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MR. W. F. POOLE, the most distinguished of all the members of the library profession, at least in the eyes of the general public, has just sent out a pamphlet containing comments upon library architecture in general, and that of the proposed Congressional Library in particular, adding as an appendix to this portion a criticism of the treatise called "*Suggestions on Library Architecture*," which was published a few months ago by the architect of the Congressional Library, and spoken of in these columns. Those who have read any of Mr. Poole's writings will not need to be told that his criticism of Mr. Smithmeyer's book is pretty lively reading — much too lively, in fact, for the taste of those who dislike the use of such words as "fraud," "dishonesty," "ignorance," "falsification," and so on, in the consideration of technical subjects. It is true that Mr. Poole finds some provocation for his violence in expressions contained in the book which he reviews, but he should remember that a world which looks indulgently upon the unskilful brandishing of dangerous weapons by a novice in warfare turns away with terror and repugnance at the sight of the same weapons in the hands of an expert gladiator.

ASIDE trom the polemical part of the discussion, to which it is unnecessary to advert further, Mr. Poole's pamphlet contains, as might be expected, some valuable suggestions. The subject of the excessive heat of the upper portion of high rooms, already touched upon in his previous book, is here again adverted to, and several illustrations brought forward. We imagine that few architects know, or at least keep habitually before their minds, the fact which he mentions, that in a room whose atmosphere is neither disturbed by cold currents from without, nor by mechanical agitation, the temperature of the air increases from the floor upward to the ceiling at the rate of one degree for every foot; but actual experiment seems to con firm this observation. In the St. Louis Mercantile Library, which is built on the ancient plan, with galleries surrounding a lofty room, the thermometer at the ceiling, during the summer months, frequently registers one hundred and forty degrees, and this in a room without the skylights which so often seem to intensify the heat in such places. In an atmosphere at this temperature, independent of the suffering caused to the librarians and their assistants, who must constantly pass through it, the leather binding of books rapidly deteriorates, becoming parched, and finally crumbling into dust. If light is admitted from above, there is hardly any limit to the heat which may be developed just under the roof. In the books of the Naval Observatory, at Washington, several instances are recorded where the thermometer at that place, exposed to the sun, rose to one hundred and sixty-five degrees Fahrenheit, in the open air; and this temperature might be raised almost to that of boiling water, if concentrated under a skylight, with surfaces all about to reflect and radiate back the heat.

THE attention of those interested is called to the fact that Thursday, April 3, the day set for the preliminary examination in Boston of candidates for the Rotch Travelling Scholarship, has been appointed by the Governor of Massachusetts as a fast day, and the examination is therefore necessarily postponed until the next day, Friday, April 4. Candidates should provide themselves with at least one drawing-board, on which it will be convenient to have paper ready stretched, and with T-square, triangles, scale, pencil and rubber, and instruments. Colors will be convenient, as furnishing the best means for quick and effective rendering. As before announced, the examination is to be held at the Boston Museum of Fine Arts, on the corner of St. James Avenue and Dartmouth Street, near Trinity Church, at nine o'clock, A. M. The preliminary examination will be in design only, the examinations in theory and history not taking place until May.

A CHURCH steeple fell recently at Philadelphia, apparently from mere weakness, owing to its defective and unworkmanlike construction. Fortunately, the tower fell toward the street, so that the church to which it was attached suffered little injury, and no one happened to be passing through the street near enough to be within reach of the falling mass. The tower, which was about sixty-five feet high, had had the misfortune to be all of masonry built in winter; the construction of the church having been begun in the autumn of 1882, and suspended in the following spring, for want of funds, to be resumed again last autumn. A wall so built would be naturally infirm, and the stones used are said to have been small, and laid in inferior mortar. A day or two before the final crash portions of the wall had fallen out, and the doors of the church were boarded up, to prevent any one from entering. Why guards were not set in the street to keep people away from the outside of the tower is not very apparent, and it seems to have been owing to no merit of the church authorities that loss of life did not occur. The cost of repairing the damage will be about three thousand dollars, and it is likely that, before that sum is raised, those who pay it will be moved to inquire whether true economy would not indicate a different method of carrying on such work.

