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THE troubles of the Massachusetts officials about the new Medfield Insane Asylum has been smoothed over in a manner which, at least, accords well with the rest of the proceedings in the case. It will be remembered that the work on the buildings was required to be done to the satisfaction of the engineer, or architect, or both of them, we cannot say which. The engineer's supervision does not seem to have given any one much concern, while that of the architect was so far from being satisfactory to the building-committee that he was dismissed. It was, however, apparently satisfactory to the contractors, for, on his discharge, they brought complaints to the Governor, which resulted in the summary dismissal of the three members of the building-committee itself. This left the contractors in sole possession of the field, but, under the contracts, the work had to be done to the satisfaction of somebody, and, as any other architect than the victim of the recent circumstances appeared to be distasteful to the contractors, they were, according to the Boston papers, invited to name some person to whose satisfaction they would consent to do their work. In accordance with this request, they graciously proposed the name of a contractor, who had for many years, previous to entering into business, been bookkeeper in a builder's office. This nomination was, it is said, immediately accepted and confirmed by the Governor and Council.

MEANWHILE, three new members were added to the Board of Trustees of the Asylum, and a new building-committee was chosen from among the trustees, the building-committee, this time, containing a member who ought to have been on it from the first, Dr. Park, an expert in hospital and asylum administration, and probably the only one of the trustees whose advice in regard to questions of design and construction, other than those which the architect was the proper person to answer, would be of any value whatever. Meanwhile, nothing seems to have been done about appointing another architect. Whether such a personage appears to the Governor and Council superfluous, or whether the appointment is only delayed, we cannot say; but the spectacle of the contractors for a million-dollar group of public buildings going on with their work without supervision or direction from any architect, under terms which require them only to make their work satisfactory to a book-keeper, who owes his appointment to them, is one to make enterprising builders dance for joy.

THERE are circumstances under which the lamp of life is extinguished, in which even the slight dread with which Christian man contemplates the inevitable coming of death is altogether lost sight of. To have the thread of life snapped on Christmas day while engaged at the church door in bestowing alms upon one's needy neighbors is an ending each one of us would be glad to welcome. Unusual as these conditions are, such were those which attended the death of Robert C. Fisher at the door of Trinity Church at New Rochelle, N. Y. The act, half real charity, half the expression of kindly neighborly feeling, was but the crowning of many charitable acts in which Mr. Fisher delighted to employ the large wealth which he had acquired as one of the largest dealers in marbles and fine building-stones. While the element of pathos is altogether absent in the case just cited, there is abundance of it in the circumstances which have led to bring mourning upon those interested in another business in which architects in this country have an indirect interest. On November 27, Stephen Wilcox, the junior member of the well-known firm of the Babcock & Wilcox Company, died and in less than three weeks his life-long friend and partner, George H. Babcock, followed him to a better world. Mr. Babcock was, we believe, that one of this pair of friends upon whose skill as an inventor the firm founded its first successes and its later large business. Born in 1832, in humble circumstances, Mr. Babcock led the life that usually falls to the lot of successful self-made men, and like so many others his first step was taken as a printer and newspaper editor. This led to his engaging in the manufacture of printing-presses and while engaged in this work he evidently discovered that certain powers were dormant in him, for we find him next studying for several years in the office of a patent lawyer and helping to support himself by teaching mechanical drawing at the Cooper Institute. Later he was employed in sundry iron-working establishments in Connecticut and Rhode Island, during which time he encountered Mr. Wilcox, and with his aid perfected his inventions and established a business which is known in every quarter of the globe.

IN a paper read a few months ago before the Boston Society of Civil Engineers, and reported in the *Journal of the Association of Engineering Societies*, Mr. M. M. Tidd calls attention, from the engineer's point of view, to a matter which we have already repeatedly discussed from that of the architect, — the crying need of a change in the manner of taking expert testimony before the courts. Mr. Tidd does not enter, as he might, into the ludicrous exhibitions of ignorance and assurance which are constantly made in court by the creatures whom lawyers provide, under the name of experts, to impose upon juries in favor of a client whom they know to have no case, and whose testimony is accepted as of equal weight with that of the masters of the profession, but he says, with only too much truth, that the present system, under which each side employs experts solely to help its own case, and the experts on either side are pitted against each other, brings disrepute on the experts, and on the profession which they practice. Mr. Tidd thinks that the engineers, or architects, or whoever they may be, who are called as experts, are so much influenced by their friendship, or sense of obligation, to the person by whom they are employed, that their testimony is unconsciously inclined in favor of his side, and that the opposite bias of the two sets of experts gives rise to those contradictions which are so often observed in such testimony, and which are so fatal to the reputation of those that give it.

A CERTAIN length of experience with expert testimony leads us to think that Mr. Tidd, while right as to the fact of the frequent occurrence of humiliating contradictions in such testimony, is wrong as to the cause. We are sure that there are few engineers or architects who would be led, by any amount of friendship, or sense of gratitude, to vary a hair's-breadth from a clear and precise statement of the truth, as they understood it; and almost always the difficulty with such testimony is that the witnesses, instead of speaking about the actual state of the case, testify in relation to a certain compound of half-facts, unintentional errors, intentional mis-statements and omissions, constructed by the counsel for the side that employs them, which they suppose to be a faithful presentation of the whole question. These structures of hypothesis are propounded to them in the lawyers' offices, where their testimony, based upon them, is carefully rehearsed; and, as each lawyer has a structure as different from that of the opposing counsel as it is possible for legal ingenuity to make it, the natural result is that the ideas of the experts on the opposite sides, as brought out by carefully chosen questions, appear to differ. It is true that a skilful cross-examination, by one of the few lawyers who know anything whatever about engineering matters, will readily elicit the truth from such a witness; but lawyers generally cross-examine a witness to confuse him, not to get the truth from him, and, at the best, it discredits an expert to find that his answers to a cross-examiner differ from those given to the lawyer on his own side under direct examination. As a specimen of the gross misrepresentations of facts which are often submitted to experts for their opinion, Mr. Tidd mentions a case where the owner of a water-power, which partly supplied a mill, sued a town for damages, for diverting a portion of the water. The water-power was unreliable, and the mill was supplied with a steam-plant for running it without any aid from the water-power. It was agreed on both sides that the amount of water-power diverted by the town did not exceed seven horse-power. The town offered to pay for coal enough to replace this amount of power, but the mill-owner claimed that the proper damages would be a sum sufficient to provide a seven horse-power boiler and engine, with power-house and equipment, and the salary of a man to run it. In support of this theory, he swore on the witness-stand that his present steam-plant was taxed to its utmost capacity, and that he could not get another horse-power out of it. At this point the court adjourned for two days, and, as the mill was then running under steam alone, the experts for the defendant took it into their heads to inspect the plant for themselves. They found a fine plant, but, in addition to driving all the mill machinery, they discovered that the engine was driving three thirty-horse-power turbines, each with eight feet of water over it, which were permanently connected to the other end of the main shaft. They hunted up the engineer, who appeared to be an intelligent man, and asked him how much power he thought was wasted in driving the turbines, in addition to the mill machinery. He thought it was fifty or sixty horse-power, and, in answer to another question, said that he could easily get ten or fifteen horse-power more out of the plant if necessary; so that his unperverted testimony went to show, and did show, afterwards, in the court, that the steam-plant which its owner averred upon oath to be incapable of furnishing a single horse-power beyond that required to run his mill, was furnishing at the moment at least fifty horse-power more, and could have given a surplus of sixty to seventy-five horse-power.

THE remedy which Mr. Tidd proposes for this unsatisfactory and discreditable state of affairs is precisely that which we have often advocated, — to have expert witnesses called by the courts alone, and the expense of employing them added to the court costs. This is the practice in France, and the results are very satisfactory, while the saving in expense to the contestants is enormous. The first step there, in a case which evidently requires expert evidence, or in which the parties ask for it, is for the court to send to the ground one, two or more experts, according to the importance of the controversy. These are chosen out of a small number of architects or engineers, whose reputation for technical knowledge, cool judgment and integrity has gained them the valuable appointment of "expert before the courts," and nothing more is done until they have rendered to the court their report as to matters of fact, which is taken as the basis of the decision. There is no reason whatever why our State or United States Courts should not be authorized to proceed in the same manner, to the great advantage of the public.

IT seems that the code of medical ethics in England is regarded by the judges there with about the same consideration that is accorded to the regulations of other professions, and there is a certain satisfaction in observing that architects are not the only victims of the judicial vituperation which forms so picturesque a feature of English law-practice. Some time ago a certain Mr. Anderton was called in to attend a sick person who had been a regular patient of a Mr. Ashurst. It is well known that medical etiquette requires a physician who has been called to visit a patient who has previously been under another physician's care to notify the latter of the fact. Mr. Anderton neglected to do this, and Mr. Ashurst, indignant at the slight, sent him a telegram saying, "Your conduct is abominable, and I shall not fail to resent it." It was now Mr. Anderton's turn to feel aggrieved, and he sent to Mr. Ashurst demanding an apology for the telegram. With us, a man receiving such a message would, if his conscience were clear, have laughed, and thrown it into the fire, but telegraph offices seem to be managed in England on different principles from those followed here, for Mr. Anderton, not receiving the apology he desired, brought suit against Mr. Ashurst for libel, on the ground that the contents of the telegram would be, or had been, divulged about the town in which he lived, and would injure his practice. The case was tried at Manchester, and the jury seems to have sustained the plaintiff's idea that the contents of telegrams should be considered as having been published to the world, for it gave him a verdict, assessing the damages, however, at one farthing. Meanwhile, the judge, with the usual airy discursiveness of the British judiciary, expounded, for the benefit of the spectators, his views on the case, and on doctors generally. As to the claim before the jury, he said that it was "a most trumpery one," and having thus disposed of the plaintiff, he proceeded to score the defendant, saying that he had no sympathy with the rule which forbade what he was pleased to call "violating the right which doctors claim of a monopoly to kill." He went on to say, "I know doctors claim a right not to be interfered with, but the public have as much right to change their doctor as they have to change their baker." We have read a good many stories of the sayings of English judges, but for insulting and ignorant mendacity we have never seen anything that surpassed this deliverance. How long an American judge would stay on the bench who declared before a jury that physicians claimed "a monopoly to kill," we cannot say, but it would not be long. As to the extraordinary assertion that doctors claim "a right not to be interfered with," and the suggestion that anybody in the medical profession denies the right of the public to change their doctor as often as they like, it is most charitable to attribute them to ignorance, combined with indigestion, but their effect in misleading a jury would not be less than if they were inspired by deliberate malice, and as far as the public is concerned, the medical profession in England now stands charged, on the authority of a judge addressing the jury in open court, with having devised its rule, that a new physician shall give notice of having been called to the one who has previously had the patient in charge, not for the well-being of the patient, which is obviously promoted by putting the two physicians in communication, but for the purpose of securing to each member of the profession his "monopoly to kill"; while the fact that people change their doctor quite as freely and frequently as they do their baker, without the slightest objection from the profession, is, by implication, denied, in order that this ridiculous charge against the members of one of the noblest and most self-sacrificing of all callings may not immediately refute itself.

