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CONTENTS

THE attempt to preserve the Boston State-house on the one hand and the counter attempt to do away with it on the other, in favor of an elongation of what was intended to be a mere annex, bid fair to result alike in architectural failure, unless the friends of the present building can bring to pass that the new extension shall be, as it was intended at first to be, one integral and independent structure and Bulfinch's building another independent structure, the two connected together by the most appropriate architectural hyphen in the shape of a bridge or tunnel that the architect can devise. Such a solution of the controversy would be much more unfortunate for the new building than for the old one, and we do not wonder that the architect and the commissioners are making every effort to prevent an outcome so distressful to them. But their opponents have all the arguments in their favor, while, practically, the best argument the commissioners have is that if this is to be the result, then all the money spent on the Extension has not produced the effect that might have been secured if it had been known that the public was not to be cajoled into giving up the old building, which Bostonians hold in higher esteem than they had supposed. The present situation is in a manner quite unexpected, for even those who were most interested in the subject imagined that, in some way or another, the architect had provided a proper hyphen, and there was no reason to seek to know just how it was to be employed; but when the buildings on the east side were cleared away, and people had a chance to see the east front, it was at once plain that things had, behind the high fence, arrived at a very dubious stage. Taken as it stands, this east front seems to suggest nothing so much as that it was the designer's original intention to do away absolutely with the old building and to repeat at the south end the treatment employed at the north. Doubtless this may not have been the architect's real intention, for it could hardly have been known at the time the design was prepared that a park was to be made on the east side which would expose that part, instead of leaving it to the seclusion of a narrow street. Still that is the way the matter does look, and it is only one of the misfortunes which have fallen on the architect. Another is said to be that the Extension, if kept to what was understood to be its original lines, does not afford the necessary accommodation, and offers no chance for future growth of the departments housed in it.

OUR own position on the question is this: We have expressed our great regard for the old building and the traditions and memories that centre about it, and have declared that as a landscape feature it is most important for the identification of Boston, though injured now by certain too-lofty buildings near it. We have called the dome and its supports a fire-trap and protested that it ought to be replaced in proper materials. We have spoken of the Extension as the too-large tail for the little dog at the top of the hill, and may, with equal disrespect, have likened it to a tender too large for the wood-burning locomotive that was trying to pull it up hill, but these mild jibes were aimed, not at the architect, who was working under a programme laid down by law, and had a most difficult problem to handle, but at the concrete results attending the solution of the problem. There appear to be now three ways of extricating ourselves from the difficulty. First, by keeping the buildings separate and integral, and spending a portion of the money which the commissioners seek to spend on a new southern end in enlarging the Extension and giving it a proper façade on Mt. Vernon Street. Second, by keeping the buildings separate and integral, but spending nothing on the Extension for enlargement. Or, third, by taking ten million dollars and building on the enlarged site of the present building a State-house which shall reduce to a proper state of subordination the new Extension which, if it should ever be connected with the old building, would overpower it and be architecturally unsuccessful.

MR. ST. GAUDENS has at last, according to the newspapers, consented to remodel his Columbian-medal figure in accordance with the laws of American decorum, not only putting clothes on it, but, if requisite, adopting a new scheme altogether. Certainly the public is to be congratulated on this determination. A figure cut on a die by one artist, and furnished with clothes by having them dug out by another, would be a pitiable object, and, as Mr. St. Gaudens probably feels, it would have been better to throw the design aside altogether than to mangle it in such a way. We notice that some of the newspapers, in mentioning this new development, have furbished up the old theory, that Mr. St. Gaudens, although a great sculptor, "is by no means the greatest medal-maker" that this country has produced, and that owing to his "want of familiarity with technical points," . . . "the net result of his work, might, therefore, not be so good as the result of the work of some inferior artist, who thoroughly understands die-cutting," and so on. It is about time for artists in this country to interpose to contradict this notion, which has been used to suppress good artists and good art, as we suppose, ever since the world began. There is a story of a musician, we think Handel, who was found by some critics playing to himself portions of one of his new compositions. The critics, on listening, were filled with horror, and pointed out to him the gross violations of the technical rules of composition which he had committed. Handel listened meekly, and, at the end of the lecture, thoughtfully played his piece over again. "It sounds well," he said, at length; "I think we will not change it"; and he left the composition as it was, while the critics, later, changed the rules to fit it. Every great artist, to a certain extent, introduces innovations, which, for a time, shock the little routine men, but are accepted in the end as steps in the progress of art. To say that Mr. St. Gaudens, who is not only a great sculptor, but one of the greatest masters of low-relief since the Italian Renaissance, cannot design a good medal, because he is not a professional die-cutter, is ridiculous. In point of fact, he is, we believe, an expert and highly trained die-cutter, and his lack of routine habit frees him from just the obstacle which would stand most in the way of his producing a work of transcendent merit.

ARCHITECTS will hear with regret of the death of Mr. William Frederick Poole, the Librarian of the Newberry Library, at Chicago, and one of the most distinguished members of his profession, if, indeed, he may not be said to have been one of the principal founders of what is now a profession of great importance. His first technical work, the well-known "*Index of Periodical Literature*," was published nearly fifty years ago, and has been continually republished

ever since, growing constantly more valuable; while the improvements in cataloguing which his active brain frequently suggested to him have been adopted all over the world. His principal claim to the attention, if not to the gratitude, of architects lies, however, in his suggestions for the improvement of library buildings. So far as the preservation and easy accessibility of books is concerned, it must be acknowledged that library buildings, as a rule, are about the worst planned structures that could be imagined, and it is not wonderful that Mr. Poole, who knew what was good for books, but knew nothing else of the requirements which library architects are called upon to fulfil, was not noted for his regard for our profession. Nevertheless, his criticisms on library architecture had no more appreciative readers than the architects, and his little pamphlet of "Suggestions" for library building probably has its place in most offices. However, even among librarians his radical notions of library design, according to which everything else was to be sacrificed to having the books accessible, as they might be, for example, in a great publisher's warehouse, did not meet with much favor, and, unless it may be his own Newberry Library, no important building of the kind has yet been designed after his notions, and it will probably be reserved for the architects whom he rated with so much energy to find means of reconciling the reforms which he advocated with the other conditions of library planning.

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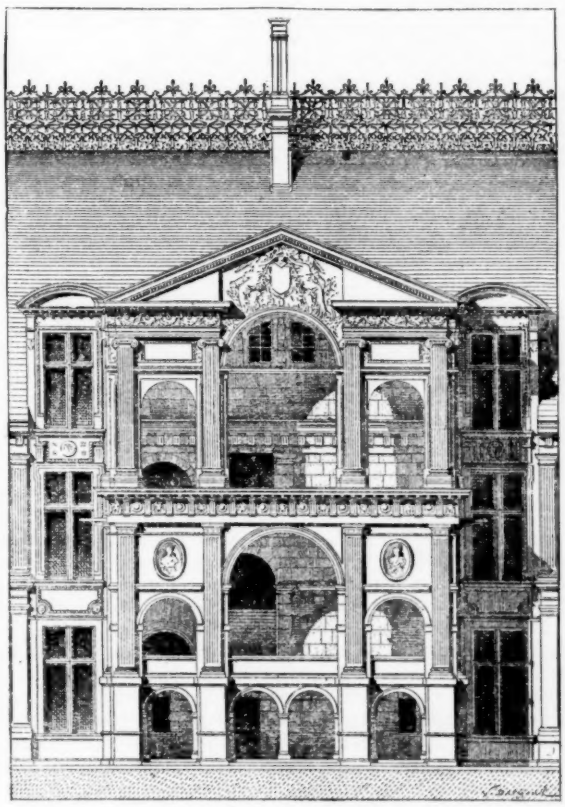

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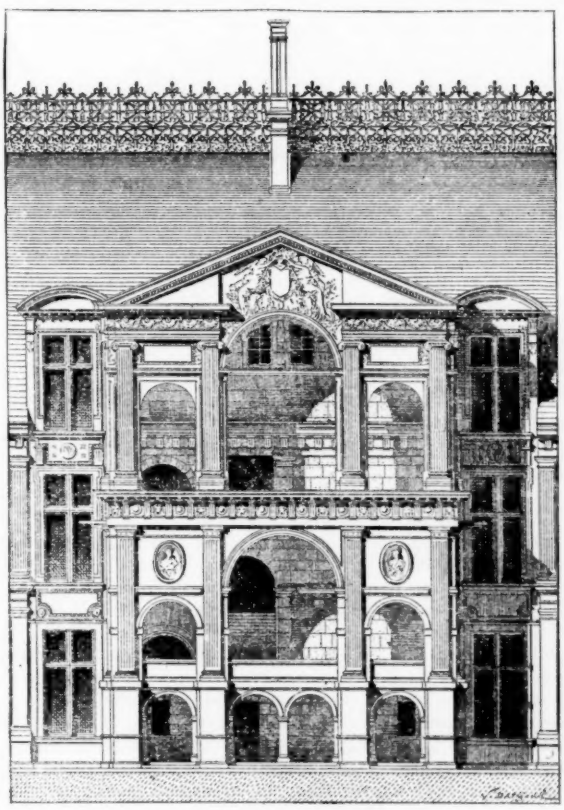

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which had given the tone to Pointed architecture, had ceased to exercise any suzerainty in the sixteenth century. On the other hand, Brittany, which was tributary to Normandy during the Gothic and Romanesque eras, attained to a degree

[1] From the French of Anthyme Saint-Paul, in Planat's *Encyclopédie de l'Architecture et de la Construction*. Continued from No. 949, page 101.

of originality which made it a world apart, as soon as it regained the mastery over itself, and at the very moment when it was losing political autonomy by out-and-out annexation to France (1532). The Breton monuments are imposing, full of surprises, charming in their sincerity, but composed without any regard to the *ensemble* and executed with a want of correctness, for which we may find an excuse in the quality of the granite generally used. Then follow, descending in the scale of originality, the schools of Troyes, Toulouse and Orléans, the Norman and Burgundian schools, the schools of Blésois, Touraine, Anjou, and doubtless others which at last become unrecognizable except in the very minor details.

