thrust of the floor arch-blocks should be determined by computation, using Formula 45 as described in § 226. Segmental arches are only economical where considerable spans are essential, and where the architectural treatment requires the domed effect. They should be made 6″ thick when of hollow blocks, for spans up to 16′ 0″, with a 12% rise. Guastavino tiles should be made two layers thick for a 3′ 0″ span, with an increase of one layer for each 4′ 0″ of increase of span. In spans of 16′ 0″, the thickness of the crown need not exceed four layers, increasing to the springing line one layer for each three feet, or reinforcing with a light arch as shown in Figure 128.

Slabs should be put on T-irons using $3'' \times 12'' \times 24''$ rebated slabs and $2\frac{1}{2}'' \times 2\frac{1}{2}''$ T's 5.4 lbs., or a pair of $2\frac{1}{2}'' \times 1\frac{1}{2}'' \times \frac{3}{16}''$ angles rivetted together, back to back, thereby saving in weight 0.8 pounds per lineal foot or 0.4 pounds per square

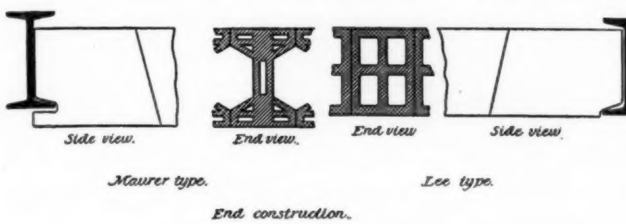


Fig. 127.

foot. These should be spaced apart 25″, and with 4′ 0″ spans are safe for a concentrated load of 400 pounds or a uniformly distributed load of 75 pounds per square foot. For spans up to 6′ 0″, use blocks of the same size, spaced the same distance

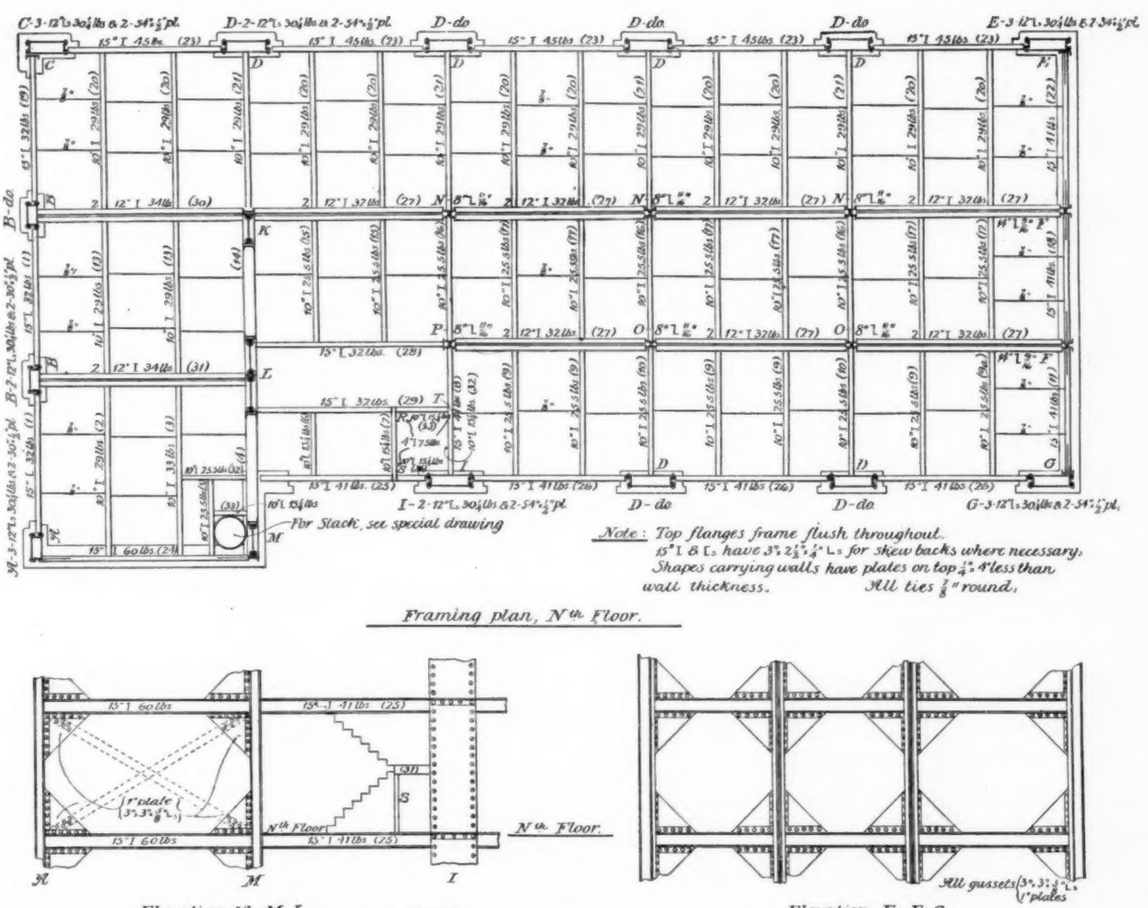


Fig. 130.

apart with $2\frac{1}{2}'' \times 3''$ T's 6 lbs. Where this construction is used for roof-covering, the stems should be covered with a strip, shown in Figure 129, for securing the roof-covering to, and in all cases the flanges of the T's should be protected, using wire-lath to hold the plastering.

Suspended Ceilings: — Can be formed by hanging these T's from the beam framing, or more economically by the use of 6″ beams and blocks, making the beam spans about 10′ 0″.

§ 326. Setting: *Flat Arches:* — These should be set in a good Rosendale-cement mortar, No. 3 of Table II. The centering is usually boarding carried by wooden beams, which are, in turn, carried by hooks passing over the

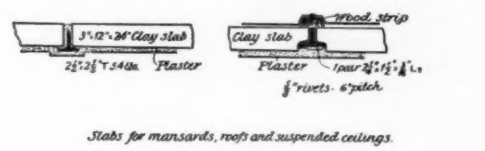


Fig. 129.

steel beams, the length of the hook being adjusted by a wing nut. Voids are left where these hooks pass through the arch, which are subsequently plugged up with mortar and broken pieces of the block. Where the old style skew-back is used, the flange of the beam should be covered with Roebling wire-lath, No. 16 wire, $\frac{1}{4}''$ mesh. Wherever openings are required through the blocks, they can be obtained by punching a hole or leaving out the block up to an area of about 1 square foot, beyond which the opening should be framed out either with channels of the depth of the beam used, or else with two angles, one at the top and one at the bottom. Where the work is completely planned in advance of construction, the laying of the arches should be immediately followed with a levelling-up of cinder concrete, and the laying of the under floors.

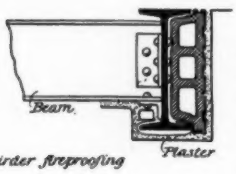


Fig. 131.

Segmental Arches: — These, when made of blocks, are laid in manner similar to that described for the flat arches, except that the centering is made in arch form. For the Guastavino tiles, a staging is built on which the workmen stand, and the centre is a piece of $1\frac{1}{4}''$ plank cut to the desired form, on which the course of tile being laid is balanced. The first course or layer is usually laid in plaster-of-Paris and the balance in Portland cement. Great care must be exercised to see that the work is not frosted, that no retempered mortar is used, and that the arch is not stepped on until it has had ample time to set, say three days.

§ 327. Protection: — When it is intended to plaster on the underside of arches, care must be exercised on the location of the boiler for the hoisting-plant, so as to prevent staining by the smoke or soot, neither of which can be removed. No foul or muddy water should be permitted to be used in the mixing of the mortar, or to flow over arches, as that will cause a staining through. Care must be exercised that the arches are not loaded until they have had an opportunity to set and are not overloaded at any time. A general rule would be to require that no piles of material other than iron should exceed 4′ 0″ in height.