THE *Scientific American* copies from the *Pacific Medical Journal* a letter from a California physician in regard to solar cautery, which he has used in place of caustics or other forms of cautery, with the happiest results. He finds that, by concentrating the sun's rays, by means of a lens, upon morbid tissue, the portions to be removed are destroyed with less pain, and less injury to the surrounding tissue, than by any other process; and he thinks that the chemical rays of the sun have "a curative power as yet unexplained." He applies a high degree of heat, so as to carbonize the tissues at once, without blistering, and finds that the pain ceases as soon as the operation is over. In one case, where he had to burn the skin off nearly all one side of the face, at one sitting, the surface was free from pain in five minutes after the cautery was stopped. Probably this effect is due less to the curative power of the chemical rays than to the concentration of the heat. It is well known that a cautery with a white-hot iron is much less painful than one with an iron at a low red heat; but even the white-hot iron blisters and scorches the tissues at a little distance from it, by the radiated heat, while, with the solar cautery, there is practically no radiated heat, whatever the temperature of the focus may be. The *Scientific American* mentions that this method of cauterizing was patented by Augustus Barnes, of Connecticut, in 1867, but no particular notice seems to have been taken of the invention, and the patent has long expired, so that any one who wishes to burn off warts, or apply the treatment to unhealthy ulcers, which are said to be often cured by it, can do so without asking permission.

OFFICE-HELP FOR ARCHITECTS.[1]—XXII.

CHAPTER VIII.—WALLS.

SECTION I.—MASONRY WALLS.

§ 301. Materials:—Masonry walls are built of some imperishable, non-combustible material, usually bound together with mortar. The materials usually used, either separately or in combination, are brick (face and common), stone and concrete. According to the duty they have to perform, they are divided into;

Class I.—Bearing-walls or walls that carry the beams or girders of a building.

Class II.—Curtain-walls or walls that have only themselves to sustain, with an occasional floor load.

Each class should be sub-divided into:

(*a*) Homogeneous walls, or those built throughout of one material.

(*b*) Non-homogeneous walls, or those that are built with a facing that does not bond with the backing, or has a different rate of shrinkage.

§ 302. Strength:—The strength of walls is usually limited by the strength of the mortar. Walls that belong to Class I (*b*) or Class II (*b*) are only as strong as walls of the thickness of the backing, the facing not counting unless it is equal to or exceeds 12″ in thickness and then only for the strength of the backing. In Table XXXIV safe practical values are given for the strength of walls, but when Portland cement is used to get

TABLE XXXIV.

STRENGTH OF VARIOUS KINDS OF MASONRY WALLS.

Material of wall.	Parts of				*Sc*	
	Lime.	Rosendale.	Portland.	Sand.	Tons per sq. ft.	Pounds per sq. in.
Common brick	1			2	3.0	41.7
"	2	1		4	5.5	76.2
"	1	2		4	6.0	83.0
"	1	3		6	7.0	97 0
"		1		5	6.0	83.0
"		1		4	8.0	110.0
Common hydraulic pressed brick		1		4	8.0	110.0
		1		3	10.0	139.0
"		1		2	12.0	167.0
"		1		1	15.0	208.0
"		4	1	10	12.0	167.0
"		3	1	10	14.0	194.0
"		2	1	10	15.0	208.0
"		1	1	6	15.0	208.0
"		1	2	10	18.0	250.0
"		1	3	10	20.0	278.0
"			1	4	20.0	278.0
"			1	3	25.0	348.0
"			1	2	30.0	417.0
"			1	1	40.0	555.0
Common rubble		1		4	8.0	110.0
"		1		3	10.0	139 0
"		4	1	12	12.0	167.0
"		2	1	6	15.0	208.0
1st class rubble		1		3	10.0	139.0
"		1		2	12.0	167.0
"		1		1	15 0	208.0
"		3	1	10	15.0	208.0
"		2	1	8	18.0	250.0
"		1	1	6	20.0	278.0
"		1	1	3	25.0	348.0
"			2	5	25.0	348.0
"			1	2	30.0	417.0
Ashlar			1	6	15.0	208.0
"			1	5	18.0	250.0
"			1	4	20.0	278.0
"			1	3	25.0	348.0
"			1	2	30.0	417.0
"	Stone		1	1	40.0	555.0
Ordinary concrete	5	1		3	8.0	110.0
"	4	1		2	10.0	139.0
"	30	4	2	16	12.0	167.0
"	15		1	6	15.0	208.0
"	12		1	5	18.0	250.0
"	6		1	4	20.0	278.0
"	5		1	3	25.0	348.0

[1] By George Hill, Consulting Engineer. Continued from No. 931, page 45.

as great strength as possible, great care must be used in all of the operations to get the desired results. Walls should never be strained in tension, should never be subjected to vibration and should be so designed as to be sufficiently stable or secure against failure by buckling.

§ 303. Stability:—The stability of a wall is secured when three conditions are fulfilled:

(*a*) When its clear height is not too great for the thickness.

(*b*) When it is thick enough to resist the pressure against it by the earth, water, wind, or other fluid or solid.

(*c*) When it can receive the thrust due to rafters, arches or the like without being overthrown.

Case (*a*):—All walls of Class II should be examined for the fulfilment of this condition. Under this class come many of the front and rear walls of city structures, the filling-in walls of all skeleton constructions, chimneys, the enclosing walls of courts, gable walls of churches, libraries and the like.

If a section of the wall of a length equalling the thickness and of a height equal to eleven times the thickness is sufficiently strong to carry the superimposed weight according to Formula 3, § 172, the wall fulfils condition (*a*). In walls of Class I whenever the height of a story exceeds twelve times the thickness, take a section of wall equal to the thickness and ascertain whether the superimposed load is within the limits of strength. All piers and columns of masonry should be examined also to see that they are sufficiently strong, remembering that the wind-pressure on a tower will often concentrate the weight of the entire tower on one pier or wall.

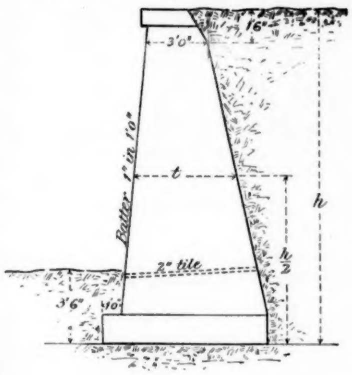

Fig. 100.

The requirements of the majority of our municipal building-regulations are such as to give safe thicknesses for gable walls, etc., when properly built and permitted to set before being strained.

Case (*b*) *Lateral Pressure: Earth:*—To resist the earth-thrust with a retaining-wall, proportion the wall by the following:

t in inches, h in feet.

$$t = 3.7\, h \qquad (81)$$

or of sufficient weight to resist P in Formula 54.

For walls sheltered from frost, the free face of the wall should batter 1″ per foot and the rear be so battered as to make the average thickness not less than t. Where frost must be resisted, the wall should go 3′ 6″ below grade, unless frost

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 " " "

is known to go deeper; *h* should be figured from the bottom of the wall, *t* should be made what the wall requires, making the top in all cases 3′ 0″ wide; the top 1′ 6″ should be chamfered off at 45° from the vertical, and the slope and the entire back for the free height of the wall should be pargeted with Portland-cement mortar, 1 to 3. After pargeting, the wall should be damp-proofed with asphalt, and every 4′ 0″ should have a 2″ tile-pipe built-in just below the grade to afford an escape to the water flowing down the back (Fig. 106). Resistance of earth-thrust of vault-walls is given in Chapter VII, § 258. Walls of buildings are not loaded like retaining-walls, and the thickness is fixed usually by conditions of strength. For buildings of 50′ 0″, or less, in height, use thickness as in Table XXXV.

TABLE XXXV.

THICKNESS OF FOUNDATION WALLS.

	Depths.			
Class of building.	3′ 6″	5′ 0″	10′ 0″	15′ 0″
Ordinary frame dwelling......	8″	12″	12″	16″
Good ordinary frame dwelling..	12″	12″	16″	20″
Heavy frame buildings........	16″	16″	20″	24″
Common brick buildings.......	12″	16″	16″	20″

Water-pressure: — Let *t* and *h* be as before, then the proper size of wall to resist the water-thrust will be:

$$t = 7.2\,h \qquad (82)$$

If the wall is held at the top, the bending-moment will be

$$M = 6.92\,h^3 \qquad (83)$$

In cisterns the water-thrust is resisted in part by the earth-thrust, and the bending-moment due to the earth should be

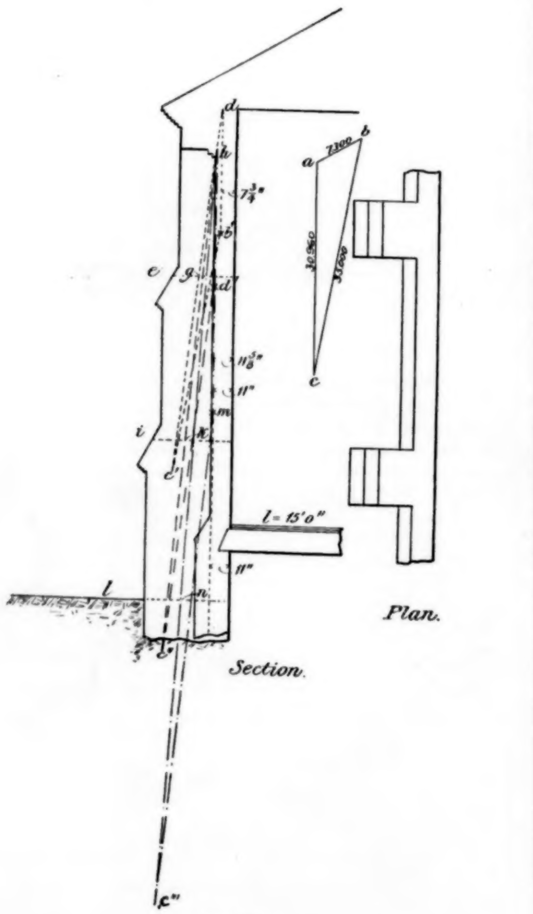

Fig. 107.

found and the wall proportioned to resist the difference found by subtracting Formula 56, §258 from Formula 83.

When dams are to be built, the proper section should be taken from Fanning's "*Treatise on Hydraulic Engineering*," if the dam is of any size; if small, proceed as for a retaining-wall for earth determining *t* from Formula 82. For grain or other fluid, change the factor in Formula 83 in the ratio that the weight of the material bears to the weight of water.

Wind: — Wind has a twofold effect, one to overturn the wall, and the other to blow in the central portion. To resist

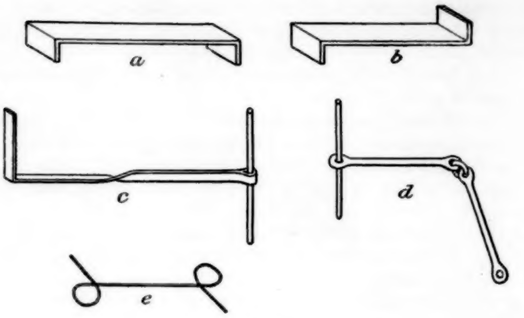

Fig. 109.

the first, the wall should be braced by means of buttresses or transverse walls wherever practicable, and to resist the second, the thickness of the wall between buttresses should equal in inches six-tenths of the distance between the buttresses in feet, or the nearest size next above the amount so found; and the wall for at least one-third of its total height must be solid and of uniform thickness. The buttress should be on the inside wherever practicable.