The schools of Troyes, Orléans and Toulouse are peculiar to the three cities whose names they bear. They are not regional schools; but they are deserving of a passing notice, for their merits appear to be in an inverse ratio to their comparatively restricted limits. Moreover, each member of this little privileged group has its individual characteristics, separating it sharply from the other two. The school of Troyes is a school of religious architecture which originated in, or rather which was developed after, a conflagration that destroyed, in 1524, the greater part of the city and necessitated the construction or restoration of about ten churches.

All of the existing churches of Troyes either belong wholly to the Renaissance or have some of their important parts in this style, characterized by ingenious applications of ancient types to the portals, by the perpetuation of the pointed arch for the windows and by the spandrel or tracery, the motives of which are borrowed less from Pointed art than from Greco-Roman (Fig. 12). The school of Troyes was especially strong in ornamental sculpture and bas-reliefs; its sway extended five or six leagues, at least, from its centre; like Brittany, this part of Champagne, in the luxuriousness of its portals, of its tabernacles, altars and divers other devotional accessories, furnishes delightful fields for the intelligent amateur, and here he will find correctness in addition to other qualities. The Orléans school distinguished itself by its houses with the gable end toward the street, in which the doors and windows are treated with a spirit that defies all classification, aside from the beautiful windows with coupled, or twin, arches that seem to have been more common there under François I. At Toulouse, the characteristic features are found in the mansions of municipal or parliamentary magistrates — two Toulousan types, however, occur outside of this class of structures, namely, the door of the Church of La Dalbade and the small cloister of the Augustins (Fig. 13); these fine residences have superimposed stories of arcades, either open or filled-in, on the courts, and windows framed with a certain wealth of curved mouldings, pediments, casings and *gaine*-shaped caryatides. Dijon, Fontenay-le-Comte, La Rochelle and Riom may possibly be considered as having been in a very small way seats of other local schools; the architecture of Dijon, which already belonged to a provincial school, would thus have a double origin, of which unfortunately no adequate idea could be given here without entering into a long and complicated discussion.

In all provincial schools, the more pronounced and overmastering the traditions and habits the less could the peculiar genius of an artist show itself; for this reason, the school which was weakest as a school, that of Ile-de-France, was most favorable to the display of individual power. The school of Ile-de-France was, in reality, superseded by a sort of vagrant, nomadic school, following the king from one residence to another, and subject to the passing influence of any talent which the protection of the monarch or of a powerful courtier might bring to light. The "official" architects were at that time the ones who possessed in the highest degree a "manner" of their own, either in their creations, combinations or choice of motives, which to a trained observer serves as a signature — the exact reverse of the situation to-day. Pierre Chambiges distinguished himself at Saint-Germain and Fontainebleau by the use of brick in the buttresses, angles and window-framings, and stone for the mass of the masonry, thus interchanging the rôles usually assigned to these two materials. Jean Bullant, immortalized by Écouen, the *petit château* of Chantilly, Fère-en-Tardenois and possibly Monceaux, introduced the colossal order into his works, though with adaptations peculiar to himself; he begins and ends the column so that it overlaps the ground-floor and first-story and cuts the frieze or moulding

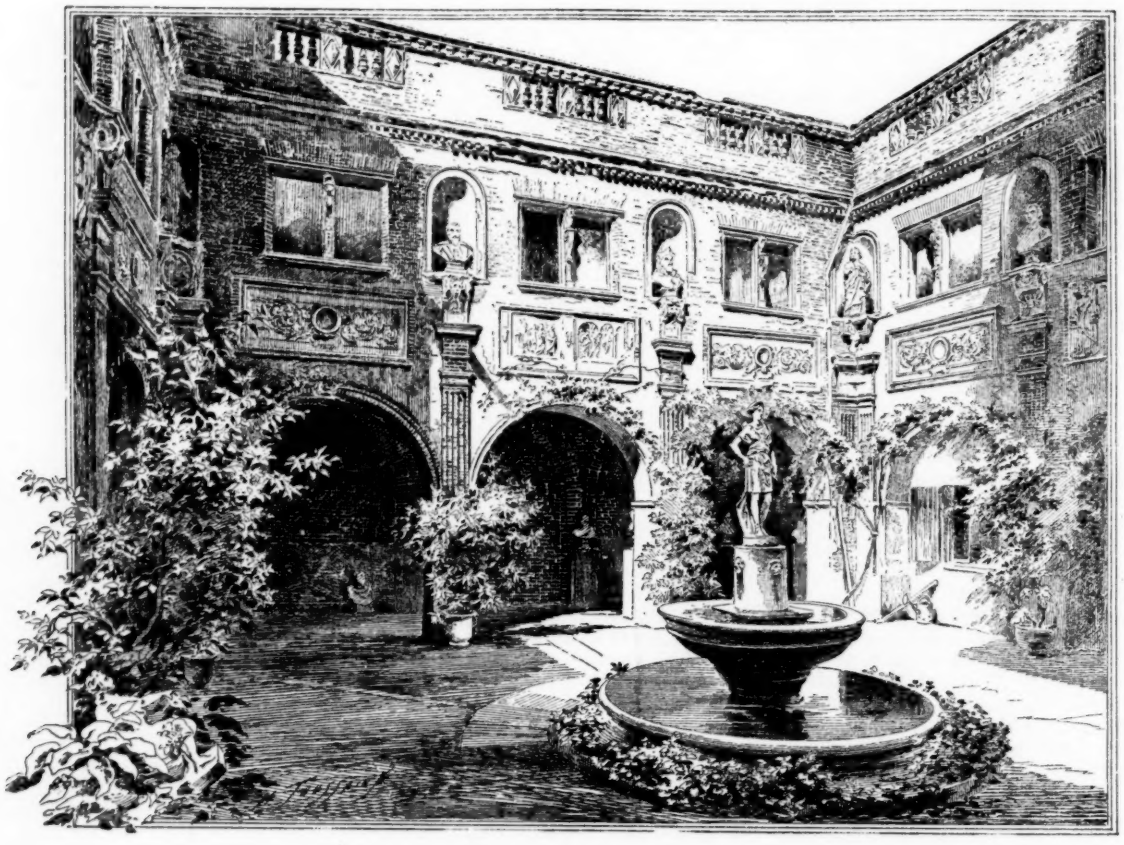


Fig. 13. Small Cloister of the Augustins, Toulouse.

indicating the intermediary ceiling, and so that the entablature is, in its turn, cut by the upper window (Fig. 14). There was but little temptation to follow this arrangement, which was odd rather than graceful, and the monopoly of it was left to its author. His signature could not, therefore, have furnished a stronger proof of the authenticity of his work. Philibert Delorme, the architect of the Tuileries and the Château d'Anet, came forward with his "French order" — spacious doors with semicircular arches, with framings of pilasters and an imposing pediment, and sometimes opening in a semicircular recess, as at the Church of Saint-Nizier at Lyons. The Le Bretons exhibited an individual style at Fontainebleau and Villers-Cotterets; but, at Fontainebleau, at least, it was rather barren. In Saint-Eustache at Paris, Pierre Lemercier — if he was indeed the architect of the church — has bequeathed to us a structure without a forerunner as it has remained without a follower; in its presence the student asks himself whether it was a challenge sent by Pointed art to the Renaissance or by the Renaissance to Pointed art. The three provincial schools of the Loire are, perhaps, merely the outgrowth of the teachings and practices of two schools of architects, one represented at Orléans (hôtel de ville), Beaugency (hôtel de ville), Blois (François I wing) and Chambord, by Viart, the Sourdeaus and Pierre Trinqueau, called Nepveu; the other represented in Anjou and to a certain extent, we are assured, in Berry (Valençay) by Jean de Lespine. In Normandy, Hector Sohier secured a rich field for himself; the finest production of his labors is the apse of St. Peter's at Caen, a work that has been so often reproduced in engravings and paintings during the past century that it would seem commonplace, if that were possible with such a creation. Though Sohier was not the originator of ceilings on ribs, he it was who made the finest application of them in apsidal chapels. On the exterior of his churches he employed the semicircular arch for the windows and for the candelabrum-like pinnacles, which he transferred to civil constructions and which enable us to recognize his hand or the hand of some one of his disciples in the Château de Lasson. His ornamentation is lavish, but in this respect he merely conforms to the notions of the Norman school, one of the distinctive characteristics of which is exuberance in decoration.

(To be continued.)

FIRE-RESISTING GLASS. — Glass having unusual fire-resisting properties has recently been produced in Germany; and competitive tests have been held to ascertain the merits of samples from several factories. The glass was put into the vertical windows and skylights of an old building, which was then set on fire; and sudden changes of temperature, shocks from weights and jets of water and other means were employed to prove its toughness. Excellent results were attained, especially by the glass from the Siemens works in Dresden, which withstood a temperature of 2140° Fahrenheit for half an hour. — *N. Y. Tribune.* It should be added that the material experimented with was wire-glass. — EDS.

A PROPOSED FORMULA FOR WHITE PINE POSTS.

A article by the present writer, entitled "A Proposed new Formula for Yellow Pine Posts," appeared in the *American Architect* of April 9, 1892. It was a straight-line formula of the form

$$S = 4{,}250 - 43\tfrac{1}{8}\,\frac{l}{d}$$

representing the average of the lowest breaking values of a series of tests, made on *full-size* sticks at the Watertown Arsenal. The working formula

$$s = 1{,}000 - 10\,\frac{l}{d}$$

was recommended,

s = allowable stress per square inch.
l = length of piece in inches.
d = smaller diameter in inches.

assuming the factor-of-safety of $4\frac{1}{4}$, approximate.