THAT renowned inventor, Mr. Keely, has, according to the Philadelphia *Times*, lost, by the deliberate character of his operations, the success and fame which have been for so many years waiting to attach themselves to him. To quote from the account given in the *Times*, for which the proprietors of that journal are expected to assume all responsibility, a certain James Rodney Barlow, an inventor of Philadelphia, led astray from the paths of honesty by his passion for mechanics, managed to introduce himself surreptitiously into Mr. Keely's workshop, where, by watching what went on, he was enabled to divine the secret of the famous motor. His next step was to build one like it, with the help of money borrowed from a credulous friend; and no time was lost in giving the counterfeit motor the practical trial to which the great original has yet to submit. The most available place for such a test is naturally a railroad track, where obstacles are few, and where the power developed can easily be estimated; and by favor of an employé of the West Jersey Railroad a hand-car was borrowed, and with it the use of the railroad track for a night. According to the *Times* reporter, who was present by special invitation on the occasion, the motor was arranged to be readily connected with the crank of the hand-car, and on the appointed evening a few hours sufficed to make everything ready. As set up in position for use, the motor appeared to consist of "two cylindrical steel vessels, five inches in diameter by eighteen inches long, placed longitudinally about one inch apart." Above them, placed at right angles to the two others, and connected with them by "steel necks," was a third cylinder, three inches in diameter by nine inches long. "From the head of each of the lower cylinders a steel tube half an inch in diameter projected, and the two tubes were curved to meet each other four inches above." At their junction was a small hand lever, and at the side of the motor was a vertical cylinder of "anti-friction metal," with a "rod and plunger;" and to this cylinder was attached "a small rotary crank." "A steel tube, one-fourth of an inch in diameter, connected the upper cylinder of the motor with the vertical cylinder by its side."

"BY ten o'clock," as the account informs us, "everything was ready, and the car, with the motor on its platform, was removed from the building and placed upon the track." After a moment's delay, the lever was pressed down by Mr. Barlow's "sinewy fingers," and the car started off along the track. After a run of about four miles, the motor was reversed, and the hand-car moved back again. The moving force seemed to be derived from some pent-up power, and Mr. Barlow, having explained to his companions that enough energy remained to carry them swiftly over the homeward trip, the valve was thrown wide open, and the car with its load returned to the starting point at a speed of seventy-five miles an hour. It is hardly necessary to point out that this experiment, supposing, for the moment, that the story is true, would be one of considerable importance to the stockholders of the Keely Motor Company. So far as we know, the latter are not protected even by a single patent, and if the caveat filed by the great inventor in deference to the demands of those who supported him has expired, his secret, if he has any, is open to any one who can steal it from him. We must confess that we have no immediate expectation of seeing locomotives superseded by hand-cars furnished with "cylinders" and "rotary cranks," but we trust that Mr. Barlow, if he is not a myth, has something better in view than a repetition of the Keely farce. The same article which contains the description of the Barlow motor mentions also that Mr. Keely has discharged all the workmen employed in his factory, on the ground that "he has built all the engines he wants," and has nothing more for them to do. This step would certainly seem to imply what the reporter states without reserve, that Mr. Keely is "discouraged," but we have other authority, probably quite as trustworthy, for saying that Mr. Keely is only engaged in "focalizing the vibrators" and that "if he lives a year longer" he will have the motor in working order by the end of that period.

THE *Scientific American* has for a few weeks past taken occasion to call the attention of the public to the bills now before Congress for the virtual abrogation of the patent laws, which we have, since our school days, been taught to regard as the main factor in the development of the ingenuity and enterprise hitherto characteristic of this country. About twenty bills, all having the same object, have been introduced, but only two of them seem to be sufficiently definite to be formidable. One of these, which is now pending before the House of Representatives, provides that patents shall hereafter be granted only for the term of five years, instead of seventeen, which is the present limit. The other, which has already passed the House of Representatives by a large majority, and is now before the Senate, while leaving the nominal duration of a patent unchanged, renders the privileges conferred by it practically valueless, by providing that no penalty shall be imposed for infringement of a patent, unless the infringer had notice, at the time of purchasing or beginning to use a patent article or process, that it was the property of some one else. Every one who has had any experience in the development of a new invention or a new industrial process, knows that years must in nearly all cases elapse before an idea, once patented, can be brought into the market. Even supposing the invention to be so simple that all its details can be immediately fixed, and so much in the course of ordinary work that machinery can be found ready to manufacture the new article in sufficient quantities, and with the requisite economy, for placing it at once before the public, a long additional period must almost always be devoted to reconciling and adjusting conflicting patents or claims, before the proprietor of the new invention can without risk offer it for sale. After the settlement of all these questions, the inventor may hope, if he is fortunate, and has a device of real merit, to reimburse himself gradually out of the revenues of his monopoly, for the outlay necessary to make it available, but the bare reimbursement of these, to say nothing of net profit, depends upon a reasonable duration of the monopoly, and in a great number of cases the limitation of the patent to five years would throw upon the patentee all the cost of introduction, without affording him any remuneration whatever.