Case (*c*), *Thrusts:* — Thrust for arches or wind-pressure of trusses is most economically resisted by buttresses, transverse walls or by horizontal trusses transferring the horizontal component of the thrusts to transverse walls. To determine the amount and direction of the resultant of the thrust and the weight of the wall or pier, proceed as follows (See Fig. 107.): Take the case of the truss shown in Figure 67, assuming that the walls are 24′ 0″ high, that the wind is from the right, and in consequence we are resisting the resultant or reaction from the fixed side, and that the material of the walls is brick, weighing 120 pounds per cubic foot. We should then have the resultant of the wind-pressures on the right as given at *ab* on the small diagram, the static load as *ac*, and the resultant of both *bc*. The requirements are that the resultants shall successively pass through the middle third of the sections that we are considering, which in this case are *e*, *i* and *l*. Considering the section *de*, we should have the load from the curtain-wall 11,020 pounds with its centre-of-gravity 6″ from the rear face. The buttress would have a weight of 6,840 pounds with its centre-of-gravity 16″ from the rear face of the wall. The distance then, between the two centres-of-gravity is 10″. To determine the position of the centre-of-gravity of the two, we have the proportion: 17,860 pounds (total weight) is to 11,020 (one of the partial weights), as 10 (the distance between the two centres-of-gravity), is to 8¼ (the distance to the common centre from the smaller of the two masses.) This makes the centre-of-gravity of the whole mass 7¾″ from the back edge of the wall

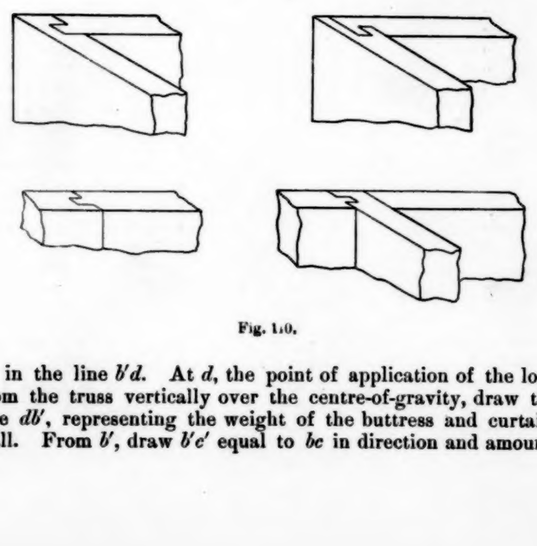

Fig. 110.

or in the line *b′d*. At *d*, the point of application of the load from the truss vertically over the centre-of-gravity, draw the line *db′*, representing the weight of the buttress and curtain-wall. From *b′*, draw *b′c′* equal to *bc* in direction and amount, then dc' will be the resultant of these two forces which cuts the joint e at the point g showing that the first section is safe. Now, considering the joint i, we would have the curtain-wall weighing 11,020 pounds as before, with its centre-of-gravity 6″ from the back of the wall; the buttress 7,700 pounds, with its centre-of-gravity 20″ from the back of the wall and the centre-of-gravity of the whole 11⅝″ from the face of the wall or in case, the effect of the floor is added to the weight of the masonry to draw the resultant still further in. The line of pressures through the buttress will be a line connecting g, h and n.

Should the analyses throw the line of pressures at any point outside of the middle third, the size of the buttress or the weight of the curtain-wall must be increased so as to keep

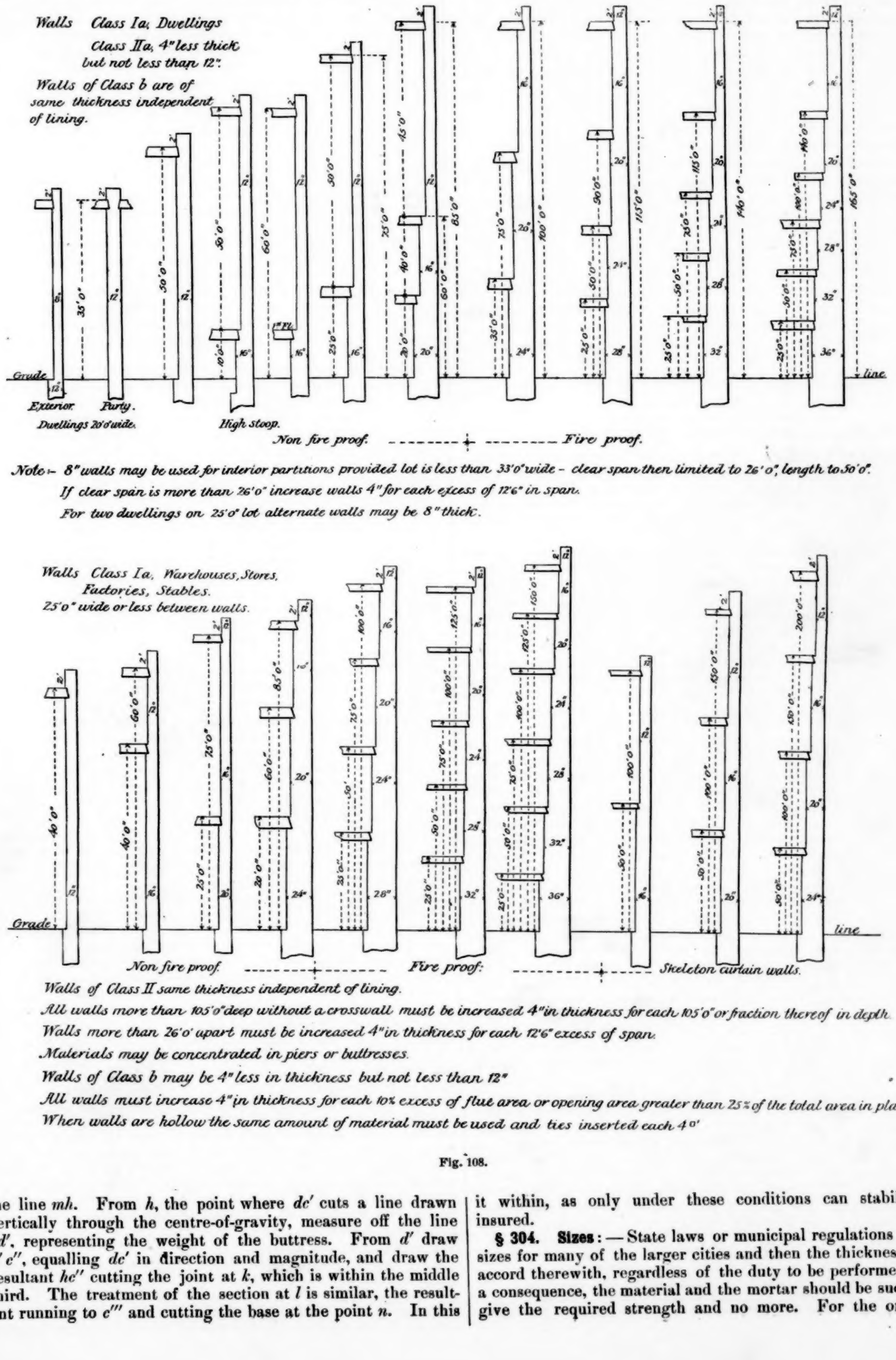

Fig. 108.

the line mh. From h, the point where dc' cuts a line drawn vertically through the centre-of-gravity, measure off the line hd', representing the weight of the buttress. From d' draw $d'c''$, equalling dc' in direction and magnitude, and draw the resultant hc'' cutting the joint at k, which is within the middle third. The treatment of the section at l is similar, the resultant running to c''' and cutting the base at the point n. In this it within, as only under these conditions can stability be insured.

§ 304. Sizes: — State laws or municipal regulations fix the sizes for many of the larger cities and then the thickness must accord therewith, regardless of the duty to be performed. As a consequence, the material and the mortar should be such as to give the required strength and no more. For the ordinary conditions of building the strength of the wall should be about ten tons per square foot and the sizes required by the New York Building Law followed. (See Fig. 108.) Note that no load should be put on the 8″ partitions when run up the maximum height without any intermediate beams, and that the 4″ partitions should not be loaded at all.

§ 305. Bonding: — Bonding is the interlocking of the several parts of the wall so as to render the movement of individual parts thereof difficult for brickwork. Similar principles apply to all other masonry walls. Several kinds are shown in Figure 7. Walls belonging to Classes I (*b*) or II (*b*) may be laid up separately and tied to the backing with Morse wall-ties *c* (Fig. 109), as often as the horizontal courses come even, the ties being spaced 8″, *c* to *c*, longitudinally. For stone facings of 8″ or less thickness, each stone should be anchored with a galvanized-iron anchor, *a* and *b* (Fig. 109), and the coursing of the stone should be so laid-out as to bring it right with the brickwork. They should be carried at the level of each story by means of a course of stone projecting into the wall a sufficient amount to carry the facing for a height of one story, as shown in Figure 110, and the best practice is to make the thickness of the ashlar but 4″. Where it is desired to have rather a stronger facing, or necessary to carry it to a greater height, the stones might be made with every third course 8″ deep, bonding into the brickwork. In all solid stone walls each face should have one-fifth of its area of stone passing at least twice as far into the wall as the other four-fifths does.

Coursing: — Coursing is shown in Figure 5.

[To be continued.]

HARDWOOD JOINERY.[1]

PROBABLY modern hardwood joinery would have been a better title for the present paper, as at the request of your President, it deals more especially with this branch of the subject, mediæval work only being referred to incidentally; cabinet-making, intarsia, etc., are also outside its scope, as they are really distinct trades.

Hardwood joinery may be considered from various points-of-view, from the elaborate vaulted canopies of a cathedral worked almost entirely by hand, to the simplest domestic fitting, now produced to a very great extent by machinery, but each giving scope in a greater or lesser degree for the skill of the workman. For its production, if the work is to be really good, two things are absolutely essential — good workmen and good, well-seasoned wood, for it is as impossible for a good workman to produce satisfactory work with bad material as it is for an inferior workman to turn out creditable work, however good the material may be. A short review of some of the hard woods more generally used may, therefore, be of interest at the outset.