§ 328. Framing: — A correct plan of every floor should be made wherever there is the slightest change. This plan should show the exact location of the beams and columns of the framing, with the sizes of the beams marked thereon, and designating numbers or letters given to the beams, and designating numbers or letters given to the columns. (Fig. 130.) Even where the floors are exact duplicates, one of the other, the plan should be made, so as to insure the covering of every point. There should also be made at least two sections, and an elevation of each wall, with the floor-lines drawn through, and the framing shown in outline. Arches should start at the wall-line from a skew-back angle or channel supported on the framing or on one course of brick corbelled out $1\frac{1}{2}''$. Tie-rods should be round, spaced from 3′ 0″ upwards on centres, and of proper diameter to take up the thrust.

§ 329. Openings: — All openings should be finished off, using heavy wire-lath, plastered on, or girder fireproofing, as shown in Figure 131. Openings for skylights will be considered in a subsequent chapter.

§ 330. Bottom Surfaces: — The bottom surfaces should generally be plastered. The bottom of fire-clay arches comes from $\frac{1}{2}''$ to $\frac{3}{4}''$ below the I-beams as shown in Figure 125 [prepared from full-sized sections of beams and arches]. The protection of the bottom flange of the iron beam should be by wire-lath as above noted. False beams, large and heavy cornices and the like, should be carried from the skeleton framing by means of a framing of angles and bars, as shown in Figure 132; the wire-lath on which the plastering is supported being secured to the shapes, or a similar framing can be made of wood at a great saving in cost and without increasing the

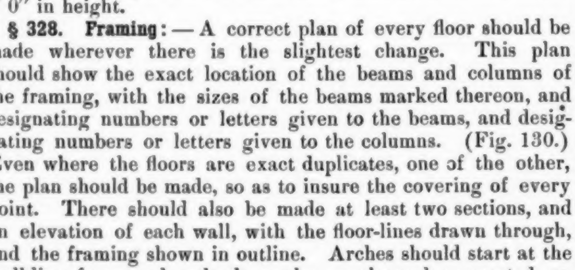


Fig. 132.

fire-risk. All filling of inequalities in the surfaces of the arches, preparatory to plastering, should be done with Rosendale cement and sand mortar. Where it is intended to expose the arches, showing all masonry and construction, the old style of skew-back should be used, and the beam protected with wire-lath and plastered, showing the shape of the flange. The plastering is best done with a hard plaster.

(To be continued.)

ELECTRICAL SCIENCE FOR ARCHITECTS.[1] — III.

THE ELECTRICAL UNITS.

THE strangeness of electrical terms is, perhaps, largely accountable for the lack of knowledge about electrical matters. It is discouraging to meet at the start with "volts," "ampères," "ohms," "watts" and other names and expressions as mysterious as the cabalistic signs on a physician's prescription. But it is only another illustration for Carlyle's "Philosophy of Clothes." Electricity is not the only subject that is looked upon with increased respect and awe because of the peculiar names given to ideas concerning it.

This clothing of the ideas no doubt obscures many simple facts and fails to suggest their semblance to ideas that are familiar, but, in the end, it is an aid to clearness to have the terms distinctive. When once there is clear conception of the fundamental ideas, the electrical nomenclature is found simple and direct and it is an advantage to have specific terms that will not suggest too readily foreign ideas not analogous in all particulars. It is, perhaps, this very directness, the absence of all roundabout terms, that makes most electrical talk seem highly technical. It is encouraging to the uninformed to meet in explanations with "pounds," "feet" and other common quantities, because they are familiar and the most abstruse talk in someway seems to gain clearness when this much is understood. It is, however, largely a question of familiarity, and it is doubtful if our knowledge of the ultimate meaning of pounds and feet is much clearer than our knowledge of volts and ampères.

Analogies are sometimes confusing because they are taken too literally, and the attempt to reconcile the analogous ideas in all particulars will sometimes cause more confusion than if a more abstract conception were attempted at the start. Thus, while it is often helpful, it is not necessary to compare electrical forces and quantities with those that seem to have a more material existence. We may compare them, for instance, with the "pressure of public opinion," "currents of feeling," "resistance to changes." These expressions have a definite meaning to us even though the ideas themselves do not appeal to the five material senses. If there were a way to measure "the pressure of public opinion," we should probably do so, fix upon a unit and give a name to it. But because we cannot do this and yet can measure "electrical pressure," it would seem as if the latter should be not less clearly recognized.

We have these abstract ideas of pressure, resistance and current, and, if they are kept in mind while the names are looked upon as figures of speech rather than as literal definitions, the ideas are of great usefulness.

There is what is termed "electrical-pressure" or electro-motive force. It is a definite force and can be measured. It does not show its effect in quite the same way that water-pressure or steam-pressure does. We do not see it push masses of substance before it, but the abstract idea of a pressure can be applied to it just as we apply it to "pressure of public opinion." It causes certain actions in an electric circuit. When the force is great the action is great, when it is small the action is accordingly small. It agrees with our idea of a pressure and it helps to a clear conception of its nature to think of it as such. Resistance, current and other electrical quantities may be looked at in the same way. It is not necessary to assume that there is an actual flow of something material. It is not known that anything material actually passes through a wire, but it is known that there is a progressive effect along it "like a current" of something and that it is produced by the electro-motive force which acts "like a pressure."

When once it became known that definite electrical forces and quantities existed and gave rise to certain effects, and when these had been named, it remained of course to decide upon units, so that they might be measured and compared. It is hardly necessary to discuss here how or why the different units were made what they are, nor to mention more than three or four most commonly used. As is generally known, the units have been given the names of the physicists who have done most for electrical science. Thus the unit of electro-motive force or electrical-pressure, corresponding to "pounds per square inch" in hydraulics, is called the "*volt*," and the electro-motive force is often spoken of as the "voltage." The unit of current corresponding to "gallons per minute," in hydraulics, is called the "*ampère*." There is no unit of resistance in hydraulics: it is recognized in its effect upon the pressure and is spoken of as being equivalent to so much loss of "head" or "pounds per square inch" pressure. In electrics the resistance may also be recognized in its effect upon the pressure, but it is readily measured as a resistance simply, and is expressed in terms of a unit called the "*ohm*."

These quantities come to have a definite meaning as they become familiar through use. One mentally forms a rough idea of the number of units of electro-motive force, current and resistance in an electric circuit, from the actions that take place, from the visible

[1] Continued from No. 948, page 90.

manifestations of the electrical energy. By continued experience one gradually gets an idea of the relative resistances of conductors of different sizes and materials: an idea is formed of the amount of current that is necessary to heat them or to cause the different magnetic effects, and of the amount of electro-motive force necessary to force the different currents through a certain length of conductor.

There is nothing in an object to tell of its hardness or softness except its similarity in various ways to other objects that we have felt. There is nothing to show the temperature of a body except the effects that are seen when the heat energy is changed to other forms. But continued experience teaches us to appreciate all the slight changes and small actions. Electrical forces and quantities become familiar and seem real, by the same process, and with experience one intuitively forms rough judgments just as one does of weight or temperature.

It will, perhaps, help to form an idea of a few of the electrical quantities, if their magnitude in some common instances are mentioned:

The electro-motive force of a voltaic cell, such as is used in telegraph and telephone work or for ringing electric bells, is from 1 to 2 volts.

The pressure at the terminals of an incandescent lamp is usually either 50 or 110 volts.

The pressure used in electric-railway work is nearly always 500 volts.

The current through an incandescent-lamp when made for a pressure of 50 volts is about 1 ampère; when made for a pressure of 110 volts the current is about ½ ampère.

The current through an arc-lamp when it is of 2,000 nominal candle-power, is about 10 ampères.

The resistance of a copper-wire .01 inch in diameter and 10 feet long is almost exactly 1 ohm.

The resistance of a German-silver wire .01 inch in diameter and 1,000 feet long is about 1,500 ohms.