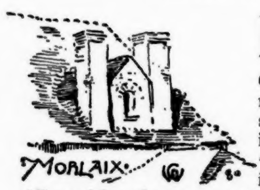
TO those who have occasion to study the innumerable ways in which the so-called zymotic infections are transmitted from one person to another, the question often occurs, whether any possible precautions will be so effective in preventing contagion as to make it worth while to take much pains about them. By a recent investigation, carried on by an official Board in New York State, and reported in the *Sanitary Engineer*, a new and dangerous method of communicating disease has been discovered. The occasion for the investigation was the death of two children, and the illness of a third, from malignant diphtheria, in a family at Amsterdam, in that State. The death of the second child followed that of the first at a long interval, and this circumstance alone made the explanation of the cases somewhat difficult. A thorough examination of the house in which the family lived, with its surroundings, showed no conditions which could account for an outbreak of diphtheria, and the Board of Health, in consultation with the family physician, was led to the conclusion that the disease was imparted from a cat, with which the child first attacked was accustomed to play. A short time before the outbreak, this cat was observed to have a swollen throat, and to be affected with a discharge from its mouth and nostrils, and a few days after these symptoms were noticed, it died. Three days after the death of the cat its little mistress was seized with malignant diphtheria, and died in about a week. To amuse the patient a doll was brought it to play with which was subsequently thoroughly fumigated with burning sulphur, and given to the younger children. Both of these, after a certain time, were attacked with the same disease, one of them dying, while the other finally recovered. The deduction which the Board makes from these circumstances is that while the original infection was derived from the cat, it was perpetuated and communicated by means of the doll, which, even though subjected to the powerful action of sulphurous acid fumes, retained for months the contagious particles which had fallen upon it in a state of sufficient vitality to affect, and nearly to destroy, two healthy children at once.

ANOTHER of those competitions by which the French Government so successfully endeavors to promote artistic effect among the workmen who have made the French name famous is announced in *La Semaine des Constructeurs*. This is to be known as the Prize Beauvais, and is to be connected with the manufacture of tapestry, which is carried on in that city under Government auspices. For the next year, the subject of the competition will be a border for four panels of tapestry which are to be executed from designs by Mr. Français. The panels represent the four Seasons, and the borders must conform to directions to be issued later. To the author of the best design will be awarded a prize of four hundred dollars in money, and his design will be retained by the Government for execution. The other designs will be returned to their owners, and no second prize will be given. It is interesting to remark that in this country, where private enterprise does much that is elsewhere left to the public authority, encouragement of the same kind has been given in one branch of the decorative arts — that of designing wall-papers — with excellent effect, by a firm of manufacturers in New York.

TWO instances have recently been reported of successful attempts to preserve vessels at sea in storms from the effect of heavy waves by pouring oil on the water. In one of these a coasting schooner, on the passage from North Carolina to Nova Scotia, was overtaken by a violent storm, accompanied by a cross sea, which raised waves of a particularly dangerous character. The schooner was loaded with three hundred tons of railroad iron, the weight of which brought the hull down almost to the gunwales in the water, and every sea broke over the deck. The captain, fearing that his ship would founder, stationed a man at the extreme point of the bow with a small can of kerosene oil, instructing him to be sparing in its use, as there was only a small supply on board, but to throw overboard a little at the approach of every wave which seemed particularly threatening. The oil was poured through the spout of the can, and only a small quantity could be thrown out at once, but the effect was immediately visible in smoothing the "comb" of the waves, so that they passed under and by the sides of the ship without breaking over it. The storm continuing, linseed oil, of which ten gallons had been laid in for mixing with paint, was tried in the same way, and proved even more effective, smoothing the waves much more rapidly than the lighter kerosene. By economical management the supply of oil was made to last for fifteen hours, and before it was exhausted the gale had begun to subside, so that the danger passed, and the schooner proceeded safely on her voyage. The second case was very similar to the other, but the captain of the vessel, having a large supply of oil, and a ship perhaps more seaworthy, was able to rig a tackle by which cotton bags, filled with the oil, were hauled out to the end of the bowsprit, where the slow leakage from them was applied to the waves at great advantage, subduing them before they approached near enough to the hull to break over it.

AN ATTEMPT TO ANALYZE THE ASSEMBLY CHAMBER VAULT AT ALBANY.[1]

I. — GRAPHO-STATICAL METHOD.



IN relation to the strength of the material used in the construction of the ribs and arches of the Assembly Chamber vault, the architects, in their report to Governor Cornell, give the safe load as 600 pounds per square inch, while the real load, by their own statement, is 270 pounds per square inch.