Oak seems naturally to take the precedence, and of this there are several varieties — English, Russian, Hungarian and American being the principal; of these English still stands unrivalled for strength and durability under exposure, but it has been superseded to a very great extent for internal fittings by the others, which are easier to work, and from their milder nature less liable to twist or crack. English oak-trees are usually felled early in the year, when the sap has risen, on account of the value of the bark, which is then easily stripped off and used for tanning leather, but oak so felled takes about two years longer to season than that felled in the winter; in the latter case, however, the bark cannot be stripped off, and is, therefore, wasted. English oak-trees at times produce planks of great width; one cut down some years ago at the scene of your last summer excursion, Diss, yielding perfect ones five feet wide. Undoubtedly the finest oak available of late years for inferior work has been the variety of Russian known as Riga wainscot, the grain being very fine, close and regular, the wood a good color and easy to work. But the logs, never very large, are now smaller than ever; in fact, it is very difficult to get them at all, the supply being nearly exhausted. Several other kinds are also shipped from Russian ports; these are principally cut from small trees, the grain is coarse, and as a rule they are unsuitable for good work. Hungary produces a very fine variety of oak. The logs are much larger than any formerly shipped from Riga, and at the present time this is certainly the best oak available in any quantity, its great width making it specially valuable for panels. This is shipped at Fiume, in the Adriatic. It should be remembered, however, that Hungary, as well as Russia, also produces some very inferior sorts. America sends large quantities of oak to this country, but it is not equal either to Riga or the best Hungarian. The grain is very open, the color poor, usually with a pink tint and generally speaking is unsatisfactory for high-class work. The silver grain is a distinguishing feature of oak, and produces the figure; the radiating lines of this can be seen in any section; these lines are absent in chestnut, and in many cases form, probably, the only way of distinguishing the two woods. If the various samples of oak before you are compared with that of chestnut, this will be at once apparent. One other point respecting oak is worth referring to — the term wainscot. This does not distinguish any particular variety or locality, but is applied indiscriminately to all logs cut on the quarter. Mahogany next claims attention, the different kinds varying considerably, that known as Spanish, coming from San Domingo, being the most valued. In the past this has been extensively used, but is now very scarce, its place being taken by another Spanish variety, found in Cuba, which is very close-grained, hard and of good color; but the kinds more generally used at the present time are obtained from Tabasco and British Honduras; Panama and Africa also send mahogany to this country, but the quality of both is very poor. Of walnut, five descriptions deserve notice, Indian coming first, both for closeness of grain and beauty of markings. This is difficult to obtain at the present time, but a variety much resembling it is now imported from Circassia. English is lighter in color and not so richly marked. A totally different kind, known as black-walnut, is shipped at Quebec; it is much softer than the others and almost devoid of markings, but can be obtained in large sizes and is not likely to crack. A lighter shade of the same wood is shipped at New York and other United States ports. Teak is imported from Burma, and is especially valuable for work exposed to the action of sea-air and salt-water; it is also coming into very general use for hospital floors; a variety is found at Bangkok, but the color is not so good. Many devices have been tried for artificially drying hard woods in a short time, but all seem open to objection of some kind or other, and allowing the wood to season by the natural action of the air on the boards and planks is, after all, the most satisfactory, although, of course, it is a long process. But it is time to pass from the material to the various methods of working it.

Starting at the beginning, the selection of the wood before it is cut to size is more important than appears at first sight, for on this much of the final appearance will depend, and too much care cannot be exercised at this stage, for carelessness in matching will prevent the work ever looking really well, and most likely result in considerable waste. Cutting to length and width is now done entirely by steam saws. Afterwards the wood is passed through a trying-up machine, which planes it to thickness and width, leaving it quite true and ready for moulding. Mortising and tenoning are also done by machinery, and absolute truth secured. So far, machinery is of advantage in every way, and, in addition, it also relieves the joiner of the very hard labor necessary before its introduction, leaving him free to devote all his energies to the remaining parts of the work, in which a good workman will find plenty of opportunity to display his skill. Up to this point the preparation of all hardwood joinery is practically the same (nor does it differ materially from soft woodwork), but as in its further stages the methods diverge considerably, it will be well to consider these under two broad heads: — First, the simpler forms, in which machinery continues to play an important part; and afterwards the more elaborate work, which has frequently to be done almost entirely by hand. Formerly, mouldings were worked either by planes of various shapes or by routers; the latter were of steel, much the same as modern machine irons, but let into a piece of wood and worked backwards and forwards by hand — a long and tedious process. One or two of these planes and routers are on the table for reference. The introduction of machinery has, however, done away with both these methods, so far as the ordinary mouldings used for domestic fittings are concerned. In such work the mouldings can and should be turned out in such a manner as not to need touching by hand, and when cost is of great importance care should be taken that the sections are such as can be worked by passing once only through the machine. A few examples of mouldings so worked are before you.

Before further considering the question of sections and the important bearing they have both on the appearance and cost of work, it may be of advantage to call attention to the practice followed of cutting boards and planks to the nominal thicknesses of 1 inch, $1\frac{1}{4}$ inch, $1\frac{1}{2}$ inch and so on, but as the saw-cut and planing have to be taken out of this, they never hold the full thickness when worked-up, 1 inch finishing $\frac{7}{8}$ inch; $1\frac{1}{4}$ inch, $1\frac{1}{8}$ inch; $1\frac{1}{2}$ inch, $1\frac{3}{8}$ inch; therefore (paradoxical though it may seem), it costs more to produce work $1\frac{1}{4}$ inch thick than $1\frac{3}{8}$ inch, for $1\frac{1}{2}$ inch boards must be used in each case, but there will be increased labor in reducing them to $1\frac{1}{4}$ inch. Planks also finish about $\frac{1}{4}$ inch less, and wide English oak ones sometimes even $\frac{1}{2}$ inch less, as, on account of the greater strength of their grain, the latter are more liable to twist in drying; by keeping this in mind unnecessary waste may frequently be avoided. It should also be remembered that cornices, cappings and similar mouldings will stand infinitely better if built up, and be far less likely either to twist or crack than if made solid, the result being better work at less cost; care must, however, be taken that each part is properly tongued or cross-tongued. There are several sections of actual work on the table which will show the system fully. Attention is specially called to many of these sections, and particularly to the ebony frame, which show what effective mouldings can be obtained from thin material.

Construction deserves more than a passing notice, for on it very much depends, and every detail should be carefully thought out. It is difficult to lay down any hard-and-fast rule on the subject, as each work should be considered on its merits, but mortises and tenons are always safe and reliable. In the case of very thick doors, however,

[1] A paper read by Mr. H. W. Barnes before the Architectural Association, (London).

it is sometimes desirable to put these double rather than single, to avoid any possible warping of the styles; where, however, mortices and tenons cannot be employed, handrail screws may frequently be used with advantage. Dovetails are also very good, but apply more especially to sashes and cabinet-making. Wall-panellings, dados and skirtings should always be tongued together at the angles and into the floor, otherwise dust will find its way between and underneath them, possibly forming a harbor for the germs of infectious disease. Flooring should be laid in narrow widths and tongued at the joints; the system now illustrated is an excellent one, and gives every opportunity for good secret nailing. Large columns will never stand if made solid, but will crack and twist out of all shape; if, however, they are made in sections, the difficulty is entirely avoided, the result being very much better work at no increase of cost, but rather the reverse. When great strength is required, such as an open-timber roof, solid wood must, of course, be used.

The various systems of mitreing next claim attention. In cheap joinery the work is framed up square, and the mouldings mitred in afterwards on the top of the panels; but this method is open to serious objection, the stability of the mouldings depending entirely on nails driven in at an awkward angle, and if these chance to go through the panels instead of into the styles and rails, and the panels shrink, the result will be an unsightly crack; except in the case of bolection mouldings, which can be rebated onto the styles, etc., and properly fastened. This treatment should never be adopted for good work. An infinitely better system, and the one usually employed in high-class joinery, is to work the mouldings on the solid of the styles, rails, etc., cutting out the styles to receive the rails, and so forming a mitre. A third method, applied more especially to ecclesiastical joinery, will be referred to later on.

When the work is ready for framing up, it is most desirable to put it together and let it stand as long as possible before actually gluing and wedging, as no matter how dry the wood may be it is sure to shrink when first worked; in fact, there are well authenticated instances of this occurring when re-working old beams which have been in position for 200 or 300 years. Framing up and cleaning off afterwards are two very important matters; shoulders, which in soft woods need hardly be touched after leaving the machine, must, in hard woods, be gone over carefully by hand, otherwise good results cannot be obtained. Mitres, too, demand very special attention; for all such work the tools differ very materially from those used for soft woods, the most effective having either metal faces or being entirely of metal; in finishing off these tools are also of the greatest assistance, as glass-paper should on no account be used. A few tools are shown illustrating those formerly in use and those of the present day.

When the more elaborate and intricate forms of ecclesiastical joinery are entered upon the greatest demands are made on the skill of the workman; ancient work was, of course, all done by hand, and still fills us with admiration for its beauty, variety and general excellence. Evidently in those days, time was only a secondary consideration, and nothing was spared to make the work worthy of the high purpose for which it was intended.

> In the elder days of Art,
> Builders wrought with greatest care
> Each minute and unseen part;
> For the Gods see everywhere.

Unfortunately, at the present day, time is of so much importance that it is very difficult to devote the same amount of it to any particular work as the old men did; but there is ample proof, even now, that when cost is not the first consideration, work of high quality can still be produced.

Vaulted canopies require much care. These, if of any size, should be built up; if worked in the solid they will crack and twist, utterly spoiling the effect, and in addition be much more expensive; but if the ribs are worked singly to the required sweep and section, rebated for the spandrels, then mitred together, the spandrels filled-in afterwards and the whole covered at the back with strong canvas well glued, they will stand. Very small and specially elaborate canopies, such as the one shown, must, of course, be cut out of the solid to a great extent.

The third system of mitreing already referred to (known as mason's mitres) now claims attention. It consists in working the returns of the mouldings in the solid of the styles, to stop those on the rails and on the rails and sills, to stop the mullions. The actual working of these returns is done after the work is glued up. It is of necessity a more costly method than the others, but there can be no doubt that in such work as that before you (which will show the system clearly) it is the only proper way, and far stronger than any other.

Much old panelling was filled with linen-fold panels, which always look well, and several good ancient examples are before you. These, however, seem to have fallen into disuse, which is to be regretted, more especially as they are really inexpensive, considering the good effect produced, the play of light and shade being very pleasing.

In tracery great opportunities occur, but it is only when cut by hand that all its beauty is brought out, and endless variety can then be obtained. When, however, cost is of supreme importance, the aid of machinery can be called in, and by its use the mouldings worked, leaving only the angles and pockets to be done by hand, and if the cusp points are simply turned out the cost will be still further reduced. In sunk tracery the various sinkings can also be done by machinery; the least expensive section consists of a hollow, a second member, more especially if it is a bead, considerably increasing the labor.

How to treat the face of hardwood joinery frequently requires much consideration and deserves a passing notice. In the case of oak, the action of the atmosphere would tone it down admirably; but this takes time, and the first appearance of newness is often removed by the fumes of ammonia, which can be regulated to produce any desired shade, and the treatment is a good one when the work is not subject to much handling; where it is, however, beeswax and turpentine are generally applied afterwards, as otherwise the damp heat of the hands will leave dark marks; care must, however, be taken that as much of the wax is rubbed off as possible or the work will very probably turn yellow in time. After this application the oak will cease to darken, as the wax fills up the pores and prevents any further action of the air. Beeswax and turpentine alone also produce good results on most hard woods when well rubbed in and a very pleasant surface is the result, much the same as the slight polish seen on an egg-shell. This treatment is also particularly useful for floors. These, however, require periodical attention. Simple oiling is never satisfactory. French polishing is a very general treatment, but is too well known to need any description.

It is of the most vital consequence to remember that damp plays havoc with seasoned woodwork, causing it to swell and warp. It is, therefore, fatal to put it against damp walls; when it is impossible for these to have time to dry, the wood should be well coated at the the back with a damp-resisting preparation and not be fixed close against the wall.

Hardwood joinery is a dry subject — in fact, so essentially a dry one and affords so little opportunity for making a paper on it attractive, that it is much to be feared the present one has caught the infection and become in its turn thoroughly dry; still hardwood joinery is a matter which deserves some attention, and possibly the facts placed before you may induce a further study of the methods of working, which will certainly prove useful.

The introduction of machinery, although materially reducing the cost of production, has not by any means done away with the necessity for skilled workmen; skill, however, can only come by practice following long and careful training, and in some respects the two essentials requisite for thorough work, good workmen and good materials, bear a strong analogy in the careful preparation both require. The forest may contain the finest trees, but unless these are properly converted and allowed to season, much of their value is lost; and a youth may have all the natural qualifications necessary to make a good workman, but without proper training is never likely to reach a high standard of excellence; both the seasoning of the wood and the training of the youth require time — time which may seem at first sight wasted, but is really fitting each to become of real use. It must be a matter of regret to all who have the true interest of the British working-man at heart, that the system of apprenticeship has almost died out. No doubt it entailed much drudgery (this must, however, be encountered in all callings earnestly pursued), but it gave a man a better insight into his trade and a more thorough mastery of all its details than can possibly be obtained by any other means.