A copper-wire 0.5 inch in diameter and a mile long has a resistance of about 0.2 ohms. The same wire 10 miles long would have a resistance of 2 ohms, the resistance being proportional to the length. If the same wire were one-half the diameter it would have four times the resistance, since the resistance is inversely proportional to the sectional area and consequently inversely proportional to the square of the diameter. RUSSELL ROBB.

[To be continued.]

SHUMAN'S PROCESS AND APPARATUS FOR EMBEDDING WIRE-NETTING IN GLASS.[1]

THE Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts, by its Committee on Science and the Arts, investigating Shuman's process and apparatus for embedding wire-netting in glass, finds as follows:

The object of this invention is to strengthen, or reinforce, sheets of glass of various dimensions intended to be used for roof-lights, partitions, vault and pavement lights, port and deck lights, etc., by inserting a metallic-netting into the body of the glass sheets at the time they are rolled, with the view of protecting the glass against fracture and of preventing fragments of fractured sheets from detaching themselves in case of accident.

The present mode of protecting glass-skylights is to suspend copper-wire netting immediately beneath the glass, the wire being fastened to a framework holding the glass. In situations exposed to smoke, corroding-gases and other destructive influences, as in railway-stations, chemical works, etc., this practice is attended with serious objections, for the reason that, in such situations, even copper and brass wire will become corroded and will then be worthless as a protection against the fall of large fragments of glass, should the skylights become broken.

The enormous extent to which wire-netting is used thus to protect skylights was strikingly illustrated at the late World's Columbian Exhibition in Chicago, where 1,045,000 square feet of wire-netting were placed under the glass roofs of four of the main exhibition buildings.

The use of wire-netting in such a manner that it cannot be corroded and, at the same time, will reinforce and strengthen the glass (which, in the old practice, the netting does not do), would obviously be a great step in advance and one which should commend itself to architects and engineers, and the advantages of embedding the wire in the glass itself to accomplish these objects are so manifest that further comment would seem unnecessary.

In examining the prior state of the art of producing sheets of glass with metallic enclosures for the purpose of strengthening and guarding the same, the following references, bearing more or less directly on the subject, have been found and consulted.

The first invention, showing wire-netting embedded in glass, is the British patent, No. 1,528, of 1855, granted to Newton for fire and burglar proof glass. This patent describes the depositing of a quantity of molten-glass into a mould, then placing on the glass a sheet of wire-gauze, then placing upon the wire another quantity of molten-glass, and finally pressing the mass into a sheet. The wire is prevented from projecting beyond the glass by constructing the mould in two parts and mounting the wire between the parts; it is claimed that several sheets of wire-cloth can be thus introduced into the glass. . . .

The Shuman patents, Nos. 483,020 and 483,021, of September 20, 1892, as far as can be found, are the only patents granted in the United States for embedding wire-netting in glass.

The first attempts to put the idea into practice appear to have been made in England, some twenty years ago, by Thaddeus Hyatt, whose British patent, No. 1,482 of 1871, is referred to above, and concerning which we give the following additional details:

A section of wire-netting is securely clamped in a frame of cast-iron of a thickness equal to that of the glass-sheet to be made. This frame is then laid upon a flat table, and sufficient glass to form a sheet poured into it. By means of an hydraulic press, part of the glass is forced through the meshes with the view of getting the glass on both sides of the netting; or, in other words, placing the netting as near as possible in the centre of the glass-sheet. While this seems very simple in theory, Hyatt appears to have encountered great difficulty in forcing the glass through the meshes when a fine netting was used. To obviate this difficulty, a square or round hole was made in the centre of the section of wire-netting in order to facilitate the flow of glass underneath.

The netting was thus necessarily subjected to a severe strain in forcing the glass through the meshes, and, since the metal becomes red hot by its contact with the molten glass, it will evidently stretch and sag when pressure is applied to it, thus making it impossible to keep the netting even approximately in the centre of the glass sheet. Another objection to this method is that the dimensions of the glass sheet are limited to the size of the face of the plunger of the hydraulic-press. Hyatt's process was apparently found to be impracticable, and, so far as can be determined, his product never became a commercial commodity. . . .

By the Shuman process the wire-netting is inserted into the glass whilst a sheet is being rolled, the wire being heated, just before its incorporation, to a temperature near the melting-point of glass. The wire-netting thus incorporated with the glass forms part of the sheet itself and it cannot by any means, short of violence, be detached or removed therefrom. Of course, such a sheet may become cracked and portions detached from and expose the wire; but even in such a case, there are so many points of attachment that it would hardly be probable that sufficient corrosion could take place to seriously weaken the wire and damage the sheet, no matter how many fine cracks it might contain through which the corrosive influences could work their way to attack the metal.

The inventions of Shuman form the subject of two letters-patent of the United States, one covering the details of the machine, and the other the features of the process. In the following description, reference will be made to both of these specifications without special distinction, as it will be convenient to regard them for the purpose of this investigation as a single invention. . . .

The table upon which the glass is rolled is arranged so that it may be heated from below by large gas-jets, prior to beginning work. The table is made preferably of cast-iron, and is provided on each side with ribs of sufficient height to allow for the rolling of the glass, and on the outer edges are rails upon which the rolls travel. On each side are rails, supporting the carriage before and after its travel. These rails are mounted in any suitable manner and are in line with the rails of the table.

The carriage is provided with four rolls, a front smoothing-roll, a ribbed-roll and two following smoothing-rolls. It is moved across the table by power transmitted by means of a sprocket-wheel and link belt. The front roll is intended to smooth out the molten glass after it is poured out upon the table and prepares it for the reception of the wire-netting.

An inclined chute, for feeding the wire-netting to the glass as this is spread by the front roll, is shown in connection with the carriage, arranged at the proper angle, and has a trigger, or other stop, at its lower end to detain the sheet of wire-netting placed thereon until the proper time to discharge it upon the glass. The sheet of wire-netting is preferably heated to the proper degree, so that it will not chill the glass when it is placed thereon. Directly back of the chute is a roll independently mounted in the carriage and having on its periphery a series of annular ribs, so arranged in reference to the table as to press the wire-netting into the molten-glass. The ribs may be so arranged that although all the wire is incorporated in the molten glass some portions thereof will be pressed more

[1] Abstract from the report of the Committee on Science and the Arts of the Franklin Institute and published in the *Journal* of the Society.

deeply than others, thus corrugating the wire within the glass, if this be desired.

A smoothing-roll directly behind the ribbed-roll then passes over the glass and closes up the openings made by the ribbed-roll and wire, completing the rolling of the glass. A second smoothing-roll is preferably employed, in order to correct the tendency of the rolled sheet, while still in the plastic state, to curl up over the first rear smoothing-roll.

The finished glass is then removed and placed in an annealing-furnace. After the glass has been annealed, any glass or wire projecting over the edges of the sheet is cut off, after which the glass is ready for the market. The wire is preferably cut to the proper size prior to its application to the glass. The three smoothing-rolls support the carriage, the ribbed-roll being so mounted therein that it is free to rise or fall independently of the carriage. Thus by raising this roll when the carriage is returning it will be clear of the glass. In order properly to handle the glass, the smoothing-rolls are made hollow, and the heads are perforated to admit a gas-pipe with jets for heating the rolls before beginning work. The rolls when thus brought to the proper temperature will not chill the glass during the process of rolling.

In operating the process a sufficient quantity of glass is poured upon the table at a point immediately in front of the first roll. As the carriage is moved forward, the roll smooths out the molten-glass to the proper thickness, after which the wire-netting is delivered upon the molten glass and pressed into it by the following ribbed-roll. The next following smoothing-roll closes the openings and corrugations made by the netting and ribbed-roll. By this means a sheet of glass is produced with strips of wire or a sheet of wire-netting embedded therein. By having, at certain distances, a series of annular grooves upon the ribbed-roll, it is possible to corrugate the wire within the sheet. The heated wire being pliable, it will yield only at the points where it receives pressure, and may, accordingly, be made to follow a waving, or any other desired course in the sheet, as the outline of the periphery of the ribbed-roll shall determine. Thus the wire is, so to speak, woven within the glass in such a manner as to tie both wire and glass together.