All particles of a cross-section acted on at its centre of gravity by a force normal to its plane are subjected only to stresses of compression,[2] and these of the same intensity or amount per unit of area. But if the point of application deviates from the centre of gravity, the intensity of the stress on the cross-section varies, and if it deviates sufficiently, not only stresses of compression, but also stresses of tension come into action, and moreover, in all cases, the intensity of the stress is proportional to its distance from the neutral axis, or line of no stress. To examine what effect a force normal to the cross-section would have whose point of application is at a given distance from the centre of gravity of the cross-section, we first have to determine the neutral axis.

In statics we find the following law: "The neutral axis is always the antipolar of the point of application of the force in relation to the ellipse of inertia in cross-section, and this as long as this point is outside of the ellipse of inertia; but if the point of application is within the ellipse, the axis is a parallel line to the polar of the point of application — here the polar line coincides with the point of application — this parallel passing through the antipole of the antipolar."[3]

Herein the ellipse of inertia of a cross-section expresses the law of the moment of the inertia of this cross-section relatively to different axes of the centre of gravity, indicating that the square roots of the moment of inertia of cross-section (relative to different axes of the centre of gravity) divided by the area of cross-section, are equal to semi-diameters of an ellipse measured in lines normal to the axis of the centre of gravity, and by the same unit of length taken for a determination of the area of cross-section, this variable semi-diameter of the ellipse (starting from the centre of the ellipse) is called "the radius of inertia," while the ellipse itself is called the ellipse of inertia of cross-section.

From the foregoing law of statics, it appears clearly that stresses of tension in the cross-section exist as soon as the neutral axis falls within the cross-section. Now, as in stone-work, and especially in vaulting, stresses of tension can with difficulty be resisted, the structure should at all events be erected so as to prevent the neutral axis falling within the cross-section. This will be done if the point of application of the force is in a determined closed figure called the "central core" of the cross-section. To find the figure of the central core, a straight line (neutral axis) has to be drawn around the figure of the cross-section, so that both lines and figures are always in contact, but never cutting each other. Then to this line the antipolars relative to the ellipse of inertia have to be constructed; each crossing point of one of these antipolars with the corresponding axis is a point of the bounding line of the central core, and a continuous line joining all these points produces the figure of the central core. This method is employed for the cross-section of the rib in the large groined vaulting of the Albany Capitol, and gives, in connection with my former examination of its stability (*American Architect*, October 29, 1881) a correct figure of the real tensions in the voussoirs.

For determining the moment of inertia, a simple method of graphical statics — that of Professor Mohr, of Dresden — has been employed. The lengths 1, 2, 3, 4, 5, of Figure 1 *b*, fixed in a straight line, correspond to the strips 1, 2, 3, 4 and 5 (*lamelles*, drawn parallel to the smaller side of the cross-section in Figure 1 *a*). *D E* is halved and made equal to *O G* and all terminal points of the lines of force joined with *O*. (It is not necessary that *O G* should equal one-half of *DE*, as the pole *O* may be taken at pleasure.) In this way the funicular polygon in Figure 1 *c* is constructed, the sides of which are parallel to the radiating lines of Figure 1 *b*, passing through the point *O*. The vertices of the funicular polygon are always in the line of the centre of gravity of the respective strips. Prolonging the extreme sides of the polygon of forces, their intersection determines the position of the centre of gravity *S* in the symmetry axis of the cross-section. Drawing the funicular curve[4] in the funicular polygon constructed before, the area of the figure formed by the funicular curve and the sides *A L* and *B L*, measured by the same unit as that used in measuring the area of cross-section, gives the factor by which the area of cross-section is to be multiplied to obtain the moment of inertia. In this way in Figure 1 *c*, the moment of inertia is determined for the horizontal symmetry axis, and as the semi-axis of the ellipse of inertia is always equal to the square root of the area of the figure formed by the sides of the funicular polygon and funicular curve, both determining semi-axes of the ellipse of inertia are found, and then this ellipse has been drawn in the voussoir, Figure 1 *a*.

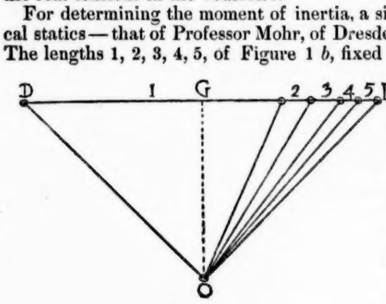


Fig. 1 *b*.

Fig. 1 *e*.