Really good men are as much in demand as ever they were, and the more care and attention a man bestows on his work and the greater the skill he brings to bear upon it, the more likely will he be to insure what every good workman desires, constant employment; and beyond this he will have the satisfaction of knowing that he is doing good work — a satisfaction dear to every earnest and honest worker, be he artist or artisan.

Mr. Owen Fleming proposed a vote of thanks to Mr. Barnes, and said he listened to the paper with great attention and interest, as he was sure all present had likewise done. Mr. Fleming then put various questions to Mr. Barnes.

Mr. C. Hindley seconded the vote of thanks, and drew attention to what he called the artificial dodges of joinery. For one thing, joints in cabinet should be avoided — as in chimneypieces and similar kinds of joinery. Mouldings should be screwed on from behind. In regard to door-panelling, he described on the blackboard the best mode of cutting tenons. He also alluded to the best way of using glue where it had to be used. Scotch glue, according to tests, was better than French glue, but the two combined were very good.

Mr. Beale mentioned a newel by Messrs. George Smith & Co., of Grosvenor Square, built up of forty or fifty pieces of wood, but looking to the amateur eye like one piece, and he asked Mr. Barnes what would be the fate of it in a few years as compared with solid oak. In his opinion solid oak was far ahead of built-up work.

Mr. W. S. Weatherley said he thought solid work had died a natural death. In Sir G. Scott's office solid oak was always specified, but it used to crack afterwards. He advised young architects to visit workshops.

Mr. Max Clarke thought more good could be got by inspection and study in country workshops than in the London workshops.

The President said that Mr. Barnes must be complimented on the large audience he had drawn together. It was not any question of cost that influenced the use of oak in small pieces, but the reason was that in small pieces it lasted so much longer. With pine backing it would stand for centuries. The Mediævalists would not use solid oak, as their experience was it would not last. The old Georgian examples were not in the solid. Trades-unionism looked only to wages, without having any interest in the quality of work turned out. He would not allude to putty, which formed about ten per cent of framework joinery; the makers said an extra coat of paint would put it right. In the case of a pulpit, fumigation had deadened the grain if not taken it out. Mr. Barnes said that was because it had not been sufficiently fumigated. As to oak, builders did not appear to agree which was the best.

The vote was then put and carried by acclamation.

Mr. Barnes, in reply, said he hoped his paper would do good if it only called attention to the possibilities of designing in hardwood and for use of machinery. Scotch glue was stronger than French, but in using glue you must squeeze every particle out again as far as possible. The Austrian — or more properly the Hungarian — oak that comes from the Slav forest was somewhat open in grain, but he considered it the best oak that could be supplied, now the Riga supply was exhausted. The inferiority of Trieste oak perhaps accounted for the bad reputation of Austrian oak among builders.

PROTECTION OF CONSTRUCTIVE IRONWORK.[1]

IN many instances constructive ironwork is exposed to corrosive influences of so exceedingly injurious a character as to render all attempts at preventing its action hopeless; but in every case it is possible to arrest and to restrict the evil within certain remediable limits — or in plain language, not to allow it to go too far. There are a large number of excellent preservative paints for every description of ironwork in the market, which have given proofs of their durability and efficiency, both at home and abroad. But it is too much to expect that a single application of two or, at the most, three coats is to preserve ironwork from rust for an indefinite period. The manufacturers themselves could not guarantee their goods to be absolutely imperishable. Even in interior work, which is never exposed, or, at any rate in a comparatively slight degree, to climatic influences, it is necessary to renew at certain regular intervals the protective coats of paint or varnish. Clearly this necessity must become *à fortiori* accentuated when it concerns the preservation of work which is exposed, according to its locality, to the gradually destructive effects of every climate in the world. It has alike to withstand the heat of the Tropics and the cold of the Arctic regions. The greatest aid to, or friend of, the corrosion of ironwork under all circumstances is neglect. It is positively amazing to reflect upon the fact that, while hundreds of thousands of pounds are cheerfully spent upon the erection and construction of large examples of ironwork, a thousand or two are grudged for their proper maintenance and preservation. It is often easier to obtain a large sum to build a new bridge or ship from the "board" than it is to raise the comparative trifle necessary to properly scrape and repaint an old one.

There are not wanting examples of ironwork which, when properly protected, have withstood for very long periods the deteriorating action of external atmospheric influences. When, about seven years ago, the enlargement of the Westland-row Railway terminus in Dublin was carried out, the old original iron roof over the station existing in 1846 was found to be in such excellent preservation, that the principals were utilized, with some slight alterations, for the roof, the court-yard entrance on the north side of the new station of the walls of the court-yard having been built to the proper width to suit. The old principals carry Braby's patent glazing of $\frac{1}{4}$ inch rough rolled plate-glass in zinc and timber. It is not, however, so much of iron structures above ground, the preservation of which is a mere question of care, proper inspection and cost, that we are now treating of, as of those parts of the same structures which are located underground. If they could be so thoroughly protected as to be altogether exempt from the action of water, air, or other agents which combine to set up an acid reaction, there would be not much to fear from corrosion; but such an immunity is practically an impossibility. Dry air and pure water act but very feebly as oxidizing elements upon ironwork; but when the former becomes moist, and the latter impure and acidulated, oxidation of the material is very speedily set up, and when once commenced, its ultimate destruction, unless the process is arrested, is a simple question of time.

The effect of lime, whether as one of the ingredients of mortar, cement, concrete, or of limestone, as a corrosive agent of ironwork, appears to depend very much upon the conditions of each particular case. A mixture of coal-tar and slacked lime was applied to the wrought-iron flooring of the tubes of the Britannia Bridge, with marked success, and this combination has been frequently used in foundation work. It has been found in examining the wire cables of some of the American suspension-bridges, that where portions of the limestone used in the foundation of the bridges have, by some chance or other, come into permanent contact with the strands, some of the latter have been completely eaten away. The presence of water was no doubt essential to this corrosive action, but it is a very difficult matter to build masonry so that it will not allow of some moisture permeating it. This difficulty becomes greatly increased when the parts of the ironwork inclosed or surrounded by masonry are subject to motion, no matter how slight it may be. The anchoring lengths of the cables or chains of suspension-bridges are all subjected to a slight see-saw or rocking motion, which must gradually affect the concrete and masonry surrounding them, so as to render them slightly porous, and thus allow of the passage of water. Movement of this description is not confined solely to the anchorages of suspension chains. There is no doubt that the bases of all columns and pillars set in concrete, or upon blocks of masonry or brickwork, are affected in the same manner. As a protection for ironwork when exposed to subterranean or submarine influences, cement-mortar appears to afford satisfactory results. It has been found to act very beneficially in protecting the inside skin of a ship against the oxidation caused by bilge-water. In whatever instances it may be employed, the contact between it and the plates it is designed to protect must be maintained intact. Any percolation of water through cracks and fissures would be as fatal to its preservative powers as if sulphur gases were present. Where the mortar has been preserved in a perfectly hard, compact, and dry condition, links of the anchoring-down chains of suspension-bridges have been taken up in a perfect state of preservation without the least appearance of rust. In some instances the ironwork imbedded in the cement-mortar was painted before being so fixed, and upon the paint being chipped off appeared perfectly bright and clean beneath. As the extra expense would in all cases be trifling, it would be as well to make assurance doubly sure, and paint all constructive ironwork with coal-tar or two good coats of iron-paint before setting it underground or below water in either cement-mortar or masonry or brickwork.

[1] Paper by Thomas B. Grierson, M. Inst. C. E. I., A. M. Inst. C. E., and read before the Institution of Civil Engineers of Ireland, April 5, 1893.

BOOKS AND PAPERS

W. M. PATTON's treatise on foundations[2] has been noticed indirectly in this journal quite extensively in recent issues in connection with the discussion which has been raised as to the quality of the English cements. The book itself starts out with the very engaging statement that the author, having been a professor for over six years, fully realized the need of suitable books by which to temper the almost painfully scientific, abstruse and purely theoretical books which he was compelled to put into the hands of students in engineering. A perusal of the table of contents also suggests great possibilities in the work itself, but when the subject-matter is reached there is so much that is unnecessary, so much added that has no special reference to the subject whatever, and notwithstanding the prefatory reference to painfully abstruse books, there is so much complication about the attempt at arithmetical solution of so simple a subject even as the strength of a retaining-wall, that the value of the book for reference and for study by practical students is hardly what it might be. The work is too complete. If it were restricted entirely to foundations as such, and the chapters upon Building-stones, Quarrying, Stereotomy, String-courses and Copings, Ice and Wind Pressure, Arches and Skew-arches had been entirely omitted, the work would then have been more likely to answer the needs which the preface seems to suggest. The fact is, the matter of foundations is not a complicated subject. It is too fundamental to admit of abstruseness or a purely theoretical treatment, and while there is a mass of valuable information scattered through the book which every student ought to possess and which every practical man needs to have at his command, the real merit of the work as a whole could be vastly improved by a judicious course of pruning.

GOOD text-books on descriptive geometry and on its various practical applications are sadly wanting in the English language. American teachers of these branches have been particularly backward in giving to the public in permanent form the substance of their lectures and class-room instruction. Architectural students outside of the large technical schools have been not a little hampered by this dearth of text-books, especially in stereotomy and sciography. With the development among us of a more academic and serious style of architectural rendering than formerly prevailed, the calls for concise and practical treatises on shades and shadows are constantly multiplying, and Mr. Wm. H. Lawrence, instructor in the Massachusetts Institute of Technology, has set a good example in taking the first step to supply this demand. His "*Elements of Shades and Shadows*"[3] is hardly more than a first step, though an excellent one and in the right direction. With its twenty-four pages of text, its twenty-one problems and its thirty-seven figures it is so modest and unpretending in size, style and form, as almost to disarm the obvious criticism it calls forth, that it is an incomplete work. It is more like the first section of a text-book on the subject than a text-book itself, and might, perhaps, have been more properly entitled "Selected Problems in Shades and Shadows." It is not quite clear what was the author's programme and why he stopped where he did; there is no preface nor introduction to explain it. There is a first chapter of definitions, with one problem (the shadow

[2] "*A Practical Treatise on Foundations*," by W. M. Patton, C. E. New York: John Wiley & Sons.

[3] "*Elements of Shades and Shadows for Architectural Students.*" Prepared by Wm. H. Lawrence, Instructor in Architecture, Massachusetts Institute of Technology. Boston: Press of H. G. Collins, 15 Milton Place, 1893. Small 8vo, pp. 24, 9 plates.

of a point), and a series of elementary propositions, all compressed into four and a half pages. Then follow twenty more problems in three chapters, which treat respectively of polyhedrons, of cylinders and cones, and of double-curved surfaces of revolution — the sphere, torus and scotia; with a concluding problem on the shadows of a pediment. There is no attempt to analyze or classify the different methods and processes employed, or to lay down general principles of procedure from which the special applications are derived and developed. With the exception of the shadow of a chimney on a roof, of a line on a flight of steps, and of the pediment, the application of the elementary geometrical problems to architectural forms is not even alluded to. There are none of those special solutions for particular cases, or of those delightful "short-cut" processes, which sometimes so greatly simplify the draughtsman's task. Nor is there any discussion of shadows cast by objects on other surfaces than their own or those of the coördinate planes. These things one would expect to find in a text-book for architectural students, and their absence justifies the verdict already suggested, that the book is an incomplete work. Its programme is *too* modest and restricted, to the serious detriment of its usefulness.