The glass, after it has been rolled, is carefully annealed in a furnace of the usual construction. The wire embedded in the glass not only strengthens the sheet, but also prevents the particles of glass from breaking entirely away from the main sheet, while, on the other hand, the glass protects the wire against corrosion.

From the foregoing abstract, it will appear that the radically novel feature of Shuman's apparatus is the ribbed or grooved roll, by which the wire-netting is pressed to a pre-determined depth into the glass whilst the sheet is being rolled, and, at the same time, is permanently fixed in position by the following smoothing-rolls; and the scope of the process may be defined as rolling out a sheet of glass, pressing into it a metallic fabric, and finishing the sheet by pressure of a heavy roll or rolls, whereby the metallic fabric is permanently embedded therein, these steps constituting practically a single operation.

The pressure of the rolls in the later machines is about fifty pounds to the square inch; the distance from centre to centre of the ribs or grooves in the ribbed-roll is one inch. It has been found that with grooves of this size, any wire-mesh between one-fourth inch and three inches can readily be embedded. These sizes of mesh represent the extremes of the sizes employed. A smaller mesh would require a groove of different size.

The average temperature of the fused glass is about 3,000° Fahrenheit. It is stated that the glass may be rolled at about 2,200° Fahrenheit, although the higher temperature is evidently the better one.

The inventions of Mr. Shuman are in practical operation on an extensive scale at the works of the American Wire Glass Manufacturing Company, at Tacony, Philadelphia.

The works cover an area of one-and-one-half acres, and the plant at present consists of one main building, 300′ x 100′, and two auxiliary buildings, each 20′ x 150′. The glass melting-plant is an eight-pot Siemens's regenerative furnace of the latest design and capable of melting ten tons of glass per day. The fuel used is gaseous, furnished by three Wellman gas-producers. There are twelve annealing-ovens of the Belgian type for tempering the glass sheets immediately after the wire has been inserted, and to these the glass is carried in a tray. These annealing-ovens are heated by the Aërated Fuel Company's system, using crude petroleum.

The steam-plant consists of one fifty horse-power Babcock and Willcox, and one fifty horse-power upright, boiler. All mixing and handling of glass is done by machinery. There are three sizes of rolling-machines at present installed; two, capable of rolling sheets up to 24″ x 84″; two, capable of rolling up to 30″ x 84″, and one machine capable of producing sheets as large as 54″ x 144″.

Machinery has been introduced for handling the product wherever it could advantageously be applied. Thus, all the waste material is removed by tramways, and all cars and wagons are loaded from overhead tracks. The waste ends and imperfect sheets are utilized by separating the glass from the wire by means of special bending-rolls. The glass broken off is returned to the furnace, and the wire, wherever practicable, utilized for other sheets. With the experience now gained in the operation of the plant, it is stated that the percentage of defective sheets made is so small that it does not enter as a factor in the cost of production.

The rapidity with which sheets are made varies with the thickness. With three-sixteenths inch, the time of rolling is eighteen seconds; with one-fourth inch, twenty-five seconds; with three-eighths inch and over, thirty-five seconds. The capacity of the plant is 5,000 square feet per day of all sizes, and it is stated that the demand for the product has been large enough to keep the works fully occupied.

With its present facilities, which, it has been stated, will be extended as the requirements of business demand, the company is now engaged in the manufacture of wired-glass sheets of any required dimensions up to 4′ x 10′ and from three-sixteenths inch to one inch in thickness. It is manifest that there must be a limit, beyond which it would not be prudent to increase the dimensions of sheets on account of their weight and the risk of cracking in handling and transportation. The usual dimensions for skylight and roofing glass range from 10″ x 20″ to 30″ x 84″. Sheets larger than 48″ x 144″, therefore, will rarely be called for.

The objection that has been urged against the process — the difficulty of cutting the sheets to desired dimensions — is a real one, but to a great extent has been overcome. In the operation of cutting, the sheets are first scratched with the diamond, then broken across the cut, when the ductility of the embedded wire readily permits, by bending slightly to and fro, a sufficient separation of the edges of the cut to allow a thin-bladed saw to be inserted, by which the wires are cut through with comparative ease. In nearly all cases, however, the demands of the trade are for standard sizes, which require no cutting beyond that necessary to trim the edges. . . .

Another point of interest which is worthy of notice, in connection with the operative features of the Shuman process, is the preliminary preparation of the wire for the production of the higher grades of wired-glass. This consists in, first, removing the oil or grease from the wire by treatment with a cheap solvent (such as benzine), then passing the wire under a swiftly revolving roll, provided with bristles, and finally beneath flannel buffing-wheels, whereby the wire is thoroughly cleansed and polished. For the best grades of wired-glass, a specially annealed steel wire is used, which, after the cleansing treatment, presents a white and brilliant surface.

The following claims of merit, made on behalf of the new product, appear to be substantiated, viz: When used for the skylights in railway sheds, the much greater strength of wired-glass permits the use of thinner and larger sheets, thus reducing the weights in the roof. It is hail-proof, and proof against vibration. The copper wire-netting which is now required beneath such skylights, to protect persons below from injury by the accidental falling out of glass, may be dispensed with, thus saving not only the cost of the guard, but also the cost of renewing such netting when weakened by corrosion. The increased strength of wired-glass will enable it to support with safety great weights of snow, which occasionally prove destructive to skylights of the ordinary kind; and, even should it become cracked by reason of rough usage or by accident, the tension of the wires will hold the fractured portions together, and the efficiency of the sheet will not be notably impaired.

Worthy of mention, also, is the fact that the common skylight guarded with wire tacked on beneath is so difficult to clean that this important item is practically neglected, with the result that the glass in time becomes greatly obscured by accumulation of soot and dirt.

It is probable that there would be much less likelihood of the occurrence of fatal or minor accidents caused by persons falling through skylights of wired-glass when it is properly set in its frame; also, stones and heavy articles falling on such glass will often be arrested; and, on account of the time and trouble entailed in cutting through it with the diamond and severing the wires, it would interpose a much more serious obstacle to thieves, than the plain, unguarded glass. These qualities commend the new product for use in show-windows where articles of value are exposed. It is proposed for windows in warehouses and stables, machine-shops, railroad-shops, and it is also suggested as advantageous for partitions in buildings. For deck, port and cabin lights in vessels, the same reasons should ensure its serviceability.

Finally, it is suggested that in the form of large sheets of extra thickness, strengthened by one or more enclosures of wire-netting, and properly supported in an iron frame, wired-glass would afford an advantageous substitute for the round bull's-eye and other small patterns at present largely used for pavement and vault lights. The wired-glass could not only be made sufficiently strong for such service, but would also admit much more light per square foot of area than the forms of lights in common use.

These claims appear to be well founded.

The members of the committee of investigation, having had the opportunity of examining this invention in the course of its practical development on the commercial scale at the Tacony Works, are fully satisfied that the mechanical elements of the problem have been admirably worked out; that the present mode of manufacture is simple, efficient and rapid; and that the quality of the product is good. In conclusion, they find that the process and machine of Mr. Shuman, not only represent a marked advance upon all previous efforts in the class of inventions to which they relate, but also that they meet for the first time in this branch of the arts, the requirements of a practically operative method and means of manufacture.

For the reasons herein stated, and because of the undoubted advantages of wired-glass for those uses for which it is adapted, the Institute recommends the award to the inventor, Frank Shuman, of the John Scott Legacy Premium and Medal, for his machine and process for producing wired-glass.

JOSEPH M. WILSON, *President.*
WM. H. WAHL, *Secretary.*

Approved, November 1, 1893.
H. R. HEYL,
Chairman of the Committee on Science and the Arts.

ENAMELLED BRICKS.