The object of the present article is to bring to notice a similar formula for *White Pine Posts.* As in the former case, the tests were made at the Watertown Arsenal on *full-size* sticks and each test has been plotted with the breaking-load in pounds per square inch for the ordinate and the ratio of l to d for the abcissa, as shown in the cut. An average line for the lowest breaking-loads in each set of tests has been drawn whose equation is

$$S = 3{,}150 - 40\,\frac{l}{d}.$$

Using the factor-of-safety of 4, we may write

$$s = 800 - 10\,\frac{l}{d}.$$

Of course, any other factor-of-safety may be used, and, if the formula of the style

$$S = \frac{K}{1 + \frac{1}{x}\frac{l^2}{d^2}}$$

is preferred, we may use for breaking loads

$$S = \frac{3{,}200}{1 + \frac{1}{1{,}200}\frac{l^2}{d^2}}$$

which gives very nearly the same results as the simpler form above.

Considerable search has been made for tests on *full-size* posts of *oak* and *spruce*, but without success. Judging from the tests on small-size specimens made at Watertown Arsenal for the Tenth Census[1], and also from the results of tests on large-size beams[2] made by Professor Lanza and noted in his "*Applied Mechanics*," we may assume, in the absence of other information, that yellow pine and white oak have about the same value and that white pine and spruce also are nearly equal in strength, as posts.

The following is recommended for the allowable stresses per square inch:

$$\left.\begin{matrix}\text{Yellow pine}\\ \text{or white oak}\end{matrix}\right\} s = 1{,}000 - 10\,\frac{l}{d}$$

with a factor-of-safety of $4\frac{1}{4}$

$$\left.\begin{matrix}\text{White pine}\\ \text{or spruce}\end{matrix}\right\} s = 800 - 10\,\frac{l}{d}$$

with a factor-of-safety of 4. [It may be noted that, from the above formulas, white pine and spruce are worth about 20 per cent less than yellow pine and spruce.]

The tables herewith have been computed from the above formulas

	Yellow pine.	White oak.	White pine.	Spruce.
[1] Av. value of tests in lbs. per sq. in.	7,000	7,100	5,000	[1] 4,900
[2] " " " " " " " " " "	7,300	6,100	4,800	4,900

Safe Loads, in Pounds, for Yellow Pine Struts.

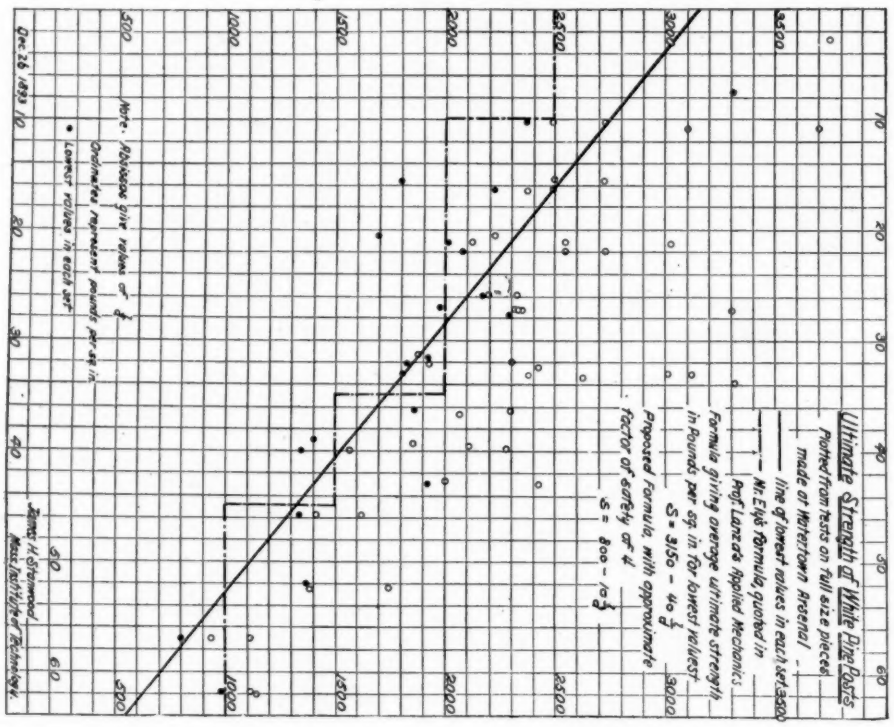
Computed from the Formula 1000 − 10 $\frac{l}{d}$. l = length in inches d = smaller diameter in inches. This is approximately the same with a factor of safety of 4¼, as the Formula 4250 − 43.3 $\frac{l}{d}$, which was obtained by plotting all experiments obtainable, on full-sized sticks, made with the Government Testing Machine at Watertown Arsenal and represents the average of all the lowest breaking weights in each set of tests.

J. H. Stanwood, Mass. Institute of Technology, 1891.

Size	6 Ft.	8 Ft.	10 Ft.	12 Ft.	14 Ft.	16 Ft.	18 Ft.	20 Ft.
4×4	13 100	12 200	11 200					
4×6	19 700	18 200	16 800					
4×8	26 200	24 300	22 400					
4×10	32 800	30 400	28 000					
4×12	39 400	36 500	33 600					
6×6	31 800	30 200	28 800	27 400	25 900	24 500		
6×8	42 300	40 300	38 400	36 500	34 600	32 600		
6×10	52 800	50 400	48 000	45 600	43 200	40 800		
6×12	63 400	60 500	57 600	54 700	51 800	48 800		
6×14	74 000	70 600	67 200	63 800	60 500	57 100		
6×16	84 500	80 600	76 800	73 000	69 100	65 300		
8×8	58 200	56 300	54 400	52 500	50 600	48 600	46 700	44 800
8×10	72 800	70 400	68 000	65 600	63 200	60 800	58 400	56 000
8×12	87 400	84 500	81 600	78 700	75 800	73 000	70 100	67 200
8×14	101 900	98 600	95 200	91 800	88 500	85 100	81 800	78 400
8×16	116 500	112 600	108 800	105 000	101 100	97 300	93 400	89 600
8×18	131 000	126 700	122 400	118 100	113 800	109 400	105 100	100 800
10×10	92 800	90 400	88 000	85 600	83 200	80 800	78 400	76 000
10×12	111 400	108 500	105 600	102 700	99 800	97 000	94 100	91 200
10×14	129 900	126 600	123 200	119 800	116 500	113 100	109 800	106 400
10×16	148 500	144 600	140 800	137 000	133 100	129 300	125 400	121 600
10×18	167 000	162 700	158 400	154 100	149 800	145 400	141 100	136 800
12×12	135 400	132 500	129 600	126 700	123 800	121 000	118 100	115 200
12×14	157 900	154 600	151 200	147 800	144 500	141 100	137 800	134 400
12×16	180 500	176 600	172 800	169 000	165 100	161 300	157 400	153 600
12×18	203 000	198 700	194 400	190 100	185 800	181 400	177 100	172 800
14×14	185 900	182 600	179 200	175 800	172 500	169 100	165 800	162 400
14×16	212 500	208 600	204 800	200 900	197 100	193 300	189 400	185 600
14×18	239 000	234 700	230 400	226 100	221 800	217 400	213 100	208 800
16×16	244 500	240 600	236 800	233 000	229 100	225 300	221 400	217 600
16×18	275 000	270 700	266 400	262 100	257 800	253 400	249 100	244 800
18×18	311 000	306 700	302 400	298 100	293 800	289 400	285 100	280 800
	6 Ft.	8 Ft.	10 Ft.	12 Ft.	14 Ft.	16 Ft.	18 Ft.	20 Ft.

and may be found useful for reference. The table of Yellow Pine Posts is reprinted from the earlier article.

James H. Stanwood, S. B.,
Instructor in Civil Engineering, Mass. Institute of Technology.
December 26, 1893.



Safe Loads, in Pounds, for White Pine Struts.

Computed from the formula $800 - 10\frac{l}{d}$, l = length in inches, d = smaller diameter in inches. This formula was obtained by plotting all experiments on full size pieces made at Watertown Arsenal and represents the average of all the lowest breaking weights in each set of tests.

James H. Stanwood,
Mass. Institute of Technology.

Size	6 ft.	8 ft.	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.
4×4	9 900	9 000	8 000					
4×6	14 900	13 400	12 000					
4×8	19 800	17 900	16 000					
4×10	24 800	22 400	20 000					
4×12	29 800	26 900	24 000					
6×6	24 500	23 000	21 600	20 200	18 700	17 300		
6×8	32 600	30 700	28 800	26 900	25 00	23 000		
6×10	40 800	38 400	36 000	33 600	31 00	28 800		
6×12	49 000	46 100	43 200	40 300	37 400	34 500		
6×14	57 100	53 800	50 400	47 000	43 700	40 300		
6×16	65 300	61 400	57 600	53 800	49 900	46 100		
8×8	45 400	43 500	41 600	39 700	37 800	35 800	33 800	31 900
8×10	56 800	54 400	52 000	49 600	47 200	44 800	42 400	40 000
8×12	68 200	65 300	62 400	59 500	56 600	53 800	50 900	48 000
8×14	79 500	76 200	72 800	69 400	66 100	62 700	59 400	56 000
8×16	90 900	87 000	83 200	79 400	75 500	71 700	67 800	64 000
8×18	102 200	97 900	93 600	89 300	85 000	80 600	76 300	72 000
10×10	72 800	70 400	68 000	65 600	63 200	60 800	57 400	52 000
10×12	87 400	84 500	81 600	78 700	75 800	73 000	70 100	67 200
10×14	101 900	98 600	95 200	91 800	88 500	85 100	81 800	78 400
10×16	116 500	112 600	108 800	105 000	101 100	97 300	93 400	89 600
10×18	131 000	126 700	122 400	118 100	113 800	109 400	105 100	100 800
12×12	106 600	103 700	100 800	97 900	95 000	92 200	89 300	86 400
12×14	124 300	121 000	117 600	114 200	110 900	107 500	104 200	100 800
12×16	142 100	138 200	134 400	130 600	126 700	122 900	119 000	115 200
12×18	159 800	155 500	151 200	146 900	142 600	138 200	133 800	129 600
14×14	146 700	143 400	140 000	136 600	133 300	129 900	126 600	123 200
14×16	167 700	163 700	160 000	156 100	152 300	148 500	144 600	140 800
14×18	188 600	184 300	180 000	175 700	171 400	167 000	162 700	158 400
16×16	183 300	179 100	185 400	181 800	177 500	174 100	170 200	166 400
16×18	207 400	203 100	208 800	204 500	200 200	195 800	191 500	187 200
18×18	246 200	241 900	237 600	233 300	229 000	224 600	220 300	216 000

ARTIFICIAL REFRIGERATION THROUGH STREET PIPE-LINES FROM CENTRAL STATIONS.[1]

A POPULAR idea prevails that we furnish cold air. As a matter of fact we do not send out cold air, or anything cold, through our pipes. All such methods have been, and must be, financial failures, in spite of the most costly insulation, because of the percentage of loss of cooling power through absorption of heat from the earth or air through which the pipes pass.