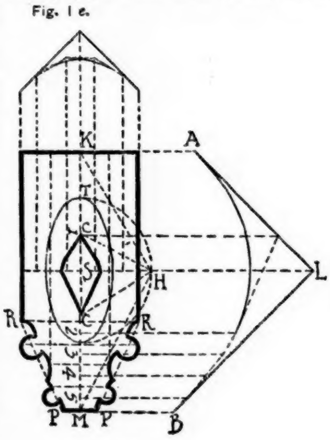


Fig. 1 *c*.

Fig. 1 *a*.

The construction of the central core is thus a very easy one, as is seen in Figure 1 *a*. As to the determination of the points *C C* in the vertical symmetry axis of the cross-section, *S H* is laid off normal to the axis and equal to its corresponding semi-diameter of ellipse of inertia (here *S T*); then the lines *K H* and *M H* joining *H* with the extremities *K* and *M* of the axis are drawn, and lines are drawn from *H* normal to them. The intersections of the normal lines with the axis give the required points (*C C*) of the central core.

A similar operation employed for different axes of centre of gravity gives a number of points, the locus of which is the bounding line of the central core. Then the figure of the central core is drawn in the cross-section. Here is to be noticed, as to the construction of the central core, that the irregular bounding of the lower end of the cross-section has been replaced by a straight bounding line (the dotted line *R P P R*). As soon as the point of application of force is outside of the figure of the core, not only compressive but also tensile stresses act in the cross-section.

If the cross-section is a rectangle, the central core occupies in height the inner third of the cross-section; but if it is moulded, as in the instance under examination, the position and height of the central core changes, as shown in Figure 1 *a*. The height of the central core here is $11\frac{1}{4}$ inches, its distance from the upper bounding line $11\frac{1}{4}$ inches, and from the lower, $13\frac{1}{2}$ inches. As the height of cross-section amounts to 36 inches, the lower bounding point of the central core, in consequence of the deviation of the profile of the cross-section from a rectangular figure, has mounted $1\frac{1}{2}$ inches above the bounding line of the inner third of the cross-section.

According to my former examination of the stability, the normal pressure at a joint of rupture for each foot of depth is 165375 pounds. As the rib is but 1 foot 4 inches in depth, the entire normal pressure is $1\frac{1}{3}$ times 165375 pounds, equal to 220500 pounds.

The analytical determination of the line of pressure had given 7 inches as the distance of the point of application of the force at the joint of rupture from the lower bounding line of the arch. In Figure 2 *a*, the diagram of the stress on the cross-section per unit of area is conformably shown. Here *e* is the neutral axis, below which we have compressive, and above tensile stress, details to be seen in similar triangles *a b e* and *f g e*. In Figure 2 *b*, the figure showing the stress on the entire cross-section is constructed, and on a smaller scale the stress per unit of area is graphically represented (see diagrams, *q b n* and *n o r*). To find the diagrams for the entire cross-section *a b n c* and *n o p*, we have to multiply the ordinates in *q b n* and *n o r* by the corresponding depths of the voussoir, as shown in Figure 1 *a*. The polygon *a b n c* then represents the resultant force of compression, *Z*, acting at the height of the centre of gravity of this polygon. In the same way the triangle *n o p* represents the resultant force of tension *M*, and its point of application is at a depth below *o* equal to the depth of the centre of gravity of *n o p*, below *o*. As the resultant of *Z* and *M* must equal *N*, the original force, by making the plane figure *d e n* equal to *n o p*, we obtain *a b c n* — *d e n*, = *a b e d c* = *N*; therefore triangle *d e n* represents a force $M_1 = M$, acting at the height of centre of gravity of triangle *d e n*. *Z* consequently is

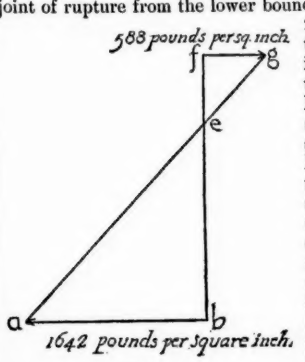


Fig. 2 *a*.

[1] By H. W. Fabian.

[2] Here we might start just as well from an original tensile force.

[3] If two tangents to the ellipse are drawn from a point outside of the ellipse, the line joining the points of contact is the polar. Laying off on the line connecting the point of intersection of the tangents with the centre and on the other side of the centre of the ellipse the same distance from the centre gives the antipolar.