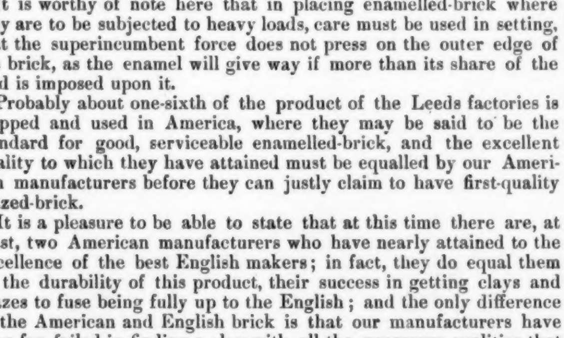
SOME thirty years ago the Farnley Iron Company and one of its neighbors in business at, or near, Leeds, England, finding that the fire-clay found in connection with the coal-seams in that district was particularly suitable for allowing an enamel surface, began the manufacture of glazed-brick. For some years after the trade was started the brick made were very inferior compared with those of the present day, the best brick of that day not being at all equal to what are sold as second quality now. Notwithstanding this, the brick found immediate sale with architects, especially in London, where they were used partly for sanitary reasons (the glazed surface being washable and non-absorbent) and partly for light afforded in narrow alleys and courts. As the quality of the bricks improved with the experience of the makers, the demand still further increased, and they are now used in large quantities in all English cities. It is estimated approximately that the total output capacity of the Leeds district is about 4,000,000 to 5,000,000 per week. Of these numbers not more than sixty per cent can be reckoned on as first quality, and thirty per cent second quality; the remainder, as thirds, are available only as building-brick. These thirds are valuable where strength is required; the superior clay and hard burning make them of high value, because of their resistance to crushing loads.

It is worthy of note here that in placing enamelled-brick where they are to be subjected to heavy loads, care must be used in setting, that the superincumbent force does not press on the outer edge of the brick, as the enamel will give way if more than its share of the load is imposed upon it.

Probably about one-sixth of the product of the Leeds factories is shipped and used in America, where they may be said to be the standard for good, serviceable enamelled-brick, and the excellent quality to which they have attained must be equalled by our American manufacturers before they can justly claim to have first-quality glazed-brick.

It is a pleasure to be able to state that at this time there are, at least, two American manufacturers who have nearly attained to the excellence of the best English makers; in fact, they do equal them in the durability of this product, their success in getting clays and glazes to fuse being fully up to the English; and the only difference in the American and English brick is that our manufacturers have thus far failed in finding a clay with all the necessary qualities that will, after burning, have a surface as smooth as is the product of our English friends. The only American manufacturers who have thus far succeeded in making a thoroughly good and merchantable glazed-brick from the standpoint of the English standard are the Griffen Enamelled Brick Company, of Oaks, Pa., and Sayer & Fisher Company, of New York. The experience of our American, as well as the English manufacturers, in getting the manufacture of glazed-brick started on a successful basis, has been fraught with many sad experiences, and with them, as with the makers of other kinds of brick, the working of clays and enamels has been "eye-openers," and in all cases success has only been attained at a great cost in money and vexation of spirit. — *G. B. Engle, Jr., before the National Brick Manufacturers' Association of the United States of America.*

ALBERT MOORE'S WORKS.



"Beads," by Albert Moore.

"A COLLECTION of pictures and studies by the late Mr. Albert Moore brought together and exhibited as a tribute of respect to the memory of that great artist, whose loss we deplore, and with a view of giving some idea how great this loss is to English art." Such is the somewhat uncomfortably composed heading to the list of Albert Moore's works, now on view at the Grafton Gallery, London; and doubtless, among his many admirers upon your side of the globe, some may be interested in a little run, vicariously, through the room.

It is always trying for an artist's reputation to have his works thus assembled together. Jostled in the ordinary way against other pictures, a painter has much to lament when he sees how his own works "swear" at their neighbors, or how his neighbors' work reviles his own; but for all that, it is possibly less damaging than placing his individual schemes of tone and color side by side, with no relief or variety. A painter must be a strong worker to escape monotony under these circumstances; and it is more than doubtful whether Albert Moore was "great artist" enough to escape failure. We have had a Millais collection of late years, besides assemblages of the work of Rosetti, Burne-Jones, Gainsborough, Reynolds and Watts; and of these, it may not be unjust to say, that Millais and Reynolds were the two painters who were completely free from convention, monotony or weakness — qualities to be found, more or less, in all the other masters' work.

Therefore, it is not surprising if Albert Moore's pictures strike one as somewhat weak and *fade*. That he was an able artist, a thousand times superior to many of the Academicians who kept him out of their society, is undeniable; but possibly the term "*artiste de talent*," as the French say under certain circumstances, would be a more suitable one than "great." His figures are eminently graceful, the lines are pleasing, and sometimes there is poetry and sentiment in the composition: color, too, occasionally, but more often not. His flesh is dead and wooden, his stuffs just anything you like; indeed, there is no attempt at realism of any sort. Draperies appear to be tempest-blown, but there is no wind to move them. Shadows denote a sun, but it does not shine. Moonlight, sunlight, storm and calm, all are of the same effect; poetic, perhaps, but it is not the poetry of nature. The little studies are charming and the old "Quartett," painted years ago, remains unsurpassed by any of the later work — it seems an echo of an elegant fresh coin or gem. But there is a dreariness about most of the pictures, a want of light, and sun and life; a feeling that all spontaneity has been sacrificed to infinite labor and pruning, a want of the emotional element and a terrible lack of color; still, there is, withall, a conscientiousness, a purity, a desire to deliver a message which should only work for good, or an originality within certain limits (rather, perhaps, a Renaissance of Greek feeling), which ought to have been rewarded by admittance into the honored ranks of the Academy — if it be an honor to pass that threshold.

That it is quite possible to combine poetry with nature is proved by Mr. G. Hitchcock's "S. Geneviève"— an exquisite piece of color harmony. It is instinct with life and poetic feeling; so, too, M. Roll's "Flight into Egypt." These pictures form two more links in the chain of modern religious art: strong, both in feeling and technical qualities, S. Geneviève is standing amidst her sheep in a mass of high grass and wild flowers, clad in a blue gown, the symbol of purity, and a simple flannel cape; that is all the color, a lovely harmony of blue and green. In M. Roll's work we see a workman with his wife plodding over the rough ground; the Virgin bends over her babe which she is caressing. There is no effort at reproducing any land between Judea and Egypt; this piece of ground might be in France, England or Italy. There is no distinctive dress, no effect of, or straining at, holiness; it might be named "Evening," or "After the Day's Work." Just a gleam of a nimbus is all that tells the tale; and yet it is immeasurably more spiritual than three-fourths of the religious pictures of the old masters. It is a pity that the hangers have condemned the picture to a dark spot in the vestibule.

Professor von Uhde is not at his best in the "Sermon on the Mount." He has caught the intensely religious feeling of the Bavarian peasants, but they are unnecessarily ugly; and the painting is coarse and commonplace.

The sunny meadows of M. Claus, and the flowers of M. Fantin Latour are old friends in a new dress; but Professor Zügel's "Sentinel," is a new and fine acquisition. A glowing sunlit down, and some sleepy sheep are guarded by a large white dog who looks watchfully at the spectator. The anxiety lest evil should approach his charge during his master's absence, and the importance of the task allotted to him, are most powerfully depicted upon that dog's face: one would like to know and honor him as a dear friend.

Some of the Glasgow school's eccentricities are raging upon the walls, feeble imitations of the early French Impressionists; and it seems a pity that after all these years, Manet should be imitated, and his faults exaggerated, by those who ought to have profited by his failures. In France, the lesson taught by Manet was all learned and has been applied equally well by the later school; at Glasgow, they seem to have gone back twenty years to produce works, the principal aim of which appears to be to caricature a chess-board.

M. Rodin exhibits some black-and-white sketches of figures dashed in with a most masterly touch; and, as for M. Raffaelli's little etchings, they are simply and quaintly charming. PENGUIN.