Correctly speaking, our business is not to furnish anything; but to remove from the premises of our customers two things of which they wish to be rid — heat and humidity.

The most suitable material, as well as by far the cheapest, which can safely be used as a heat extractor, is ammonia. It conveys heat to the central station, where the heat is disposed of through an application of cold water; and the water, after being thus loaded with heat, is ordinarily discharged into the sewer.

To make the illustration more clear to those having no knowledge of ice-making or refrigerating machines, it might be well to explain by saying that expanding ammonia absorbs heat and that water absorbs ammonia, just as a sponge absorbs water. One might say

[1] A paper read by Mr. David Branson before the Franklin Institute and printed in the *Journal* of the Society.

that water is a sponge for ammonia, and ammonia is a sponge to sop up heat.

Since the first practical development of artificial refrigeration and its application to the cooling of breweries and packing-houses, and to ice making, it has been the dream of many inventors, and also the aim of industrial promoters, to achieve a practical, safe and economical method of distributing refrigeration. Some twenty or more costly efforts to accomplish this result had been made in a dozen different cities, including Paris, London, New York, Boston, Louisville and Nashville. These resulted either in failure or in only partial success, but there was a great gain of valuable knowledge of the difficulties to be overcome with little knowledge of how to overcome them, until five years ago, when Messrs. Starr, Thornburgh & Branson, the inventors of the system which we are to discuss

Madison Square Garden, New York, N. Y. Sketched by Claude Fayette Bragdon.

this evening, undertook to study the causes of the failures of their predecessors.

Fortifying themselves with all the data that could be obtained, they experimented extensively, and visited many of the wrecks of other experiments.

The result has been a series of inventions which have been put into practical operation on a commercial scale in the cities of Denver and St. Louis. The plant in Denver was started on the eighth of August, four years ago, and has not been obliged to stop a single day since, though it has been twice enlarged and the street line extended. The street line in St. Louis has also been operated for more than three years. Both plants give such satisfaction to their patrons that many would not return to the use of natural ice could they procure it for nothing. . . .

At the outset of our attempt to construct and operate our street pipe-line system, we found that the principal obstacles were:

(1) The loss of power by absorption of heat from the earth.

(2) The difficulty of handling the constantly changing refrigerating-load.

(3) The occasional stoppage of service of an entire district by reason of fire or breaks in the line, through accident, or the necessity of making new connections.

(4) The automatic regulation of temperature.

(5) The leakage of the volatile material used as a refrigerating agent.

The absorption of heat from the earth is avoided by what is known as a direct-expansion system, in which the liquid anhydrous-ammonia (usually at a pressure of 150 pounds to the square inch at summer temperature) flows from the machine through one pipe (the liquid-line) to the point of use, and is there expanded by being allowed to flow through a small hole, in a carefully-adjusted valve, capable of being regulated to suit the amount of refrigeration required. This expansion takes place in a coil of pipe, within the space required to be cooled, which pipe is known as the expansion-coil; and from this coil the anhydrous-ammonia, now changed to a vapor, returns through a larger pipe (the vapor-line) to the central station. By this system, the entire cooling-power of the machine is delivered and utilized in the refrigerators of the customers, none being lost on the way. The pipes, with the exception of the expansion-coil, remain at the temperature of the ground or air through which they pass.

Our predecessors had managed fairly well to provide regular temperatures in large establishments under the changing conditions of the seasons, or of day and night, by increasing or lessening the number of machines in operation or the speed at which a single machine was operated. But this had its limitations, both financial and mechanical.

In the street pipe-line business this difficulty is increased tenfold. Experience soon taught us that no possible calculation could enable

us to predict when the demand upon the machine would suddenly rise tenfold, without a moment's warning, or as quickly fall to practically nothing.

To provide against this difficulty, we introduced one reservoir (for liquid anhydrous-ammonia) at the outgoing end of the machine, a second reservoir (for strong aqua-ammonia) at the incoming side of the machine, and a third (for weak aqua-ammonia), which is usually placed at a higher elevation.

When the strong aqua-ammonia reservoir is full, both the others are empty, as their contents are supplied by the separation of the ammonia, or the greater part of it, from the water originally holding it in the strong aqua-ammonia reservoir. The contents of this reservoir are pumped into the still at a uniform rate, and from the still the pure ammonia passes through the condensing-coils to the reservoir for liquid anhydrous-ammonia and the water or weak ammonia remaining flows to its reservoir above, each impelled by the pressure obtained from the heat of the distilling process.

The contents of the weak-ammonia reservoir flow by gravity to the absorber automatically, as required, and absorb the returning anhydrous-ammonia vapor from the street-line.

As we use what is known as an absorption-machine (because compression-machines have been found impracticable for this purpose), the anhydrous-ammonia vapor returning from the line is first discharged into a tank of peculiar construction, called an absorber, where it is reunited with the weak aqua-ammonia from which it was originally driven by distillation. When this aqua-ammonia has absorbed all of the anhydrous-ammonia vapor that it is capable of holding, it is automatically discharged into the reservoir for strong aqua-ammonia, from which it is again pumped into what is known as the still or separator.

By this reservoir system several objects are accomplished; first, a machine of half the size that would otherwise be needed will answer for any required amount of service; as it will readily be seen that without the reservoir, a machine would have to be of sufficient capacity to perform the service called for during the hottest hour of the hottest day, while during other hours a machine of one-tenth the capacity would often be ample.

In the reservoir system, the machine operates steadily throughout the twenty-four hours, while the reservoirs vary in the amount of their contents alternately, as the demand reaches a rate greater or less than the average of the machine.

This system also enables us to shut off the machine entirely for short periods to make repairs and in cold weather, to dispense with a night force entirely, allowing the reservoir and the absorber to work automatically, without attention.

Of course, in very large cities, multiples of the largest-sized machine would be used with reservoirs of sufficient size to give steadiness to the operation of either machine and to permit of short stoppages.

Our third great difficulty was overcome by providing a vacuum or safety line, which is a vital part of the system; for, without it, continuous operation could not be secured, nor could necessary repairs be made. This vacuum-line is a third pipe connected with the liquid and vapor pipes, at or near their entrance to each refrigerating-box supplied, and also in the man-holes at the street-crossings.

In case of necessary repairs, alterations or additions to the pipes in any premises, the stop-cocks on the liquid and vapor pipes are closed, and the cock on the vacuum-line (which has been habitually kept closed) is opened; the vacuum-pump is then started at the station, and thus the ammonia contained in the expansion-coil is drawn back to the central station and a ten or fifteen inch vacuum is also usually produced. Then the piping in the refrigerating-box may be opened without any smell of ammonia escaping.

By the same method, any section of the main line may be cut into for additional connections or repairs, by means of opening and closing cocks in the man-holes at street-crossings.

In our later work we have made the vacuum-line of such size that it can be used as a temporary substitute for either the liquid or vapor line, during alterations, thereby enabling us to avoid cessation of service to any customer even for an hour.

By keeping a constant vacuum, the contents of any expansion-coil or any section of the line may, without previous notice to the engineer, be promptly switched into the vacuum-line from any place where trouble has occurred, especially in case of fire or break in the street, and thus the material liable to be lost is quickly saved, as the engineer at the works will immediately start the vacuum-pump, upon his attention being called thereto by an electric-bell rung by the movement of the hand on the dial of the vacuum-gauge.

The advantages of this vacuum-line are also very apparent when it becomes necessary to shut off a customer, and pump home the contents of his expansion-coil, and leave him out in the hot for non-payment of his bill.

In the matter of automatic control we had to solve the problem of supplying all degrees of temperature, not only on the same branch line or street, but often three or four in one building, or even in the different compartments of one refrigerating-box; varying from ice-making and fish-freezing, up to the very easy task of keeping rooms for furs and woollen-goods free from moths, or taking a few degrees of heat and humidity from a restaurant dining room, a public hall, business office or hospital.

To do this, numerous devices were invented and tested — nearly all with brilliant success at the start; only to be followed by dismal failure when put to the test of time and innumerable changing conditions.

They choked up, froze up, gummed up and broke up in every imaginable way. But, one by one, the weak points were weeded out, the strong features combined; until, finally, two forms of regulators were constructed, both of which have stood the test of every possible condition we could think of through the changing requirements of spring, summer, autumn and winter.