[4] The sides of the funicular polygon are the tangents of the funicular curve, and the respective points of contact are situated in the dividing lines of the strips.

to be taken as the sum of N and M, but N does not act at the centre of gravity of $a\,b\,e\,d\,c$. Relative to this, the effect of Z upon the pressed plane of cross-section is equal to an effect of $N_1 + M_1$; wherein, though $N_1 = N$, N_1 attacks at the centre of gravity of $a\,b\,e\,d\,c$. The effect of the original force N upon the entire cross-section may be represented as if two forces, Z and M, were acting upon the cross-section. Z exclusively influences the compressed part, and M the tensile part of it. Moreover, the sum of both forces is equal to the original force, and also the sum of the static moments in relation to any axis perpendicular to the plane of the forces is equal to the static moment of the original with regard to the same axis; Z being regarded as the resultant of N_1 and M_1. In consequence of this, $N_1 + M_1 + M$ must be equal to N, and also the algebraic sum of their moments equal to the moment of N. As far as magnitude alone is concerned the polygon $a\,b\,e\,d\,c$ is equal to N in Figure 2 *b*, M_1 and M being equal and opposite. The plane $a\,b\,e\,d\,c$ therefore represents the value found of the normal force of pressure, equal to 220,500 pounds, in consequence of which $q\,b$ is maximum of tension of pressure, and $o\,r$ the maximum of tension of fracture per square inch. The base-line $e\,b$ is measured in inches by

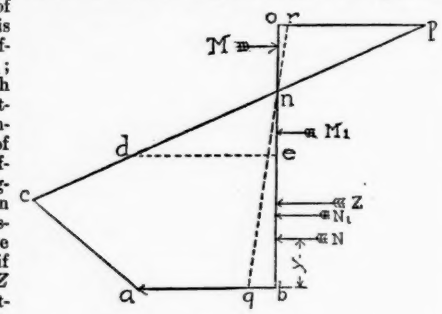


Fig. 2 *b*.

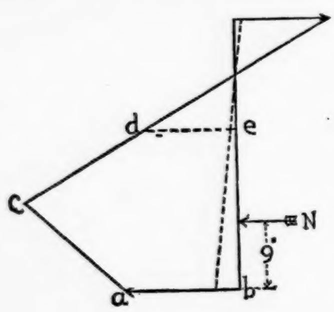


Fig. 3 *a*.

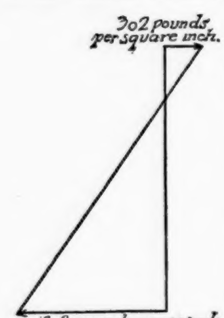


Fig. 3 *b*.

the scale of the figure of cross-section. The number of inches we obtain has to be divided into the number of pounds, the result giving the value in pounds corresponding to the mean altitude of the figure. This altitude expressed in pounds gives the scale for measuring the heights of ordinates in the original stress diagram, and this as a whole for the entire quantity of stress, as also for the stress per square inch. This scale of course is not only to be employed for the ordinates of heights of figure for N_1, but also for the whole stress diagram of the voussoir, and therefore represents a rule for the entire compressive and tensile strength.

We have still further to notice that in the construction of the diagram of the whole stress of cross-section, the straight lines $P\,R$, $R\,P$ are taken in lieu of the moulded lines of cross-section. Further, it has been shown in my former examination of the stability, that the distance of the point of application of force at the joint of rupture from the inner line of the arch may amount to nine inches. According to this position of N, the neutral axis has again been determined, and in Figures 3 *a* and 3 *b* the stress diagram of the entire cross-section, and that per square unit, have been constructed on the same scale as in Figures 2 *a* and 2 *b*. In Figure 3 *a* the plane $a\,b\,e\,d\,c$ corresponds to the normal force of compression N (in magnitude), and is therefore equal to the area of the like-marked plane in Figure 2 *b*. By reconstruction we then find that the tension per unit of area, as in Figure 3 *b*, is represented by the scale of Figure 2 *a*. In Figures 4 *a* and 4 *b* it has finally been shown, in the same way, how the stresses would vary if force N acted at the centre of gravity of cross-section.

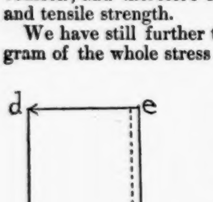


Fig. 4 *a*.

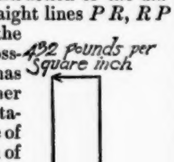


Fig. 4 *b*.