FOR EXTENSION OF WESTMINSTER ABBEY. — Yates Thompson, formerly owner of the *Pall Mall Gazette*, has offered £38,000 with which to add to Westminster Abbey a large chapel in which future memorials and monuments may be erected. The Government has deferred accepting the offer, pending the decision upon three schemes already suggested for the extension for the abbey.

ILLUSTRATIONS

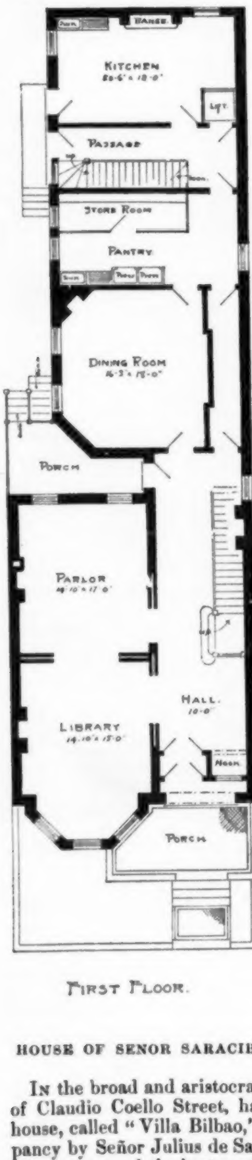
[Contributors of drawings are requested to send also plans and a full and adequate description of the buildings, including a statement of cost.]

NORTHEAST ANNEX OF THE FINE ARTS BUILDING, WORLD'S COLUMBIAN EXHIBITION, CHICAGO, ILL. MR. CHARLES B. ATWOOD, ARCHITECT.

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

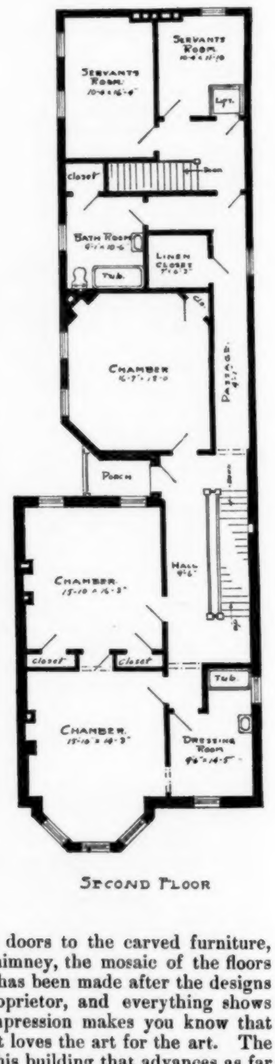
HOUSE OF HENRY LEE VALENTINE, ESQ., RICHMOND, VA. MR. M. J. DIMMOCK, ARCHITECT, RICHMOND, VA.

THE materials used in construction are brown stone, red brick and old-gold brick in combination. The house is just completed and cost, complete, $12,000.



First Floor.

House of Mr. Henry Lee Valentine, Esq., Richmond, Va.



Second Floor

HOUSE OF SENOR SARACIBAR, ARCHITECT, SALAMANCA, SPAIN.

In the broad and aristocratic district of Salamanca, and at the end of Claudio Coello Street, has been erected an elegant and artistic house, called "Villa Bilbao," which was designed for his own occupancy by Señor Julius de Saracibar, a well-known Spanish architect, who has passed the best part of his life erecting and embellishing the dwellings of many other persons, and has at last been able to construct his own, being able in it to display his genius and his skill as a constructor.

This residence occupies an area of about 8,000 square feet. It is difficult to distribute this space with more dexterity, for on this lot the villa has been built with an ample and marbled exterior *escalinata*, garden, small lake, grotto, kiosks, stables, departments for straw, a greenhouse and other accessories, all arranged so that nothing becomes a hindrance — everything is seen and everything is isolated.

In this abode, all the rooms are large, with high ceilings, profusely lighted and ventilated, with great economy of the land. The access to the property is from Claudio Coello Street, by a large and wide entrance between pillars decorated with allegorical details dedicated to the unconquerable city of Bilbao and to its famous siege.

The ground-floor has its access at the level of the garden, but the floor is raised more than a metre above this level, profiting advantageously by the slope of the site and freeing the rooms from the humidity of the adjacent plantations; it contains the billiard-room, bath-room, kitchen, pantries, larders, lavatories and servants' rooms.

The first floor is approached by a commodious staircase, and from the exterior by the wide *escalinata* that we have already mentioned: this floor contains Señor Saracibar's studio, the large drawing-room, the dining-room with a charming "rotunda" on the side of the garden, a hall and the beautiful staircase that goes to the second floor; in the latter are the bed and other rooms, all with direct light and with all the best conditions of sanitary and commodious arrangements; rooms for servants and for domestic services are provided in the roof, and a pleasant and isolated study-room is at the top of the turret.

We will not fatigue our readers with an exact account of the magnificence and elegance of the ornamentation of these rooms. But we think it is our duty to attest that everything that is seen in this residence, from the ironwork of the doors to the carved furniture, from the curtain to the enormous chimney, the mosaic of the floors and the painted ceilings, everything has been made after the designs and under the direction of the proprietor, and everything shows the seal of the artist. The first impression makes you know that this is the habitation of an artist that loves the art for the art. The treatment of the principal block of this building that advances as far as the line of the street, seems rather florid, and some people have qualified it as overloaded.

The house is divided into three sections: the first vigorous and light; the other with its ample triple window, by which enters abundant light for drawing (for it lights the studio), is severely decorated with appropriate elements so as to facilitate the delicate and prudent transition to the upper part — the richest portion. We all know that the sculptured figure always has a great value as a decorative element, and placed as these caryatides are, they give a great importance to this part of the building, that some judge excessive.

The four fine arts have between themselves ties of union that are common. Architecture the same as music must seek for the harmony of its parts with the whole, the perfect accord of its elements. As painting studies the effect of light and shade perspective, the intonation of color; as sculpture searches for grandeur of line and has to accuse the structure, the anatomy of the body that it models, so Señor Saracibar has rendered homage to the four sisters, receiving and giving them a lodging in his own house. In these caryatides there is originality and taste; they are neither the *canephoras* of the Villa Albani, nor the caryatides of the Athenian Pandrosium; they are his, and nothing more.

The pediment is crowned by a colossal head of the "Genius of Art." In the tympanum are sculptured the emblems of architecture, with branches of laurel and oak round them, and the heraldic shield of Señor Saracibar is suspended in a prominent place of the façade.

Forming part of this block of the building, follow at its left side and parallel to the public road other two blocks in the centre of which is the entrance door, and above on the same axis, a window; in front of the door there is a small terrace to which leads the broad *escalinata* of which the balustrade is in the line of the street, adorned with openwork metal and vases in a very good taste.

The other block on the left side is formed by the square tower so characteristic in Spanish construction. There was in it a problem of no easy solution; in its large massiveness there were larger surfaces of the building that had to be decorated with sobriety, but in harmony with the rest of the work. A colossal bust and a statue have been enough to decide the difficulty with dexterity. The first is that of Michael Angelo Buonarotti, and the second the Venus of the Island of Melos.

The tower terminates in a belvedere and in the middle of the cornice is a colossal bust of Apollo, the god who presides over the fine arts.

In the north façade, which is not covered and is beaten by the north wind, he has taken great care to furnish a gap in each floor; these gaps are made to ventilate all the building. This façade, that naturally would have had a frigid appearance, and would have been, without movement, now appears agreeable and harmonious through the construction of a very large central recess, decorated with strong pilasters and an arch, that facilitates the issue of the fumes of four chimneys, converting the whole into a grandiose *motif* that constitutes the ornamentation of the façade.

The site is limited on the left side by a large, but not very high party-wall. Señor Saracibar thought, from the first, of covering the cold and ugly appearance of this wall, but he did not employ the common and vulgar lattice to cover its nakedness — far from that — he spent much time and money in reproducing, with all its details, the famous frontispiece of the Egyptian speos of Isamboul, dedicated to the goddess "Hathor."