These automatic valves are operated by electric power supplied from a dynamo through a storage-battery at the central station; thence through an insulated copper-wire circuit laid in the same conduit which contains the pipe-line, and they are caused to open and close by the action of an ordinary thermostat placed in the cooling-box and easily adjusted by thumb-screws to any required temperature. We ordinarily set them to open the valves at one degree above, and close them at one degree below, the average temperature required; though, with careful manipulation, they can be adjusted so as to permit of much less variation. In the preservation of eggs, for instance, we do not permit a variation of more than one-half of one degree; and, as a consequence, have had a remarkable success in the preservation of this most perishable product.

In connection with the automatic-valve the electric circuit can be used to signal from any refrigerator on the line to the engineer at the station; and one form of valve is so constructed that, if it should get out of order, an electric-bell would ring in the engine-room until the valve is attended to.

The most obstinate difficulty in mechanical refrigeration was the leakage of ammonia or other volatile gas used as a refrigerating agent; but constant experiment finally evolved a series of fittings and packings for joints which have been found practically perfect under continuous use for more than two years; both under and above ground, in wet places and in dry, in heat and in cold; and after being subjected purposely to all kinds of abuse.

Provision is made in their construction for contraction and expansion of long and straight lines of piping; even when, through carelessness, there might be a sudden change of temperature of over 100 degrees.

The question of measurement of the amount of service rendered has been solved in two ways:

First, by a meter, measuring the quantity of liquid-ammonia passing into each expansion-coil. Knowing, as we do, the heat-extracting power of a pound of ammonia expanded under any given condition, it is a simple matter to calculate the equivalent, in ice-melting, of the service rendered.

The second method of estimating the amount used is the measurement of the square feet of the interior surface of the refrigerating box or room, and the figuring out of the amount of heat removed therefrom, by the aid of a set of tables carefully prepared by means of a long series of experiments with every known form of insulation now in general use for refrigerating-boxes.

The entire cost of street-line construction varies from $9,000 to $22,000 per mile, depending upon the character of the street-paving which has to be removed and replaced, the kind of soil to be excavated, the crowded or free condition of the ground under the streets from other piping, etc., the correctness of the city records as to old work in the same, and the amount of street-traffic interfering with operations. The highest cost has been in narrow, crowded business streets in St. Louis, Mo., where the paving is very expensive, and where there was a net-work of both old and new pipes, of many of which no correct record existed in the city archives. This frequently necessitated the changing of plans after the streets had been opened. In a city with pavements of average character, the cost, including branches to the sidewalk, ready-for-service connections to the number of 100 to the mile, will be about $18,000 in business neighborhoods, and about $14,000 in residence districts where the lines can generally be run through back streets containing no other pipes.

We have, so far, charged prices varying from ten to twenty per cent less than would be paid for ice sufficient to furnish an equivalent amount of cooling. In addition to that saving in their ice-bills, customers have avoided slop, wear and tear, and have saved the cost of labor in handling ice. We also give them much more uniform service, and in many cases do work which it is impossible to do with ice; especially continuous and hard freezing and furnishing dry cold where damp cooling with ice would be ruinous.

BOOKS AND PAPERS.

THE Librairie de L'Art of Paris has lately issued a handy and inexpensive series of booklets, bearing the general title of "*Bibliothèque d'Education Artistique.*"[1] They comprise "*Alphabets*" by Theodore de Bry, Jean Daniel Preisler, François Emile Ehrmann and Habert-Dys, also some Italian ones of the fifteenth and sixteenth centuries from manuscripts at Siena and Ferrara. The series further includes "*Motifs Decoratifs*" from the designs of

[1] *Alphabets; Motifs Decoratifs; Bibliothèque d'Education Artistique.*" Paris: Librairie de L'Art.

the eighteenth-century artists, Augustin de Saint-Aubin and Jean Jacques François Le Barbier and a number of decorative fantasies by Habert-Dys. This designer, well known from his work in "*L'Art*," is stated in a prefatory note to have been the pupil of Gerôme and Bracquemond, but apparently owes much more to a careful study of Japanese art, coupled with a retentive memory, than to either of the great artists named.

THE animal-painters of our time — and more especially those who are of the French school — are fairly represented in the collection of praiseworthy reproductions from their works issued by the Librairie de L'Art under the title of "*Animaliers Contemporains.*"[1] The two *recueils* of which it consists enclose copies of paintings by many eminent men in this domain of art — cattle by Mark Fisher and Vuillefroy; sheep by Schenck and Jacque; cats by Lambert; camels by Guillaumet; lions by Lançon; dogs by Henri Regnault and a fine picture of stags preparing to fight, by the veteran animal-painter Karl Bodmer, lately dead. The inadequate presentation of the horse is probably due, not to lack of appreciation, but to the fact that the publisher failed to find at hand the necessary cuts with which to do him justice, for we imagine all the blocks here printed have seen service before. But many of them are so good as to merit warm commendation.

"*Sculpteurs Contemporains*"[2] comes as another welcome addition to this series of copies of modern art-works, appropriately classified by subjects and schools. The noble art whose chiefest charm is form, is here admirably shown in numerous fine drawings, some by the sculptors themselves, others by draughtsmen like John Watkins and Bichard, whose able pens have done so much to bring works, otherwise inaccessible to most, before the eyes of the people. In this day of facile "direct" photographic copies, whose many merits we heartily acknowledge, it is refreshing to see such virile and thoroughly artistic drawings as these after the originals of other men. The collection embraces, among other good things, a superb drawing by Dalou from his "*Paysanne en Prière.*"

CONSTANT TROYON[3] — a master, some of whose finest works hang on the walls of American houses — is one of the painters recently considered in the "*Les Artistes Célèbres*" series. M. Hustin is responsible for the text of the book, which carries a picture on about every other page — pictures, by the way, not as well printed as those in former volumes of the series. That which comes first is Mr. Cornelius Vanderbilt's picture of the peasant driving cows and sheep, which was in the loan collection at the World's Fair. One may believe, perhaps, that out of the hundreds of thousands of Americans who saw it there, some rough drover or Texan "cow-puncher" may have been touched by the piteous appeal of the beast which lifts its head to heaven in dumb protest against the cruel peasant's stick — a protest not without point in the great city of the stock-yards. M. Hustin tells of the youth and early efforts of the artist, of his studies and travels, his teachers and his friends, his successes and his death. The book, the first written on Troyon, has the useful lists of sales and prices which enhance the value of the series, to which it adds another volume of worth.

THE biography of Bernard Van Orley,[4] which M. Alphonse Wauters has written for the same series, is that of an artist whose fame during his life was very great, but gradually dwindled until the story of his days and deeds was all but forgotten. It is only in our own time that careful research has brought again to light the facts of Van Orley's career. Born in Brussels at the end of the fifteenth century, he studied under his father and being sent to Italy, to complete his art-education, came home deeply influenced by the great works he had there seen and admired. The pupil of Raphael, the friend of Dürer and the favored painter of Margaret of Austria, Van Orley made of his native city "a western Rome in matters of design," and dying at about fifty years of age left behind many well-esteemed works. Among them are some good portraits and a number of paintings of religious subjects, the latter including his greatest achievement, "The Trials of the Patience of Job," a commission from his noble patroness. Of much importance, too, were Van Orley's designs for tapestry and stained-glass. It is interesting to note, in many of the illustrations of M. Wauters's book, the elaborate details of the architectural surroundings in the artist's pictures, which often show a mingling of the mediæval and Renaissance styles. Van Orley evidently delighted in the delineation of costly marbles and of sculptured surfaces, of rich stuffs and of armor cunningly chased and gilded.

THE grace and spirit of that admirable and prolific designer known as Moreau le Jeune are most satisfactorily set forth in the profuse illustrations of M. Adrien Moureau's monograph on "*Les Moreau,*"[5] lately published as one of the "*Les Artistes Célèbres*" series. So far as the rest of the Moreau family are concerned, it is with the "young" artist of that name a case of "Eclipse first and the rest nowhere," as the achievements of his artist-relatives are of but little value or interest. The illustrator of Voltaire and Rousseau, and of many another author, from Ovid to Lafontaine, Moreau produced over two thousand drawings and enjoyed the favor of royalty, yet towards the end of his life became poor and shortly before his death, in 1814, was compelled, at the age of seventy-three, to ask aid of the publisher Renouard. It certainly seems fitting, however, that a member of that guild should extend a helping-hand to the suffering artist when one thinks of the money they must have realized from the labors of his accomplished hand. Well chosen examples of his skill, from a tiny vignette to the splendid drawing of the "Assembly of Notables," with its scores of courtiers sitting in the stately hall, adorn the pages of this volume, which well attest the exceptional talent of Moreau le Jeune.

M. ROCHEBLAVE has added to the series of "*Les Artistes Célèbres*" a volume of greater bulk than the average, concerning "*Les Cochin,*"[6] illustrated with 142 engravings, of which eleven are printed *en sanguine.* Excellently chosen and well-made as these are, we cannot avoid, even at the risk of displaying some ingratitude for the feast thus bountifully spread, charging the editor of this series with lacking a sense of due proportion in giving so many illustrations to this work, when, in former issues, Rembrandt was allotted but forty-one and Velazquez thirty-four. And even less excusable was it to embellish the volume which treated of the Huets, a not too well-known family of animal painters, with the largest number of illustrations (177) so far contained in any issue of the series. All this, though, does not detract from the interest of "*Les Cochin,*" by far the greater part of which is rightly filled with the work of Charles Nicolas Cochin the younger, the ablest artist of the family and one of singular merit, both as designer and engraver. Here are reproduced ball-tickets, initial-letters, frontispieces, headpieces, title-pages and business cards; here are illustrations, allegories and representations of grand functions, such as the masterly drawing of the King's gaming-tables in the great gallery at Versailles, on the occasion of the marriage of the Dauphin, in 1745. And, lastly, there are the fine portraits — portraits of Boucher and Chardin, of Garrick, of Mdlle. Clairon, and of Madame Favart, among the many other choice ones whose features were faithfully fixed by the pencil of Cochin.