Taking it, however, for what it is, rather than for what one would wish to see it developed into, its quality is excellent. The treatment of the problems is remarkably straightforward and direct. Its brevity and conciseness of statement, its simplicity of language, short sentences and clearness of expression, are all admirable, and the nomenclature and in general the notation, sensible and logical. The book is well-made and opens flat; the figures are clearly presented and legibly lettered, and the plates are so printed on long, folded slips that each can be opened out wholly beyond the edge of the book, permitting ready reference to any figure from any page of the text without turning over the leaf. This displays a very rare and delightful consideration for the reader's comfort and convenience. It is a pity that this painstaking little book stops where it does. If the author will expand his scheme to cover more ground and cover it more completely, the resulting book would certainly fill a long-felt want. As it is, students under competent instructors and such as are quite familiar with the conceptions of descriptive geometry, and can extend into their practice the applications of its problems, will find it helpful and suggestive.

SOCIETIES

ENGINEERING ASSOCIATION OF THE SOUTH.

THE Engineering Association of the South met at Nashville, Tenn., December 14, with a fair attendance. Messrs. Jno. M. Picton, George F. Blackie and Charles E. Bowron were elected to membership. The following officers have been elected for the next year: *President*, Charles Hermany, Louisville, Ky.; *First Vice-President*, W. C. Smith, Nashville, Tenn.; *Second Vice-President*, J. Kruttschnitt, Houston, Texas; *Secretary*, Hunter McDonald, Nashville, Tenn.; *Treasurer*, W. T. Magruder, Nashville, Tenn.; *Directors* from Tennessee, W. W. Carson, Knoxville, W. L. Dudley, Nashville and E. C. Lewis, Nashville; *Director* from Kentucky, Jno. B. Atkinson, Earlington; *Director* from Georgia, George H. Crafts, Atlanta.

Mr. G. D. Hicks, Div. Superintendent, Nashville, Chattanooga & St. Louis Railway, presented a paper on the Hobbs Island Transfer, from which the following is condensed: Hobbs Island and Guntersville, Ala., are 20 miles apart, on opposite banks of the Tennessee River, and on one of the lines of the N. C. & St. L. Ry. This gap is closed by the Hobbs Island Transfer. The transfer plant consists of two stern-wheel steamboats, of 40 and 90 tons burden, and two double-track barges, one for four and the other for six cars; the lighter boat conveys the passengers and the other, with the barges, the freight. Time between Hobbs Island and Guntersville, two hours for the passenger-boat and two and one-half hours for the freight.

At each of the termini is an incline, at the foot of which is a cradle movable along the incline, so the cars can be run upon the barges at all stages of the water. The river has a rise and fall of 40 feet at Hobbs Island and 47 feet at Guntersville. The inclines are on $3\frac{1}{2}$ grade, on earth fill, pile trestle, rip-rap bank, and at the bottom a crib, where the nature of the river-bed prevented driving piles. The incline at Guntersville is, in part, on a 10-degree curve. The cribs are built of 12″ x 12″ timbers, layers of 12-foot lengths (8-foot centres) crossing layers of 25-foot lengths (3-foot centres), all drift-bolted. These cribs were loaded with stone, then capped by 12″ x 12″ stringers, laid to grade and bearing the 8″ x 9″ — 19-foot ties, dowelled to the rails and the 5″ x 9″ guard-rails.

The cradle at Guntersville is novel, in that it is constructed to move on a 10-degree curve, as well as on a tangent. It consists of eight sections on wheels and two on slides, each about 16 feet long, the first section carrying a 20-foot apron and the last a feather-rail. The sections are not rigidly connected, but by a bolt allowing about 5 inches play. The rails are laid with opposite joints spiked only at the joints, and held together by tie-bars. The rails outside on the curves are $1\frac{3}{4}$ inches longer than those on the inside; on tangent the openings thus formed between the shorter rails are each filled by a short section of rail inserted and held by a split key passing through its web and the splice-plates. The bolt-holes in the rails are slotted. The cradles are moved along the incline by a locomotive or a steam-boat.

The connection between the apron and the barge is unusual. The ends of the rails on the apron are turned outward at about 30 degrees at the junction, while the rails on the barge are at the end bevelled at the same angle. The latter are held together by five tie-rods, the one nearest the bevelled ends having a turnbuckle. Just back of this rod, a lever is arranged to lift the bevelled rails clear of the apron, till the windlass has drawn the nose on the barge into the V on the apron, the gauge having been lessened by the turnbuckle. Then the bevelled rails are lowered into place and the gauge restored by the turnbuckle, making the rails continuous from the barge to the cradle. The cost of the steamboat and barges was $30,368, that of the crib and cradle at Hobbs Island, $4,343 and $837 respectively, and at Guntersville $3,045 and $961 respectively.

The association will meet again January 9.

HUNTER MCDONALD, *Secretary.*

FRANKLIN INSTITUTE, PHILADELPHIA, PA. — REWARDS FOR MERITORIOUS DISCOVERIES AND INVENTIONS.

THE attention of ingenious men and women is hereby directed to the fact that the Franklin Institute of the State of Pennsylvania for the Promotion of Mechanic Arts may grant, or recommend the grant of, certain medals for meritorious discoveries and inventions which contribute to the promotion of the arts and manufactures.

The character and conditions of these awards are briefly stated in the following:

The Elliott Cresson Medal, founded in 1848 by the gift of the late Elliott Cresson. The medal is of gold, and by the terms of the deed of trust may be granted for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process, or combination of materials in manufactures, or for ingenuity, skill or perfection in workmanship.

The John Scott Legacy Premium and Medal (twenty dollars and a medal of bronze), awarded by the City of Philadelphia. This medal was founded in 1816 by John Scott, a merchant of Edinburgh, Scotland, who bequeathed to the City of Philadelphia a considerable sum of money, the interest of which should be devoted to rewarding ingenious men and women who make useful inventions. The premium is not to exceed twenty dollars, and the medal is to be of copper, and inscribed "To the most deserving."

The control of the Scott Legacy Premium and Medal (by Act of the Ordinance of Councils in 1869) passed to the Board of Directors of City Trusts, and has been referred by the Board to its Committee on Minor Trusts, and that Committee has resolved that it will receive favorably the name of any person whom the Franklin Institute may from time to time report to the Committee of Minor Trusts as worthy to receive the Scott Legacy Premium and Medal.

The Edward Longstreth Medal of Merit, founded in 1889, by Edward Longstreth, machinist, and late member of the Baldwin Locomotive Works. This medal is of silver, and may be awarded for useful invention, important discovery and meritorious work in, or contributions to, science or the industrial arts.

Full directions as to the manner and form in which applications for the investigation of inventions and discoveries should properly be made, will be sent to interested parties on application to

WILLIAM H. WAHL.

THE ILLUSTRATIONS

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

STABLE OF MESSRS. KENNY & CLARK, WEST CHESTER PARK, BOSTON, MASS. MESSRS. PEABODY & STEARNS, ARCHITECTS, BOSTON, MASS.

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

DWELLING, NEWARK, N. J., FOR CHARLES P. BALDWIN, ARCHITECT, NEWARK, N. J.

THE bricks for this front are of two colors as indicated. The lower story, the main cornice and the angle quoins are of Pompeiian brick of various shades. The main wall surface of second and third stories of the front, including the frame enclosing windows, is of "old-gold" brick of varying shades. The bricks were specially burned for the building.

PORCH TO HOUSE OF G. S. FRASER, ESQ., WASHINGTON, D. C. MESSRS. HORNBLOWER & MARSHALL, ARCHITECTS, WASHINGTON, D. C.

THE material used in building this porch is Potsdam red sandstone.

PARISH-HOUSE FOR THE CHURCH OF THE REFORMATION, BROOKLYN, N. Y. MESSRS. DEHLI & CHAMBERLIN, ARCHITECTS, NEW YORK, N. Y.

HOUSE OF W. W. KENT, ARCHITECT, LAWRENCE PARK, BRONXVILLE, N. Y.

DESIGN FOR COURT-HOUSE, SPOKANE, WASH. MR. JOHN PARKINSON, ARCHITECT, SEATTLE, WASH.

[Additional Illustrations in the International Edition.]

CHOIR-SCREEN IN THE CATHEDRAL OF RODEZ, FRANCE.

[Copper-plate Etching.]

In almost all the old Gothic basilicas built from the twelfth to the fifteenth centuries, the chapters created about the high-altar a little structure made of enclosures of stone finely worked and decorated. Nothing is more curious and impressive from an artistic standpoint than the effect produced on the visitor when he penetrates within this sanctuary, which constitutes the forum of the officiating priests. Here is presented to the eye a monumental little *salon*, as it were, in which groups of chanters, choir boys, canons and various officials produce on days of great ceremonies effects of color and luxury which are absolutely peculiar to themselves. On such days, in fact, this precinct is garnished with fine carpeting, flowers, choir men and boys clad in brilliant colors, and from the whole space escapes the odor of incense and the harmonies of chant and organ tones, giving to the whole sanctuary a festal air which is strongly at variance with the austerity of the great nave where the faithful are massed together. It is in this rather theatrical idea that must be sought the origin of these choir enclosures. In our modern churches the clergy seem to have actually rejected the decorative principle, and in certain of the old cathedrals, as at Rouen, for instance, the prelates have caused the demolition of the existing choir-screens. What sort of religious idea it may be that commands the enforcement of such theories, we, as artists, can only bitterly regret its results.

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

[Gelatine Print.]

THE LONG LIBRARY, ALTHORP PARK, NORTHAMPTON, ENG.

BISCUIT FACTORY, READING, ENG. MR. GEO. W. WEBB, ARCHITECT, READING, ENG.

This building is in course of erection in South Street, Reading, adjoining the Baths, the whole of the property having been purchased for a new factory by Meaby & Co., Limited. The first portion now building has a frontage of 72′ x 150′, and is carefully planned (after visits of inspection to various buildings used for the manufacture of biscuits) to meet all modern requirements suitable for the production of biscuits of every kind. The various departments are connected by elevators for the rapid conveyance of goods, etc. Travelling-ovens are on the ground-floor, and the Scotch, French and other hand-ovens form a separate department. The building is faced with local red bricks and dark-red tiles of local make.

OLD TIMBER HOUSE (CIRCA 1450), CHEESEHILL ST., WINCHESTER, ENG.

The street in which this house stands is a very ancient one, older indeed than the two partly Norman churches of St. Peter and St. John, about a hundred yards apart on the opposite side, as is proved by their east-end walls being built to its curve. "Of the name Cheesehill," says Mr. Lucas, "I have heard two derivations — one from A.-S. *ceosul*, a beach, and another in the name given to the spot at which the cheese fairs were formerly held. Yet it seems to me that the steep slope beside a stream in a grazing country might get its name rather from *cisaille* (Old Fr.), shears, as it is where the sheep on the downs would be driven for shearing." The house is supposed to have been the rectory of St. Peter's Church. There is a wealth of old oak in its floors and walls; the best detail, however, is in the barge-boards, which are of ordinary design, but in which the proportion of depth and projection in the cusping is admirable. It is a pity that an execrable repair to the one most distant is still unaltered, although it was pointed out to the present owners more than a year ago.