At the junction of the party-wall with the front wall of the block, he has erected a spacious grotto, in which artificial stalagmites support the stalactitic vault of irregular shape, and here is placed a plate-glass aquarium, the seats about it being formed with Persian capitals and one of the gigantic idols of Bamiyan. He has also constructed a little mountain, erecting on it a lighthouse which at night with its bright rays serves as a lamp in that part of the garden.

What is particularly worthy of notice in this house is the economy of the materials of construction and the employment of one very seldom used in this country. The architect has striven to give the walls the precise thickness that may correspond to the necessary condition of stability and resistance, and where walls are suppressed he replaces them with iron columns or pilasters, properly spaced; this allows him to use thin walls, and to leave others open without complicating the construction; he abandons altogether all vertical wooden beams, and so economizes all the space he can.

The material of which we have spoken as foreign is the "*Sable mortier coloré*," made by M. Charles Stocker, Paris, Quai de l'Oise No. 29. It is an artificial stone of very good quality, that can be kneaded easily and is furnished ground or in powder so that it can be moulded, the same as gypsum; it acquires later a great hardness. The walls are dressed with it, and mouldings, statues, adornments and all sorts of high and low reliefs can also be made with it. Employing this stone-mortar, it is unnecessary to paint the walls, and the color that it acquires is more uniform than can be secured with any sort of stone. All the walls of the façades and all the work of sculpture of this villa have been made with it. * * *

MADRID, October, 1893.

ROOD-SCREEN IN ST. PETER'S CHURCH, MORRISTOWN, N. J. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

THIS drawing, by Mr. Frank A. Hays of Philadelphia, was hung at the late exhibition of the Architectural League in New York. The ironwork, itself, was manufactured by John Williams of New York.

THE ROBERT F. BALLANTINE GYMNASIUM AND ARMORY. RUTGERS COLLEGE, NEW BRUNSWICK, N. J. MR. CHARLES ALLING GIFFORD, ARCHITECT, NEW YORK, N. Y.

THE building was a gift to Rutgers College, by Robert F. Ballantine, Esq., of Newark, N. J. The materials are brick and stone. The gymnasium proper is 60′ x 100′ in size; while the main or Administration Building in front measures 82′ x 37′. The building is complete in every way, containing bowling-alleys, a large swimming-tank, a ball-cage, a running-track and all necessary accommodations for lockers and equipments, instructors'-offices, measuring-rooms and committees'-rooms.

A COUNTRY CLUB-HOUSE ON LONG ISLAND, N. Y. MESSRS. DOUGLAS SMYTH AND A. R. MCILVAINE, ARCHITECTS, NEW YORK, N. Y.

[Additional Illustrations in the International Edition.]

ENTRANCE TO THE GERMAN VILLAGE, WORLD'S COLUMBIAN EXHIBITION, CHICAGO, ILL.

[Gelatine Print.]

NORTHWEST ANNEX TO THE FINE ARTS BUILDING, WORLD'S COLUMBIAN EXHIBITION, CHICAGO, ILL. MR. CHARLES B. ATWOOD, ARCHITECT.

[Gelatine Print.

VICTORIA ASSIZE COURTS, BIRMINGHAM, ENG.

A GENERAL view of the Birmingham Courts was published lately in this journal. We now show on a larger scale the central block of a building that has received general commendation from the Judges who have presided in it.

CHURCH OF THE ENGLISH MARTYRS, STREATHAM HILL, ENG. MR. A. E. PURDIE, ARCHITECT, WILLESDEN, ENG.

INTERIOR VIEW OF THE SAME.

COMMUNICATIONS

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

PROTESTANT CHURCHES IN GERMANY.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In speaking of the convention to be held in Berlin upon Protestant Lutheran churches, you speak of the absence in Germany of High and Low Church divisions. But there is an enormous difference between the Reformed State Church of Prussia, and the Old Lutheran Church of Saxony and Nuremberg. The churches of the former resemble French Protestant buildings and the gowns of the clergy are similar to the Calvinist Geneva black gown. But at Leipsic and Nuremberg (especially at the latter) the churches are as the Reformation found them, and the ministers wear the voluminous black gown and white ruff of Dr. Martin Luther himself. They are most picturesque objects, these Lutheran ministers; veritable living "Holbeins." At St. Lorenz, Nuremberg, the altars retain their crucifixes, candles and images; and around the church is a mass of statues, tryptichs and carvings. At Leipsic, where the churches only date back to the seventeenth and eighteenth centuries, candles and crucifixes are upon all the altars.

I send you these notes, as they may be interesting to your Boston readers who object to the reredos offered to Trinity Church!

Yours faithfully, S. BEALE.

THE LETTER-HEAD COMPETITION.

BOSTON, MASS., March 7, 1894.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — The McFarland Manufacturing Company's competition for an artistic Letter-head has taken place and the jury have unanimously agreed to place the design by "Your obedient servant" (A. B. Le Boutillier, 410 La Salle Avenue, Chicago, Ill.), first; that by "Laurel B" (Edwin R. Clark, Lowell, Mass.), second; and "Chance" (J. J. Driscoll, 426 Cross Street, Faulkner, Mass.), third.

Will you kindly insert this decision in the next issue of your paper, and oblige, Yours respectfully,

MCFARLAND MANUFACTURING CO.

THE STYLE OF THE PLYMOUTH, MASS., CHURCH.

BOSTON, MASS., March 14, 1894.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — As there has been considerable criticism of the architectural style of our design for the First Church, Plymouth, printed in the *American Architect* of last week, will you kindly allow us to say that we had no option in the matter. We were informed that no design would be considered unless it were Gothic in style. We urged the claims of Colonial, but without success. The design published was ultimately rejected, though for another plan also Gothic.

Very truly, CRAM, WENTWORTH & GOODHUE.

NOTES AND CLIPPINGS

Electric-light Lamp-posts in London City. — The lamp-posts erected in the city [London] are of noble dimensions, the lantern being big enough for a man to get inside. To give access for trimming and cleaning, the posts have holes alternately on either side, into which the trimmer puts eight portable steps of light steel, by means of which he mounts, and which he removes as he comes down. As the result of some experiments, rippled-glass has been used in the lamp-tops, which, whilst cheaper than the ground and opal glass, also tested, absorbs less light — viz, 21.73 per cent, as against 25.18 per cent for the opal, and 46 24 per cent for the ground-glass. The glass used is one-seventh of an inch thick, and thus is not very liable to accidental injury. The bases of the posts are of an ornamental character. Considerable difficulty was experienced in getting satisfactory foundations for these lamps, owing to the crowded state of the subsoil, and many different patterns of base-plate had to be employed, thus increasing the difficulty of completing the work by the contract time. In addition to the arc-lamps, the city anthorities are also experimenting with large glow-lamps, though General Webber apparently thinks that these latter lamps are not being run under the best conditions. He considers that the glowing filament should not be exposed directly to the eye, but that it should be shaded by a glass cut into diamond-shaped facets, which, whilst breaking up the light satisfactorily, does not absorb anything like the amount which ground or opal glass would. Such lamps, weighing much less than arc-lamps, might easily be hung from light brackets fixed to the walls of the houses adjoining the street. Glow-lamps of course require much less attention from lamp-trimmers than arc-lamps, and hence a larger number of watts per candle-power can be economically used in them. — *Engineering.*