SOCIETIES

THE SKETCH CLUB OF NEW YORK.

THE regular monthly meeting and dinner of the Club was held at the club-rooms, Saturday, March 3, about fifty members being present. Some very good drawings were handed in for the Village Church and Mausoleum competitions. Mr. Albert E. Parfitt, who was a guest of the Club, gave a very interesting talk, accompanied by stereopticon views of a trip through Italy, France, Germany and England, as these countries appeared in the fifteenth century. Mr. Parfitt's lecture was very much appreciated. Next, we had an echo of the World's Fair, through the kindness of Mr. J. J. Petitt who introduced some Midway Plaisance novelties. The Club enjoyed this bit of refined entertainment hugely.

H. C. PITTMAN, *Recording Secretary.*

AMERICAN INSTITUTE OF ARCHITECTS, NEW YORK, N. Y.

AT the annual meeting of the Board of Directors of the American Institute of Architects, held in New York, on February 8, we, the undersigned, were appointed a committee of three, to report to the Board of Directors before the next annual convention suggestions embodying rules to govern competitions. We were also requested to make this statement to the different professional journals — inviting architects to submit suggestions for our consideration.

(Signed) GEORGE B. POST.
JAMES W. MCLAUGHLIN.
THOMAS HASTINGS.

T-SQUARE CLUB OF PHILADELPHIA.

A MEETING of the T-Square Club was held at the club-rooms, Wednesday evening, February 21. The subject for competition was "A Memorial Column to commemorate a Battle." There were ten designs submitted. First mention was awarded to Wm. C. Hays; second mention to Robert C. Heath and third mention to Edw. T. Boggs.

The competition for the March meeting was announced: "A Scheme in Color-decoration for a Hall in a Country House."

GEORGE BISPHAM PAGE, *Sec'y.*

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[1] "*Animaliers Contemporains.*" Paris: Librairie de L'Art.
[2] "*Sculpteurs Contemporains.*" Paris: Librairie de L'Art.
[3] "*Constant Troyon,*" par A. Hustin. Paris: Librairie de L'Art.
[4] "*Bernard Van Orley,*" par Alphonse Wauters. Paris: Librairie de L'Art.
[5] "*Les Moreau,*" par Adrien Moureau. Paris: Librairie de L'Art.
[6] "*Les Cochin*" par S. Rocheblave. Paris: Librairie de L'Art.

ILLUSTRATIONS

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

CHAMBER CEILING DECORATIONS IN THE HOUSE OF WILLIAM ROCKEFELLER, ESQ., TARRYTOWN, N. Y. MR. H. T. SCHLADERMUNDTT, DECORATOR, NEW YORK, N. Y.

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

DESIGN FOR THE FIRST CONGREGATIONAL CHURCH, PLYMOUTH, MASS. MESSRS. CRAM, WENTWORTH & GOODHUE, ARCHITECTS, BOSTON, MASS.

MORTON STREET PRIMARY SCHOOL, BOSTON, MASS. MR. E. M. WHEELWRIGHT, CITY ARCHITECT, BOSTON, MASS.

EUSTIS STREET PRIMARY SCHOOL, BOSTON, MASS. MR. E. M. WHEELWRIGHT, CITY ARCHITECT, BOSTON, MASS.

HOUSE NEAR MORRISTOWN, N. J. MR. ALBERT E. BARLOW, ARCHITECT, NEW YORK, N. Y.

HOUSE FOR MRS. HARRY WAINWRIGHT, PITTSBURGH, PA. MR. CHARLES BICKEL, ARCHITECT, PITTSBURGH, PA.

[Additional Illustrations in the International Edition.]

MOORISH FIREPLACE IN THE HOUSE OF HENRY G. MARQUAND, ESQ., NEW YORK, N. Y.

[Copper-plate Etching.]

THE VERMONT STATE BUILDING, WORLD'S COLUMBIAN EXHIBITION, CHICAGO, ILL. MR. JARVIS HUNT, ARCHITECT, CHICAGO, ILL.

[Gelatine Print.]

HALTON, HERTS, ENG.: THE ENTRANCE-HALL.

SHOW-ROOM IN DUKE STREET, LONDON, ENG. MESSRS. ERNEST, GEORGE & PETO, ARCHITECTS.

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.*]

LIVE-LOADS AND SUPPORTS IN OFFICE-BUILDINGS.

New York, N. Y., February 16, 1894.

To the Editors of the American Architect: —

Dear Sirs, — The plea of Messrs. Jenny & Mundie "for reducing the live-load in calculating the columns of lower stories" seems to some extent well founded, but the method of explanation is an objectionable one. So far as office-buildings are concerned, the time and the rush of business are all through the structure the same, so that the average highest load must certainly occur simultaneously, if the number of offices "for rent" are not carefully distributed in the building.

The maximum of floor-load would be only in this case impossible, if the use of some floors like theatres, etc., requires a different time, otherwise it would be impossible to prescribe. Meetings in rooms 82 and 83 must be held at different time on account of a girder which carries only eighty per cent of the live-load, or the like. If we allow that this girder can carry twenty-five per cent more than it is designed for, why not do the same with floor-beams? Why not reduce the supposed floor-load all through the building?

I know of a similar proceeding only in bridge-designing regarding wind-stresses.

We calculate a bridge for a gale only and suppose that some exceptional tornado shock will always be within the elastic limits of iron. Still it happens that sometimes we are mistaken. In such cases a bridge will always be unloaded and deserted, so that this supposition, if once not justified, will certainly not be dangerous. In a building the matter lies quite differently, but if it must be conceded that we take only forty-four and one-half per cent of the live-load on basement columns and 15,000 pounds per square inch (20,000 inch-wind), that a densely-packed office-building will be quite an unsafe thing; an additional accident from wind, fire or explosion or some hidden defect supposed, it may collapse, especially if we remember that some steel has its elastic limit below 30,000 pounds per square inch.

I think we should be afraid of this saving and, as a rule, never save on the live-load, if once assumed. But there is another flaw in the chain which began with floor-load, which is calculated for the full load, and ended with the column, calculated for half the load, and it is in the floor itself. I do not doubt the reliability of the floor-beams, but I am not a bulky enough fellow that I could rely on them only.

I think for a safe floor it is very necessary to have a safe flooring itself. Has this been calculated for the whole load too? and what coefficient of safety has been used?

I remember only one case where the flooring has been chosen in regard to its actual strength and not on account of lower price and weight. The comparative tests in Denver, Col., have been extensively published in your valuable paper, March 28, 1891 and I can refer to them.

The three competing firms got the following figures:

	I.	II.	III.
Breaking load per sq. ft. 3′ loaded, 5′ span..	603	953	1670
Reduced to an equally distributed load.....	483	763	1316
Live-load, 70 pounds per sq. ft.....			
Tile-load, 40 " " " "			
Dead-load 40 " " " "			
Total load.....	150	150	150
Coefficient of safety.....	3.2	5.1	8.8

Trautwine requires for stone beams out of one piece (not in arch-like pieces like tile) a coefficient of safety 10 — 8.8, if this is a fair average, will do, but how about the others? The tile-beam No. III shows only thirty-eight per cent air, something I have never seen since. The lowest which I have found was fifty-five per cent and for such loads as mentioned above, I always found tile-beam less than ten inches in height.

Messrs. Jenny & Mundie will certainly do a great favor to the profession if they let us know, out of their great experience, how the tile-beams had to be calculated and the factor-of-safety which has been employed.

Yours respectfully, Fr. von Emperger.

Chicago, Ill., March 1, 1894.

To the Editors of the American Architect: —

Dear Sirs, — At your request I reply to the communication of Mr. Fr. von Emperger, of February 16.

First, I would refer to an exhaustive article on certain lines of this subject by C. H. Blackall, that appeared in the *American Architect*, Vol. XLI, No. 922, pp. 129–131, August 26, 1893.

In calculating the steel-skeleton construction for an office-building, it is our aim to provide for all the dead-load and for the maximum actual live-load that will obtain. This last can only be reached by actual estimates. The observations of Mr. Emperger would seem to be theoretical. An examination in the building, we believe, will demonstrate there in New York, as well as here, that the live-load provided for, of 70 pounds per square foot, does not obtain in any office in the building, and this extreme figure is used because of the possibility of an office being used for a gathering or meeting of as many as could even find comfortable standing-room, or a rush into a room or rooms, due to some special momentary attraction, and particularly in Chicago to satisfy the Building Ordinance. In such cases it would be best that a beam could be loaded temporarily its whole length with the maximum load of 70 pounds per square foot, but that the girders should have the full maximum load necessitates that at the same time two or more beams assembled to the girder on each side should be all loaded with this maximum load at one and the same time, which cannot be reasonably presumed, hence the reduction of the live-load of, say, 10 or 20 per cent.

In regard to the columns: The only columns in the building that we can reasonably presume will ever carry the maximum load, are the attic columns supporting the roof, which may be loaded exceptionally with a live-load of say 40 pounds per square foot on the roof, consisting of snow and ice. This we deem sufficient even in Chicago, because these important buildings are in charge of a custodian under whom is a head-janitor and chief-engineer. In case snow-storms follow each other without much diminution of former falls of snow or frozen rain, it will be removed by the force whose duty it is to watch for such conditions, so that 40 pounds is deemed to be sufficient. None of the offices are ever loaded to the calculated capacity of 70 pounds per square foot.

Messrs. Blackall and Everett made numerous estimates of the actual live-loads in office-buildings. See article in *American Architect*, No. 922, which is very exhaustive on this subject. Live-loads were found to range from a maximum in one single instance of about

40 pounds to a minimum in several instances of 5 pounds. A live-load of 20 pounds per square foot on each floor would exceed the average. An estimate made by the George A. Fuller Company, the leading building-contractors of Chicago, gave but 6 pounds per square foot with the office comfortably full, with 9 pounds as an extreme maximum.