II. — ANALYTICAL METHOD.

In Figure 5, Q denotes the force normal to the plane of the body acted upon (special case), and q the distance of the point of application of the force from the centre of gravity of cross-section; i denotes the distance of the neutral axis, and e the distance of the outer fibres from the centre of gravity. Then let any fibre of cross-section ΔF be distant by y from the axis of centre of gravity, $F = \Sigma\,\Delta\,F$ be the area of the entire cross-section, and k the pressure in direction of Q, which the fibre most affected (the outermost) has to sustain per unit of area. As the stresses of fibres of cross-section are to one another as the distances of the fibres from the neutral axis, the stress per unit of area of a fibre distant from the axis of centre of gravity by y is $= k.\,\frac{y+i}{e+i}$; therefore the stress $k\,y$ of the fibre itself $= k.\,\frac{y+i}{e+i}.\ \Delta\,F.$

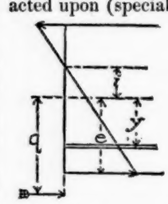


Fig. 5.

Q being the resultant of all tensions of fibre, therefore

$$Q = \Sigma\,k.\ \frac{y+i}{e+i}.\ \ \Delta\,F.$$

It is not less evident that the sum of the static moments of the stresses of fibre related to the neutral axis is equal to the static moment of Q with regard to this axis. But this equation of moments is also applicable to the axis of centre of gravity; therefore we obtain

$$Qq = \Sigma\,k.\ \frac{y+i}{e+i}.\ \ \Delta F.\ y.$$

Putting the constant values before the initials of sum

$$Q = \frac{k}{e+i}.\ (\Sigma\,y.\ \Delta\,F + i\,\Sigma\,\Delta\,F)$$

and

$$Qq = \frac{k}{e+i}.\ \ (\Sigma\,y^2\,\Delta\,F + i\,\Sigma\,y.\,\Delta\,F)$$

$\Sigma\,y.\ \Delta\,F$ as static moment of area of cross-section relative to axis of centre of gravity $= 0$, and $\Sigma\,\Delta\,F = F =$ the entire area.

$\Sigma\,y^2\,\Delta\,F = J =$ the moment of inertia.

Therefore,

$$Q = \frac{k.\,i}{e+i}.\ F$$

and

$$Qq = \frac{k}{e+i}.\ J.$$

From the equation of Q we obtain

$$k = \frac{Q}{F}.\ (1 + \frac{e}{i}). \qquad (1.)$$

By dividing Qq by Q we obtain

$$q = \frac{J}{i\,F};$$

and in consequence

$$i = \frac{J}{q\,F}.$$

Now $\frac{J}{F}$ generally being equal to the square of the semi-diameter of inertia (semi-diameter of the ellipse of inertia $= a$), i may be also expressed by the following equation: —

$$i = \frac{a^2}{q}. \qquad (2.)$$

From Equation 2 follows: $q\,.\,i = a^2$. Now a^2 being constant for a given neutral axis (in practice generally the symmetry-axis of cross-section), product $q\,i$ remains also constant; but if the point of application of force removes from the centre of gravity, then i decreases and the neutral axis approaches; and on the other hand, if the point of application approaches, the neutral axis recedes from centre of gravity. If the point of application coincides with the centre of gravity q is equal to zero and $i = \infty$; therefore the neutral axis is infinitely distant, which case corresponds to a uniform stress on the cross-section, either compression or tension, according to the direction of force.

Then $k = \frac{Q}{F}$.

In consequence of general formula (1), $k = \frac{Q}{F}.\ (1 + \frac{e}{i})$ we obtain:

$k_1 = \frac{Q}{F}\ (\frac{e_1}{i} + 1)$ for pressure, and

$k_2 = \frac{Q}{F}.\ (\frac{e_2}{i} - 1)$ for traction.

As to the analytical determination of k_1 and k_2 for the profile of Albany diagonal rib, we find: —

$F = 510\,\square''$.
$Q = 220500$ lbs.
$e_1 = 19.5''$.
$e_2 = 16.5''$.
$i = 7''$ (for $q = 19.5'' - 7'' = 12.5''$).
$i = 9{,}5''$ (for $q = 19.5'' - 9'' = 10.5''$).
$k_1\ \frac{Q}{F}.\ (1 + \frac{e_1}{i}).$
$k_1\ \frac{220500}{510}.\ (1 + \frac{19.5}{7}) = 432.\ (1 + 2.8).$
$k_1 = 432 \times 3{,}8 = 1642$ lbs. (pressure) for $q = 12.5''$.
$k_2 = \frac{Q}{F}.\ (\frac{e_2}{i} - 1).$
$k_2 = \frac{220500}{510}.\ (\frac{16.5}{7} - 1) = 432.\ (2.36 - 1).$
$k_2 = 432 \times 1{,}36 = 588$ lbs. (traction) for $q = 12.5''$.
$k_1 = \frac{220500}{510}.\ (1 + \frac{19.5}{9.5}) = 432.\ (1 + 2.05).$
$k_1 = 432 \times 3{,}05 = 1318$ lbs. (pressure) for $q = 10.5''$.
$k_2 = \frac{220500}{510}.\ (\frac{16.5}{9.7} - 1) = 432.\ (1.7 - 1).$

$k_2 = 432 \times 0{,}7 = 302$ lbs. (traction) for $q = 10.5''$.