Bilian Wood. — The strongest timber is said to be that known as "bilian," or Borneo ironwood, whose breaking strain is 1.52 times that of English oak. It is a hard, durable wood of a dark-brown color, turning to a deep red when seasoned, and becoming as black as ebony on long exposure. It resists the teredo — the dreaded timber-destroyer of the salt water — and the white ant, and is almost indestructible. It also has the property of neither swelling nor shrinking under any degree of dryness or humidity. Its weight is 60 pounds per square foot, that of lignum vitæ being 83 pounds, boxwood 80 pounds, ebony 74 pounds, and African oak 62 pounds. — *Invention.*

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.*]

THE ADVISABILITY OF LIMITING FLOOR-AREA.

Boston, Mass., December 20, 1893.

To the Editors of the American Architect: —

Dear Sirs, — One of the most important questions with which architects are especially called upon to deal, is the extent of floor-area, which may be permitted under Building Acts. Fire-Commissioner Murphy has lately called special attention to the very limited area of single floors which is permitted in European cities. I fully admit the expediency of dealing with this question, but there is another side to it of equal or even paramount importance.

First. — Floor-areas of even six or eight thousand feet maximum, are wholly inconsistent with the absolute necessities that govern a great many branches of industry.

Second. — The division of large buildings into small floor-areas separated by party-walls, has not proved to be a fully effective safeguard against very heavy losses by fire and the nearly complete destruction of very large buildings; because, of necessity, the smaller the floor-areas separated by absolutely close party-walls without doorways, the more numerous must be the stairways and other vertical openings. Party-walls which are of necessity fitted with frequent doorways are apt to be a very uncertain element of protection. If the attention of the framers of Building Acts, of owners and architects is turned too exclusively to a limitation of floor-areas, a much greater cause of loss by fire and a much more serious hazard in bad construction may be continued and may lead even to conflagrations.

My own experience in dealing with fire-hazard covers buildings of various kinds which are used, not only for manufacturing purposes but for the storage of very combustible substances. The smallest area of floor which comes under my supervision, either in factory or storage-building is, as a rule, larger than the maximum permitted under the present Building Act of the City of Boston. From this maximum which is our minimum, say six thousand feet on one floor, our supervision is extended over floor-areas reaching over one hundred thousand square feet without a break, cut-off or party-wall; yet there is no possibility of denying that the textile factories, the machine-shops, the paper-mills, the warehouses for the storage of cotton, wool, rags and paper, which come under my supervision, are safer buildings and better fire-risks, and that fires are more easily and quickly put out with small loss in these buildings, than even in city warehouses of the best construction of the present date, with here and there an exception. That exception will be found in a very few buildings in this city in which the architects and the owners have taken cognizance of a fire-hazard, which, in my judgment, is very much greater than a large area of floor, namely, open ways from floor to floor, or ways guarded only by wooden cut-offs of a combustible kind. In other words, the open vertical hazard is much greater than the open horizontal hazard.

I have in my mind a building of six floors in height, each just within the limit of the Building Act as, I believe, of six thousand feet per floor, making thirty-six thousand feet of floor-area in all. I regard that building as a much more dangerous one than one which might be constructed at less cost per square foot of floor of six floors of thirty-six thousand feet each, and much more hazardous than a one-story building of 36,000 feet in area. In that conclusion I may be completely justified by long and adequate experience.

If a building is constructed with due regard to all the rules that enter into mill-construction — to wit, floors of plank, grooved and splined, covered with top floor one inch thick, a layer of resin-sized paper between; such floor laid over heavy timbers set wide apart; free of sheathing on walls; free of combustible varnish; free of partitions of light wood and connected each floor with the other only by stairways in brick towers guarded at the doorways with proper fire-doors — there is hardly a possibility for a fire to pass from one floor to another, even if each floor is occupied for hazardous purposes or for the storage in quantity of hazardous merchandise; *provided*, the safe-guards and means for putting out the fire are established with a view to the maximum of danger.

There are very few branches of industry which are more hazardous in their processes than the textile arts. There are very few descriptions of merchandise which can be stored in piles nearly to the ceiling more hazardous than cotton in bales; yet it is not worth exceeding a quarter of one per cent per annum to insure textile factories against loss by fire for a term of years, and it is not worth an eighth of one per cent per annum to insure cotton in storehouses of very large area, when both the factory and the storehouse are properly constructed and protected.

The factory floor of right construction has never been burned through by a fire originating in any room of the working department. All extensive fires have found their way either through belt-holes, by elevator-shafts or stairways. There is but a single instance in which the well-constructed floor of a store-house has been burned through by the combustion of the contents, and in that case the fire made a hole which helped the fire-department in putting out the fire by sending a hose-stream through it.

These statements held good even before the introduction of the automatic-sprinklers. Of course that appliance has enabled us to take the risk of increasing floor-areas in very much larger amounts than ever before. We had not full confidence in the power of automatic-sprinklers to hold a fire in cotton warehouses until very lately, although we had full confidence in the automatic-sprinkler protection of cotton in its progress on the machines through the different rooms of the factory. Within the last two years we have gained confidence in the power of automatic-sprinklers to hold a fire even in a storehouse. The latest example is the most extraordinary one yet known. The account of this fire has been sent to me by Mr. John Hill, of Columbus, Georgia, an engineer of highest repute, himself the inventor of one of the best automatic-sprinkler heads. It is as follows: —

COTTON WAREHOUSE FIRE.

PIEDMONT MILLS, PIEDMONT, S. C.

A fire occurred in the cotton warehouse of Piedmont Mill, November 26, 1893. A mill operative, on Sunday morning about 7.30 o'clock, in passing the warehouse noticed water flowing under the door of the lower story. He reported the fact to the mill superintendent who, supposing the pipe had burst, sent the Master Mechanic to repair it. This warehouse is built into the hillside in such a way that the entrance to the lower story is from the ground on the lower story on one side, and on the other side from the side-hill to the doors of the upper floor or second story.

The Master Mechanic entered the door of the middle compartment, there being three compartments to the warehouse, separated by two through walls. The door-sill of this compartment is one foot above the floor level, and he found the floor a foot deep in water and water dripping through the upper floor. Passing around and entering the upper story he found it full of smoke, and seven Grinnell sprinklers open and distributing water. A large number of men were promptly at work removing the cotton-bales. The upper floor of this compartment contained 829 bales, and the lower floor 131 bales, a total of 960 bales. It was packed in solid mass without passages as closely as possible, and to a height of from 10 to 12 feet and to within about two feet of the sprinkler pipes. After some 500 bales had been removed, it was discovered that 36 bales of cotton were on fire internally, the sprinklers drenching with water the outside, preventing the fire from reaching the exterior of the bales.

The position occupied by these 36 bales in the mass stored was about the middle, between side walls and towards the back end of the compartment. The size of the compartment is about 30 feet wide by 70 feet long, and height of story 12 to 14 feet. The bales on fire were lying on a bottom tier of bales free from fire, and there were other bales piled together on top of them, none of which were on fire; so that it was confined in the middle of the height and width of the compact mass of uncompressed cotton bales. The burning bales had not disintegrated, and each was carried out separately and all cotton removed.

Water is supplied to the sprinklers from a reservoir of some 50,000 gallons capacity, located on the hill above at an elevation of about 40 feet above the cotton. The amount of water discharged by the seven open sprinklers, as shown by the amount drawn from the reservoir, as well as that necessary to thoroughly soak the large amount of uncompressed cotton and to fill the basement floor, 30 by 70 feet, one foot deep in water, as well as to pour a stream from under the doorway, indicates that the sprinklers must have been opened and operating from ten to twelve hours previous to discovery, and that they had held the fire in check for fully that length of time in bales solidly packed in a mass of cotton bales and to its interior. The building was not scorched and gave no evidence of a fire having occurred.

The 36 bales of cotton on fire were packed into the warehouse November 1, 26 days previous to the discovery of the fire. All of the 960 bales in the compartment were packed into it previous to November 16, at which time the doors were closed and locked, and no one had entered the compartment since that date for the ten days intervening. The value of cotton in this compartment was $39,000. The value of cotton in all three compartments of the warehouse was $140,000. The insurance on cotton and building was $150,000, written by the Syndicate Committee of Stock Companies.

The loss was promptly adjusted as follows:

724 bales water-soaked and damaged thereby at $3.28 each,	$2,374.72
36 bales on fire, less 33 per cent salvage (2-3 loss) . .	887.00
Total loss as adjusted	$3,261.72

I write this communication, not for the purpose of heading off any proper regulations in limiting the areas of floor-surface in city warehouses, but there is grave danger of carrying the restrictions of Building Acts too far. There are some very absurd provisions in the present Building Act of the City of Boston which increase the cost of buildings by adding to the hazard in case a fire should get well underway. Building Acts have been passed affecting some other places which have unhoused the poor by making the cost of constructing dwelling-houses so great that they could not be built so as to be let within the limits of the income of people earning average wages as laborers.

The true lesson which I have reason to think might be brought from London and from Paris has not yet been touched either by Mr. Murphy or by any public official or architect within my knowledge. When I go again to London and Paris it is my purpose to make an investigation on my own behalf of the method of constructing a floor at very low cost either in a dwelling-house, small shop or warehouse or workshop which shall be as safe, or safer, against the vertical extension of fire as the factory floor is which has been developed under the supervision of the Factory Mutual Insurance Companies.

I have reason to believe that while our students of architecture have been devoting themselves to the fine art in their studies in European countries they have wholly overlooked the useful art of constructing buildings in a safe manner against fire, such as might be constructed with the use of our own materials at moderate cost. I should like to see one student sent abroad under some one of the travelling funds, with instructions to limit his whole course of study to the art of building a safe and useful building out of the materials which are available in this country, giving only such consideration to æsthetic effects as may be consistent with the use to which such buildings are to be put.

The safety of European buildings is very apt to be attributed to the use of materials of which we have no counterparts; such as the very cheese-like stone commonly used in Paris, which hardens after it is placed in position. This, however, only affects the outside structure. The methods of constructing and finishing the inside of low-priced buildings in Paris and in London are safer, better and cheaper than our own. There are methods to which our more expensive labor can be applied and yet a lower cost may be attained than we now secure.

I make these assertions somewhat dogmatically. I cannot at present prove them, but I have picked up here and there information on these subjects which I should have long ago put together and brought into practice, had this class of buildings come under my official supervision.

The common method of combustible architecture practised in this country is not only hazardous but it involves a stupid waste of money which is due to ignorance of better methods more than to anything else. Little or no attention seems to be given to the missing-link between the ordinary practice of combustible architecture and the expensive method of what is called fire-proof construction.

If I am wrong in this, I will admit it when any one proves to me that in any school of architecture, or any technical school, or technical branch of a university in this country the attention of the students is habitually called to the consideration of the fire-hazard when the art of constructing dwelling-houses or other like buildings is being taught them. If there is such a course of instruction of any kind I should be glad to know where it is given.

If the year presently to end ends even without a great conflagration, the ash-heap of the present year will amount to one hundred and fifty-million dollars ($150,000,000) or more. What action has been taken anywhere in any technical school of any kind to save this waste? May not this waste be attributed in about equal proportions to stupidity, ignorance, carelessness and crime, to be assigned in various proportions to owners, occupants, architects and builders alike?

EDWARD ATKINSON.

RE "PROVIDENCE CHURCH."