In offices and in hotel buildings so much space is taken up by light, though bulky, furniture that the live-loads are very low. In well-appointed fireproof buildings there are vaults which form a part of the dead-load, in every suite of offices, so that there are few or no safes. The heaviest load is generally found in the lawyers' offices, consisting of books. Even in theatres Mr. Blackall quotes the heaviest load obtainable as but 58 pounds, so that the 70 pounds per square foot which is used in calculating the beams in our office-buildings is forced upon us by the Ordinance, and is fully 20 per cent above what we would be justified in using. The foregoing, we believe, is a full justification of our methods of calculation.

In warehouses actual estimates must be made of the load they are intended to carry. It should neither be too light nor too heavy, for if too heavy it leads to an unnecessary expenditure, hence a waste. In warehouses the loads are distributed in the same manner as in office-buildings — full live-loads on beams, for they may receive it, but as there must be passageways to allow for the moving of goods the girders will only receive 80 or 90 per cent, according to the class of business.

There is a very good section in the Chicago Building Ordinance, that has been recommended by the writer for some years, requiring that there be displayed conspicuously on each floor of warehouses a placard stating the load per square foot of floor-surface, which may be safely applied to that particular floor, or in each particular locality should there be a variation.

The writer had occasion to estimate the actual loads carried in the dry-goods warehouses of Marshall Field & Co., in Chicago. The maximum load over limited areas was 57 pounds per square foot, with passageways between for the trucks moving boxes of goods, so that the maximum average was less than 50 pounds.

The more stories there are above any given column the greater will be the diminution of the live-load, hence, the reduction of live-load from the roof columns to the basement is justified by the facts. (See Blackall.)

With regard to the tile-arches forming floors — experience has taught us that all things considered, the most advantageous span between beams is about 6 feet. The longer the span the deeper the beams, hence the greater loss in clear heights of stories, a matter of importance in Chicago, as the height of fireproof buildings is now limited by law to 130 feet from sidewalk to highest part of the roof. These hollow-tile floor-arches are laid in a strong Portland-cement mortar — one of cement to three of sand. The joints are entirely filled. To be assured of this, a special superintendent is put at the building. The tile are all inspected on their arrival at the building and any soft or imperfect tiles are discarded and immediately removed from the premises. Numerous tests of these floors have shown them to be in every respect satisfactory. A roller 6 feet in diameter with 16-inch face, weighing about 1,800 pounds, I have seen rolled over these arches before they were concreted. Obstacles, such as brick, 2″ x 4″ scantling, etc., were placed before the roller and it was made to jump over them without the slightest effect on the arches. In one instance while we were making these tests a 12-inch I-beam, some 8 feet in length, fell three stories, destroying a floor-beam in its fall by buckling the webb, and struck on end on the top of the floor-arches beneath. It punched a hole through the top flange and fell over on its side, without otherwise disturbing the tile or injuring the soffit of the arch.

I note that Mr. Emperger speaks of the elastic limit of some steel at being below 30,000 pounds per square inch. Such steel is not used in Chicago for constructional purposes, other than for rivets. Our specifications are those published by the Carnegie Steel Company in their "*Pocket Companion*," the edition of 1893, edited by Kindl, which calls for an ultimate of 60,000 to 68,000 pounds per square inch, with an elastic limit of one-half of the ultimate. An examination of the test-sheets for the New York Life Building, shows an elastic limit ranging from a minimum of 34,190 to a maximum of 38,380; the ultimate ranging from 61,190 to 67,850 pounds per square inch. As we have a fibre stress of 16,000 we have a coefficient-of-safety of four.

Careful calculations are made for wind-pressure at 40 pounds a square foot and methods are provided to resist this pressure without exceeding the safety coefficient. Should a cyclone run the pressure higher it would be but for a short time. As yet none of the steel skeleton constructions in Chicago have been in the slightest degree injured by the wind, although a cyclone about a year ago struck the Home Insurance Building, blowing some lights of plate-glass out of the sash.

In conclusion. — These tall skeleton buildings, as they have been erected by the most experienced architects in Chicago, are designed and calculated with all the science, inspected and superintended with all the care and attention that is given to a railroad bridge of the first order, and we believe them to be fireproof, cyclone-proof and earthquake-proof. Certainly they have never shown the slightest signs of weakness under the severest tests to which they have been subjected.

W. L. B. JENNEY, *Architect.*

TRUSS NOT IN EQUILIBRIUM.

NEW YORK, February 20, 1894.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Replying to Mr. Hult's query of January 21, published in the current number of the *American Architect*, I would say that the truss as given in Figure 1 is not in equilibrium unless there is a load on the joint *e-f* sufficient in amount to neutralize the tension in the member 9–10 of Figure 2, which would counteract the bending moment now existing at the joint *d-e*.

The diagram given in Figure 3 is apparently correct, but the truss is an exceedingly awkward one to build or analyze, and, as built, is in danger of failing from the buckling of the member 6–7 and from the bending moment at the joint *d-e*. It would give me pleasure to explain obscure points to him or any other student of "Office Help." Yours truly,

GEORGE HILL.

NOTES AND CLIPPINGS

A MOSS-COVERED DERELICT. — In 1881, when C. H. Hill, now of the Brazilian Navy, was on the "*Jeannette*" Relief Expedition to the Arctic regions, sent out by Government, his ship for a time was laid up at Reykjavik, the capital of Iceland. While there he saw a derelict float in and strike the wharf. It was at once made fast, and proved to be loaded with yellow pine lumber. The vessel was literally covered with moss and barnacles, and investigations disclosed the fact that the name of the old craft, that for years by tide and winds had been driven hither and thither, was the "*Jamestown.*" The inhabitants of the capital thought that a great prize had fallen into their hands. Everybody turned out and took a hand in unloading. The lumber came out in good condition, and the Reykjavikans estimated that there was enough of it to last them for twenty-five years. But, alas, what a world this is as a hope-crusher! After the people had unloaded and piled the lumber, the Denmark Government stepped in and confiscated it and started a lumber-yard of its own. On return of the "*Jeannette*" Expedition, Government made inquiry regarding the "*Jamestown,*" and learned that she was loaded in Pensacola, Fla., in 1865, soon after the close of the Civil War. Thus, for sixteen years the lumber-laden vessel had floated as a derelict on the high seas. — *Northwestern Lumberman.*

COLONNE DE LA GRANDE ARMEE. — The Napoleon Column at Boulogne-sur-Mer, or Colonne de la Grande Armée, as it was commonly called in France, and from which the statue of Napoleon has fallen, stood on the high ground back of the town, to mark the site of the great camp of 1804, which Napoleon I had formed preparatory to his projected invasion of England. Here he had concentrated 180,000 men and 2,400 transports, and was about ready to swoop down upon England with them when the war with Austria afforded them other employment. So certain was he of invading the country that he had a medal struck off, bearing the inscription, "Descente en Angleterre: frappé à Londres, 1804." His intention was to sweep the channel of the English fleet with the combined fleets, of France, Spain and Holland, and then to land his men on the opposite shore by means of his transports. The Colonne de la Grande Armée was a marble shaft, 166 feet high, of Doric design, surmounted by a bronze statue of the Emperor in his coronation robes, by Bosio. The corner-stone was laid by Marshal Soult in 1804, and the work commenced by the Grande Armée. It was not until 1841, however, that the shaft was completed and surmounted by the statue. — *Boston Transcript.*

A REMARKABLE TRANSFORMATION SCENE. — Louis XIV once remarked impatiently, in the hearing of the Duc d'Antin, superintendent of the royal buildings, that he hoped some time a forest, which he always disliked, because it obstructed one of his favorite views, would be cut down. Unknown to the King, the Duc d'Antin had the trunks of all the trees in the objectionable forest sawed through near the ground in such a way that they still stood, though a slight pull would bring them down. He removed every evidence of the work, and fastened ropes to the tops of the trees and concealed more than 1,200 men in the forest to manage the ropes at a signal from him. D'Antin knew on what day the King would walk in the wood, and planned his work accordingly. The King took his accustomed promenade, and, as usual, he expressed his sentiments about the hated forest. "Your Majesty, the forest shall be removed whenever you like," said D'Antin. "Indeed," said the King, "then I wish that it might be done at once." At that moment D'Antin blew a shrill blast from a whistle, and, to the utter amazement of the King and the royal party, the forest fell as if by enchantment. — *Exchange.*

THE GERMAN PARLIAMENT-HOUSE. — A share of the inflemnity derived by Germany from France after the war of 1870–'71 was set apart for the erection of an Imperial Parliament-House in Berlin. It amounted to 24,000,000 marks, and was put out at interest until 1877, when a new arrangement was made. The share had by that time increased to 28,719,964 marks. Up to the present the outlay on the building has been 27,925,000 marks. The Reichstag Palace has, therefore, not needed an appeal for supplementary votes, and this fact suggests the rigorous organization which extends to civil, no less than to military, affairs. There is not only a balance of 794,964 marks, which can be utilized for imperial purposes of another kind, but a sum of double the amount is likely to be obtained from the vacant land which was not built over. It has been stated that the building has not gained the approval of the Emperor, but the financial aspects of the undertaking deserve to be recognized as satisfactory. — *The Architect.*