Wooden Water-mains. — A recent paper read before the American Society of Civil Engineers by James D. Schuyler, Member of the American Society of Civil Engineers, on "The Water-works of Denver, Col.," contained some very interesting observations and figures relating to this subject. He states that sixteen miles of thirty-inch wooden conduit were constructed in that work in addition to a considerable length of forty-four inch pipe. The timber used was California redwood, and the thirty-inch conduit was constructed to stand under a head of 185 feet. We understand from the paper named that the total average cost of the thirty-inch pipe was $1.36 per lineal foot, of which about forty-eight cents constituted the cost of trenching and back-filling. A gang of eight to sixteen men laid from 150 to 300 feet of the same size conduit per day. These mains were composed of staves dressed very smooth to cylindrical sides and radial edges, and were held to the cylindrical form by mild-steel bands placed at a distance apart depending upon the head, but never exceeding seventeen inches. The pores of the wood are filled with the water under pressure, so that it oozes through to a slight extent, thus realizing the condition for permanent preservation. The pipe is framed in the trench, and all handling in full-size sections is avoided; at the same time the interior finish is so smooth that the most advantageous conditions of flow are secured. Mr. Schuyler estimates that the use of these wooden conduits effected a saving of over $1,000,000 in this particular work. — *Fire and Water.*

Rank as an Artist's Reward. — In conferring a baronetcy upon the great painter, Burne-Jones, Queen Victoria has merely followed the example of most of her fellow-sovereigns of Europe in granting titular and hereditary dignities to the men famous in the literary, scientific and artistic world. Thus, in Austria, the painter Munkaczy has been created a baron by the Emperor, whilst the late painter Makart was ennobled. The late Marquis de Molins, who for so many years represented Spain at the French capital, owed his title to his literary achievements. In Italy there are no less than four members of the Senate who owe their appointment to the King, who has endeavored thereby to recognize their achievements in literature and art. Among them are Verdi, the composer, the poet Carducci, the painter Morelli and the author Mantegazza. France has always been the most generous of all countries in honoring talent of this kind, and the Senate during the First and Second Empire, and the Chamber of Peers under King Louis XVIII, King Charles X and King Louis Phillippe, comprised a large number of poets, scientists, artists and authors of eminence. — *Marquise de Fontenoy in the Philadelphia Press.*

A Railroad Through the Sea. — An interesting experiment is about to be carried out at Brighton in the shape of the construction of a marine railway for the purpose of connecting Brighton with the little village of Rottingdean, some three or four miles to the eastward. The rails will be laid on the solid rock with concrete, and at high water will be covered by the sea, which, however, will not affect the carriages, the latter being supported on a framework that keeps them high and dry. At this part of the coast the cliffs are high, and the beach is practically inaccessible, so that no boating-traffic will be interfered with. The cars will be moved by electricity, like those now in use along the eastern foreshore of Brighton. — *London Daily News.*

Building a House of Buttons. — Clapisson, the French musical celebrity, is building a château composed entirely of buttons. The walls, the ceilings, the doors, the exterior, the interior are all ornamented with this novel element of architecture. Buttons of every description, from the very origin of their invention up to those of the present day, have been employed in the arabesques and ornamentation of the walls. Every country has been ransacked, and some curious specimens have been brought to light. Those dating from the lower Greek empire are of the most curious manufacture. — *London Tid-Bits.*

The "Barren Lands" of Canada. — Mr. Joseph B. Tyrrell, a geologist, and his brother, James W. Tyrrell, a surveyor, returned recently from an exploring expedition in what are known as the "Barren Lands" of Canada, the district between the Athabasca and Mackenzie River basins and the west shore of Hudson's Bay, most of which, probably, had not been trodden before by human foot. Mr. Tyrrell says of the country through which he passed that it might be likened, in a measure, to a prairie. "It is a rugged, rolling tract of land speckled over with swamps and occasionally rocky hills. In the whole Barren Lands there is not wood enough to make a boot-peg of." — *N. Y. Evening Post.*

A Tip for Travellers. — An American actress recently called in at a hardware store and purchased "a pair of nippers and half-a-dozen eighteen-inch gas-burner tips." All theatrical people while travelling in the United States are said to consider nippers and tips an indispensable part of their luggage. It seems that the managers of hotels in small towns try to save gas by putting bits of cotton in the bedroom-burners, thus impeding the flow. The minute an actor strikes a light and detects this he pulls out his nippers and tips, off comes the "faked" burner and on goes one that secures a full supply. The motto of the great American nation is: "If they don't give you what you pay for, take it," and a very good one, too. — *Invention.*

The Internal Heat of Trees. — The internal temperature of trees has been investigated in Belgium by M. W. Prinz, who finds that, as a rule, a large tree is warmer than the air in winter, and a little colder than the air in summer. The mean annual temperature of a tree is practically the same as that of the surrounding air, but the monthly means differ by several degrees. Heat changes are transmitted slowly to the heart of a tree, the temperature of the interior differing sometimes as much as 10° C. from that of the air. When the air temperature is below freezing-point, the temperature of the tree appears to remain just above the freezing-point of its sap, and in the hot days of summer the internal temperature was not known to vary more than 2° from 15° C. (59° F.). — *Invention.*

Buffalo without Water for Two Hours. — For nearly two hours recently Buffalo was completely without water and at the mercy of fire, and had one broken out the result would have undoubtedly been disastrous. The cause was the failure of the natural-gas supply which is used to run the engines at the pumping-station. About 8.30 o'clock the gas suddenly gave out, without any warning, and the gas-sheets had to be ripped out, and the furnaces put in condition to burn coal. This task occupied over an hour and a half, during which time the engines were idle, and no water went through the mains. The same thing happened about three weeks ago, and as a consequence the Water Department will at once begin the entire substitution of coal for gas, as the latter has become too uncertain to risk its continuance as fuel. — *N. Y. Tribune.*

Statuary Marble in Colombia. — A crystalline metamorphic limestone deposit, equal in beauty and quality to the finest statuary marble of Massa-Carrara, Italy, is reported upon by Mr. C. F. Z. Caracristi, C. E., as existing in unlimited quantity in the Department of Magdalena, Republic of Colombia. The stone is a great mass covering 60 square miles and lies one mile from the Carribbean Sea, a few miles from the Bay of Caira and one day's sail from the Panama Railway. It is white, gray and black in color, or varied with white, gray, black and pink, and withstands a crushing strain of 11,300 pounds per square inch. The engineer mentioned says that it can be transferred to New York for $3.65 per ton, and he estimates the cost of producing dimension stone at the quarry at thirty cents, gold, per cubic foot. The Santa Marta Railway passes within one-half mile of the quarries. — *Engineering News.*

For Completing the Panama Canal. — Edmond Bartissol, a civil engineer, who helped pierce the Isthmus of Suez, has made public his plan for completing the Panama Canal. He proposes to build a stone tunnel about ten kilometres, or six miles, long. Water from the Chagres River would be conducted by shafts to this tunnel and there be used to carry to the Pacific the soil already excavated from the canal-bed and thrown in the way of the current. The canal could be completed by such means in four years, M. Bartissol estimates, at a maximum expense of 500,000,000 francs. This plan was submitted some time ago to the Technical Commission of the Panama Canal Company. The commissioners have reported to M. Monchicourt, the judicial liquidator, that they were not sanguine of the success of the plan, but thought it expedient to try the proposed experiment under certain conditions. They are against the proposal to appeal for funds with which to build M. Bartissol's tunnel. — *N. Y. Tribune.*

The Electrical Treatment of Sewage. — It is likely that the question of the electrical treatment of sewage will be occupying a good deal of public attention before long. The success of the experiments made at Havre, under the supervision of the inventor, M. Hermite, has created lively interest in Paris, where the expenditure of 117,000,000 francs for new sewers is now under consideration. M. Magnard of the *Figaro* has set up an electrolizer in his offices, with which a series of experiments will be made in the presence of ministers, senators, deputies and other public personages. M. Humbert, president of the Paris Municipal Council, already has devoted much time to a consideration of the process, which, if it can do all that is claimed for it, threatens to revolutionize all existing ideas on the subject of drainage and to render sewers practically superfluous. If the foulest of liquids can be rendered odorless and innocuous by a swift and inexpensive method, one of the most troublesome of municipal and sanitary problems will have been solved. — *N. Y. Evening Post.*

S. J. Parkhill & Co., Printers, Boston, U. S. A.