NEW YORK, N. Y., December 28, 1893.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — We have received your very fine reproductions of the Providence Church decorations, which appeared in your issue of December 23. We are sorry that we neglected to mention that the painted decorations were the work of Mr. H. T. Schladermundt of New York, and would appreciate a notice in your paper to this effect.

Yours truly, CARRÈRE & HASTINGS.

NOTES AND CLIPPINGS

THE SYSTEM OF THE PARIS MONT DE PIETE ADAPTABLE FOR THIS COUNTRY. — The City of Paris is a model to the world in the matter of loans to the poor. Its Monte de Piété is managed in a manner that has called out the enthusiastic approval and commendation of every observer. All its operations are under the careful supervision of the public authorities. The rate of interest required upon loans is extremely low — so low in fact, that the borrowers never complain of it or look upon it as in the least excessive. The loans made upon pledges approximate very closely in amount to the actual market-value of the articles pledged. The facilities for redemption are ample and convenient. In every department and in every detail the Monte de Piété is conducted in such a way as to be of vast benefit to the poor of Paris. The amount of its profits is strictly regulated by law. It is impossible under its system that any exaction or any injustice shall be practised. New York sadly needs a Mont de Piété. The *Tribune* has already suggested that philanthropists who feel acutely the urgent need of relief to the poor should promptly organize an institution resembling that in Paris. Such an institution would almost certainly make a fair return on the investment, and properly managed would be of unlimited advantage to people in all parts of the city who need aid in this trying season. The great Paris pawn-shop is not the only one in the world which has achieved a striking success with a moderate rate of interest and with generous treatment of the borrowers. Similar institutions exist in Denmark and some other countries, and an experiment of this sort has proved successful in Boston. The subject is worthy of immediate consideration on the part of public-spirited citizens, while the duty of the Legislature is obvious and imperative. — *N. Y. Tribune.*

Dumas's Monte Cristo Chateau. — The success of "*Monte Cristo*" was enough to tempt the great Alexandre Dumas to prove to the world that the vision of the subterranean palace in the island of treasure was not merely an affair of words, but that he could also create a similar prodigy above the ground and not far from Paris. He was not the only writer of romances who was impelled to dream about building. Dumas selected a site on the road from Saint-Germain to Port-Marly, a region which is one of the most picturesque about Paris. For the new château he adopted the Italian style and imported Italian workmen in order to insure that it would have the genuine characteristics. But it was not long before he realized that conventional coldness or purity did not correspond with his dreams. Tunisians were then brought over to give a Moorish character to the interior. Landscape-gardeners were allowed to transform the ground into something that would be to Versailles what the owner was to Corneille. But as terror is the source of the sublime, the creator of Edmond Dantes also erected a miniature Château d'If in the midst of a neighboring pond, and the prison-house was approached by a drawbridge that was as coquettish as those to be seen in front of the suburban villas of Holland. Artists were able to make wonderful pictures out of the tea-gardenish architecture, and shocked precisians with scenes of luxury which outdid Eastern fables. Meanwhile the brave Alexandre felt he had immured himself in a bandbox, and in order to breath with comfort he resolved to turn traveller. He discovered also that, wide as had been his experience of duns, he had met with none to compare with those that were incubated during the building operations. The freak gave rise to accounts amounting to 10,000*l*. Dumas had no longing to go back to Monte Cristo. It passed into the possession of several proprietors in succession and the transfers must have been profitable to the notaries. As it has once more come into the market we thought a few lines might be allowed to recall one of the strangest attempts to realize a writer's visions of architecture. — *The Architect.*

How a Picture-stealer utilized his Deformity. — If any American collectors have, as a Munich paper asserts, been recently investing in sketches by Prof. F. von Lenbach, the great German portrait-painter, here is a chance for them to unburden their consciences. Some two years ago a man applied to Professor Lenbach for work, claiming to be a porcelain painter, modeller in stucco and repairer of frames. The Professor gave him odd jobs at repairing frames for him. He performed this work in the basement of the artist's house, where the latter kept stored away the great mass of sketches and studies he had made of his different sitters, previous to painting their actual portraits. The frame-mender soon discovered these, and was naturally aware of their value, so he commenced to steal them as opportunity offered. Some he carried away in the portable box in which he kept his materials and tools. Others he removed in an entirely original manner. He is a hunchback, and he ingeniously hit upon the idea to conceal his plunder in the hollow of his back below his hump, putting the sketches between his tightly-buttoned vest and his shirt, so that when his coat hung from his rounded shoulders, no one could suspect that it hid anything but his crooked spine. In this way and that he contrived to get away with over a hundred sketches and studies, among them thirty, made from life, of Prince Bismarck alone. He sold his stealings among the small-fry art-dealers, who can be conveniently blind at a bargain, for from 15 to 100 marks apiece, and secured altogether about 3,000 for what would have sold at auction for from 10,000 to 15,000 marks. He might have escaped discovery had he not, as usual with such knaves, become too greedy. Not satisfied with the product of his thefts, he got some art students to copy the sketches he stole, and having sold the originals sold the copies as original also. These copies came to the artist's notice, and led to an investigation and the rascal's arrest. The plundered pictures were mostly, it is stated, sold to American and English tourists. — *The Collector.*

The Survey of the Okeefinokee Swamp. — Several attempts have been made during the last twenty years to get a correct survey of the Okeefinokee swamp, and, until three years ago, they were all failures. The great difficulty experienced by all explorers of the swamp was caused by the jungles and a treacherous and dangerous mud, which is known as "quick mud." The hearts of the bravest men have failed them when their advance into the swamp was interfered with by these obstacles. Without a moment's warning or any signs of danger, the feet slip into the treacherous mud, where the depth ranges from five to fifteen feet in depth or the jungles become so dense that an entrance cannot be effected. There is a dense growth of small pine saplings and black cypress. In some places the saplings give way when caught hold of by a man who is sinking in the mud. Thus the surveying of the swamp requires skill and judgment. A boat is not sufficient to take one into the heart of the swamp on account of the shallowness of the water where the "quick mud" is most abundant. Three years ago a very nearly correct survey of the swamp was made under the auspices of the Suwanee Canal Company. The survey was led by Obadiah Barber, who has explored the swamp over 100 times, and is familiar with every nook and corner of the mysterious place. Mr. Barber says that he led the corps of engineers through the rough places of the Okeefinokee, and though the party was composed of strong men they were exhausted in strength when they reached the opposite side. The swamp, by this survey, proved to be fifty miles in length and twenty miles in breadth. This survey does not correspond with those on maps of this State. — *Savannah News.*

To Dam the Colorado. — A united effort will probably be made during the coming winter to induce the general government at Washington to lend aid to an irrigating proposition that will, when completed, cover a large area of what is now desert land. The plan is to build a dam in the Grand Cañon of the Colorado, the framework of which will be steel of such strength as to resist any pressure that might be hurled against it during the summer floods. Above the framework, boulders will be placed as a protection, and thus it is proposed to make a sufficient fall to furnish water-power for pumping the water to the plain above, where it may be carried in a big canal to the various locations where it is needed. The power will be furnished by turbine wheels, and a sufficient number of them may be brought into requisition to take out any amount of water desired. The fertile valleys that can be reached in this way are Wallapai and Sacramento, in Mohave County; Aubery, in Coconino; Chino, Williamson, Kirkland, and several other small valleys in Yavapai that extend south to the Salt River Valley in the vicinity of Phœnix. The supply of water in the Colorado is an unfailing one and sooner or later it will be the source of all great irrigation enterprises in Arizona. — *Phœnix, Ariz., Republican.*

The Story of a Bell. — In the church-tower of the little town of Grosslaswitz, in the north of Germany, hangs a bell, and on it is engraved its history, surmounted by a bas-relief, representing a six-eared stalk of corn, and the date October 15, 1729. This is the story of the bell: At the beginning of the last century the only church-bell at Grosslaswitz was so small that its tones were not sufficient to penetrate to the ends of the village. A second bell was badly wanted, but the village was poor, and where was the money to come from? Every one offered to give what he could, but the united offerings did not amount to nearly enough for the purpose. One Sunday when the school-master, Gottfried Hayn, was going to church, he noticed growing out of the church-yard wall a flourishing green stalk of corn, the seed of which must have been dropped there by a passing bird. The idea suddenly struck him that perhaps this one stalk of corn could be made the means of producing the second bell they wanted so much. He waited till the corn was ripe, and then he plucked the six ears on it and sowed them in his own garden. The next year he gathered the little crop thus produced, and sowed it again, till at last he had not room enough in his garden for the crop, and so he divided it among a certain number of farmers, who went on sowing the ears until, in the eighth year, the crop was so large that when it was put together and sold they found that they had enough money to buy a beautiful bell, with its story and birthday engraved upon it, and a cast of the corn-stalk to which it owed its existence. — *London Globe.*

The Prices paid by Paris and by France for Art Works. — A curious and not uninteresting item of information is furnished by a Paris correspondent of the *Münchener Neueste Nachrichten*. He states that while the Government pays a certain price for the decorative art upon its buildings, the City of Paris prides itself on being richer and paying better than the State. Thus Puvis de Chavannes, working for the municipality, received 35,000 francs for his decorations in the new saloon of the Sorbonne, and François Flameng and Théodule Chartran each got 4,000 francs for their decorations of the staircase. Had this work been done on a Government building, it would have paid them just one-half, the contract prices being: City, 500 francs a square metre; State, 250 francs. No wonder that Parisians claim that Paris is France. — *The Collector.*

The Mosque lately burned at Damascus. — The Amawi Mosque in Damascus, which was destroyed by fire last month, is a serious loss to Moslem architecture. It was built in the seventh century, not long after Mohammedanism conquered Syria, and is calculated to have cost more than $12,000,000 in modern money. It was the largest mosque and the most ancient in the world, and had a famous marble floor. With it were destroyed manuscripts of priceless value, one copy of the Koran being in the hand of the celebrated author and penman, Othman. The Sultan has sent five architects and engineers to Damascus to rebuild the mosque and adjacent dwellings at his expense. — *N. Y. Times.*

A Testing-machine for Cornell. — A testing-machine company in this city has completed for Cornell University a vertical screw-power testing-machine of 400,000 pounds' capacity. The machine will test specimen bars of metal ten feet in length, and is also adapted for crushing tests of cement and similar materials. It is the largest screw-power machine ever constructed in the Unite l States and perhaps in the world. The gearing is of cut steel, and an arrangement of clutches permits the operator to run the machine up or down at will. The connections with the beam are electrical and practically automatic. The portions of the machine which have to bear the strain of testing are particularly strong, and the adjustments of the bed and of the beam, with its automatic arrangements, are of a character to delight skilled mechanics. — *Philadelphia Ledger.*

Mahogany Roadways. — The laying-down of mahogany roadways sounds almost like a dream of Oriental magnificence, but it is what the Paris Municipal Council are engaged in at the present moment. A portion of that almost interminable thoroughfare, the Rue Lafayette — that portion nearest to the Eastern of France Railway terminus — has been pulled up, and workmen are laying down blocks of real Brazilian mahogany of a peculiarly-fine texture and color. It was confessedly an experiment, as the mahogany is dearer than the woods ordinarily used for the same purpose. Mahogany, however, is not as dear as it used to be. The actual cost of the new roadway will be 50 francs a square metre, which is considerably less than £2 a square yard. It is hoped that the extra outlay incurred will be more than compensated for by the greater durability of the material. — *U. S. Government Advertiser.*

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