The Grotesque in Art. — Nowhere is the physician more directly opposed to the artist in his judgment than on the subject of grotesques. Take, for example, the grotesque head carved on the base of the tower of Santa Maria Formosa at Venice. Of this, Mr. Ruskin says: "A head — huge, inhuman and monstrous — leering in bestial degradation, too foul to be either pictured or described, or to be beheld for more than an instant. Yet let it be endured for that instant, for in that head is embodied the type of the evil spirit to which Venice was abandoned in the fourth period of her decline. . . . This head is one of the many hundreds which disgrace the latest buildings of the city, all more or less agreeing in their expression of sneering mockery, in most cases enhanced by thrusting out the tongue. They are evidences of a delight in the contemplation of bestial vice and the expression of low sarcasm, which is, I believe, the most hopeless state into which the human mind can fall." It is rather refreshing, after this uncomfortable judgment on poor Venice, to turn to the doctor's diagnosis. M. Charcot writes: "In our opinion, this distortion of the features, which gives the mask so grotesque and hideous an aspect, is by no means the result of a mere artistic whim. Nature, in her infinite variety of forms, is a mine of inexhaustible richness, where the beautiful and the ugly, the harmonious and the deformed, are mingled with intermediary degrees. The artist of Santa Maria Formosa, seeking for a grotesque type, seems to us to have met one in his path, to have seen it with his eyes, seized it in passing, and reproduced it with a fidelity which enables us at this day to recognize in it the signs of a pathological deformation of a nervous affection, clearly defined, of which we have had under our notice at La Salpêtrière very interesting examples. The case in question is evidently a spasm of the face, and presenting characters so marked that it is impossible to confound it with any other facial and spasmodic affection." Thus the physician comes to the rescue of the artist, and reveals a mere naturalistic *tour de force* in what the artist has read as "a delight in the contemplation of bestial vice." — *London Hospital.*

Richmond's State Capitol. — Best of all that is in Richmond I liked the ancient State Capitol, copied far from exactly after a building in France which Jefferson admired, built before our Constitution was formulated, and having as a mere episode in its lifetime a stormy service as the Capitol of the Confederacy. To-day it is sacred for all Americans. It shelters Houdon's Washington, and its historic walls are burdened with paintings in number and character ample to form a gallery of the portraits of famous Americans. Pocahontas's sad face is there, and so are the countenances of Light-Horse Harry Lee and Jefferson, of Capt. John Smith and of President Tyler and his father, a one-time Virginia Governor. Gens. Johnson and Jackson and Robert Lee and Fitzburgh Lee are in the painted assembly, put there by a reverent prompting, which every true man respects. From the basement to the roof there is no spot in the splendid and substantial old edifice whose story or ornaments do not stir the heart of all Americans who go there. It teaches us that the whole country is bound by ties stronger and warmer than accident or commerce can make, for Richmond's Capitol is hers only in name and in trust. In full fact it is as much ours in New York and in Bangor and San Francisco, in Texas, and wherever the stars and stripes are flung out. — *Julian Ralph in Harper's Weekly.*

The Fall of the Vendome Column. — I had got the statue into line with a chimney in the Rue Castiglione, so as to be able to detect the slightest oscillation, but there was none at all — the column, all wounded as it was, stood immovable. Five minutes passed, five minutes of excited hope to me, for, from the braveness of the resistance, it almost seemed as if the destroying brutes would not be able to succeed. At last a shiver ran down my back; I had become conscious, after a particularly savage jerk on the ropes, that the line between the chimney and the statue was no longer exactly straight. Slowly — very slowly — the statue swerved past the chimney; slowly the great column bowed toward me — never did any one receive so superb a salutation; slowly it descended, so slowly that it almost seemed to hesitate; in a great haze of spurting dust it fell. There was scarcely any noise, and no tremor of the air or ground; but the twenty feet of fagots were flattened down to nothing, and the dust rose thick like fog. With a wild rush and frantic shouts the people dashed past the sentries into the Place Vendôme, leaped upon the dislocated fragments, and howled coarse insults at them. Mournfully I went away, murmuring to myself, "Poor France!" — *Recollections of the Commune: Blackwood's Magazine.*

London Fires. — It appears from the report of the chief officer of the Fire Brigade to the London County Council, that the fires of 1893, compared with those of 1892, show an increase of 264, or, compared with the average of the past ten years, an increase of 997. The number of fires in 1892 was 3,146 (serious, 177, slight, 2,969); those of 1893 amounted to 3,410 (serious, 180, slight, 3,230). The average for the ten years, 1883 to 1892, was 2,413 (serious, 166, slight, 2,247). The number of fires in the metropolis in which life has been seriously endangered during the year 1893 has been 107, and those in which life has been lost has been 45. The total number of calls during the year, including those for actual fires, supposed fires, chimney-fires and supposed chimney-fires, has been 6,462, or nearly 18 a day; of 1,163 false alarms received during the year, 606 have been malicious calls sent through the fire-alarm call-posts. — *Journal of the Society of Arts.*

The Texas Dugout. — Dugouts have been a great help to Texas. Many a herd has been kept and many a farm has been cultivated which never would have been till years later had the owner been obliged to wait till he could build him a house of wood or brick. Some are dug straight down into the ground, while others are dug in the side of a hill. The one in which I recently spent the night was of the former kind. It was 15′ x 20′ at the bottom and about seven feet deep. About three feet from the floor the walls were abruptly widened out, thus giving a shelf in the solid earthern wall some three feet wide and extending around the whole of the room. This was an exceedingly convenient arrangement, as it answered for chairs, dining-table, miscellaneous shelving and beds, all in one. My friend had cut a fireplace of proper size in the solid dirt wall, and by means of a post-hole auger had bored a chimney down to it. One single joint of stovepipe projected from the top of this chimney out into the open air. Looking up from within, I could see the structure of the roof. One log had been laid across the dugout in the direction of its greatest extent, and did duty as a ridgepole. Smaller ones were placed with one end on this and the other on the ground, just as the rafters of a house are arranged. Hay had been thrown on top of these, and above all a pile of dirt had been banked up. There was a slanting door in this, like that of a cellar, and leading up to it was a flight of steps. These were rather steep, but one was not afraid of their breaking down with him: they were cut in solid dirt. Under ordinary circumstances one might have objected to the room on the score of its having nothing resembling a window, but with the temperature outside as it was, this was an advantage rather than otherwise. A bright roaring fire burned on the hearth, and as we reclined on the blankets spread over our shelf-like beds, I thought the whole scene an embodiment of substantial, comfortable and picturesque luxury. We could hear the wind howling and roaring outside, but aside from this there was nothing to indicate that the first norther of the season, and one of the fiercest known for years, was raging outside. — *St. Louis Globe-Democrat.*

Courts may control Court-houses to their own Comfort. — The Courts have sufficinet power to compel the county authorities to furnish proper accommodations if they choose to exercise the power. The Supreme Court of Indiana, not long ago, held that a court might order the person in charge of the elevator in the court-house to operate it during the sessions of the court, and on his refusal might direct the sheriff to take charge of the elevator. The Court, it was held, could not be impeded in its functions by any other department of the Government. The Supreme Court in this country has more than once exercised its power by directing the sheriff to dispossess city officers from rooms in the court-house needed for court purposes. The Court of Common Pleas of Bucks County, a few months ago, had a controversy with the County Commissioners who took on themselves the appointment of men to take care of the court-house, manage the fires and clean the rooms. The Court decided that it had the power to control the court-house, and it appointed two "tipstaffs," or court officers, assigning to one the duty of taking care of the court-house and its approaches and discharging the duties usually performed by janitors as to that part of the building used for court purposes. The other tipstaff was directed to attend to the fires and heating of the court and jury rooms to the exclusion, if necessary, of other parts of the building. — *N. Y. Tribune.*

A Collector's Good Fortune. — An American collector the other day discovered in the place of a dealer in old books and manuscripts in the City of Mexico where few Americans ever go, being very remote from the centre of the city, an image of the Virgin del Carmen, in the manner of Murillo, about eighteen inches in height, so exquisitely wrought that it instantly attracted his attention. The carving was perfection: not a detail shunned, and evidently the work of some wonderful artist. The coloring was delightfully soft and artistic. The hands of the image were marvellously done. Inquiry showed that this fine bit of carving was by the famous Mexican sculptor, architect and poet, Tresguerras, who flourished long ago in Queratarо, and who built the church at Celaya, which has the most perfect domes in the New World! The image, carved from wood, is a copy of a life-size image of the Virgin del Carmen by the same versatile genius. This rare image was purchased for a small sum, but the ordinary collector would not have discerned its value. It was bought without knowledge of its origin, which, when subsequently learned, justified the collector's taste. — *F. R. Guernsey in Boston Herald.*

Six Inches of Snow in Venice. — The severe cold which swept over the whole of Italy, three weeks ago, did not spare Venice. The snow is five or six inches deep, and more where it has drifted. A correspondent, who was there a day or two ago, says that the streets and the Piazza were almost deserted. At San Marco the bright mosaics and bronze horses looked out of place and unhappy under their snow coverings. The snow was cleared away from the roads, and great heaps were made in the Piazza. On the narrow pathways it froze so hard that it was difficult to keep one's footing. The lagoons from Mestic and all along the mainland are one sheet of ice, stretching almost to Venice itself, and large masses are floating in the Grand Canal. Anything more funereal and gloomy than the sight of the black gondolas creeping about with snow on them cannot be imagined. Great suffering and misery prevail among the poor. — *London Daily News.*

Gladstone Honors Art. — Mr. Burne-Jones is the fourth artist on whom the dignity of a baronetcy has been conferred during the reign of Queen Victoria, the others being Sir John Millais, Sir Frederick Leighton, painters, and Sir Edgar Boehm, the sculptor. Had Mr. Watts accepted, he would have made a fifth. It is noted that to Gladstone are due the thanks of the artistic world for this recognition in four out of the five instances, Lord Salisbury having been responsible for the title that was conferred on the late Sir Edgar Boehm, the sculptor. It was also Mr. Gladstone who made Alfred Tennyson a peer. Lord Salisbury recognized science, instead of poetry or art, by transmuting Mr. Thomson, the famous electrician, into Lord Kelvin. — *Boston Herald.*

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