In consequence of the foregoing calculation, the maximum stress of compression of cross-section of the ribs amounts from 1318 to 1642 pounds per square inch, and the maximum of tensile stress from 302 to 588 pounds per square inch. These results, according to my former examination of stability, are based on the fact that the line of pressure in the joint of rupture approaches to the line of arch of the rib by 7″ to 9″. It is further proved, that in the joint of rupture the joint in the upper part of cross-section has to be open from 16.5 — 9.5 to 16.5 — 7, respectively, from 7 to 9.5″.

According to these explanations, it is unnecessary to criticise further the architects' assertion that the maximum compressive stress in the rib amounts to 270 pounds per square inch. Facts alone speak for themselves. As shown, the maximum stress in cross-section would even then amount to 432 pounds[1] per square inch, if the force were uniformly distributed, and this only for pressure, if the line of pressure would coincide with the middle line of arch.

Hereby it is evidently proved that the allowable stress of material in the Albany vault has been exceeded.

BRONZE CASTING IN BELGIUM.[2]—II.

RETOUCHING *the Wax Bust.* — The great advantage of reproducing the bust in wax is that it enables the artist to work upon it, so that the wax bust is not only equal to the original in plaster or terra-cotta, but may become even superior to it; for the artist, on seeing his work in a material of another color, and after a certain time, may discover certain faults which he can correct in the wax, or if he thinks it necessary he can make such alterations as he may consider advisable.

4. *Preparing the Bust before making the Casting-Mould or Cope.* — The bust in wax having been looked over and corrected by the artist, is now placed in the hands of the founder, who begins by building a layer of fire-bricks of the size required for the object that is to be cast; this layer, for a bust, may be 1 metre by 80 centimetres, and 0.25 centimetres in height above the floor of the atelier. When ready the wax bust is placed upon it on its pedestal of *potin*, and firmly fixed to the brick layer or base. The next operation is one of considerable delicacy, namely, the placing of the runners or channels to enable the liquid bronze to flow through and fill up the vacant space left by the melted wax, and the vents, which are other channels for the escape of the air and gas driven out of the hollow by the force of the liquid metal.

For a bust the placing of these channels is not difficult, but when a complicated work — a group or a large bas-relief — has to be prepared for casting, the proper position of these channels requires considerable study, for if one of them should be badly placed it would compromise the success of the casting.

In order to make a runner for the bust in question, a stick of wax is used, 0.60 metre long, with a diameter of 40 millimetres, one end of which is cut or flattened into the shape of the mouth-piece of a whistle; the other end is considerably thickened by the addition of wax, until it has the form of a funnel; it is then bent into the form of a double siphon, with the two parallel branches considerably lengthened. Having thus prepared the runner, in order to fix it three or four thin iron pins are driven, in a straight line, at a distance from each other of 1 centimetre, into one shoulder of the bust, from which they are allowed to project about 2 or 3 centimetres; upon these is pressed the flattened end of the runner, and the joint where it touches the shoulder is then closed with wax, which is melted with a heated tool, thus increasing the solidity of the joints. The vent, which is fastened in the same way on the other shoulder, is a simple straight stick of wax, thinner than that of the runner, also with the flattened end touching the shoulder.

If from any cause the runner and the vent are not firm in their positions, another iron pin is driven into the top of the head of the bust, and the runner and vent are fastened to it with packthread.

The founder has now before him the bust, surmounted by the runner and the vent rising from the shoulders to the summit of the head, like little chimneys, to the height of 15 or 20 centimetres; he then proceeds to drive a number of iron pins all over the surface of the bust, through the wax, into the core, the object of which is to maintain the core in its place; these pins must project one-half their length from the surface of the bust.

[1] In the appendix of my paper in *A A* and *B N*, 29th October, 1881, was given by mistake $\frac{765.7}{4} = 191$ pounds, instead of $\frac{765.7}{2} = 382$ pounds, the cross-section being calculated rectangularly ($3' \times 1'\,4''$). The calculation of k given there naturally can be but approximative, wherefore substitution has properly to be made.

[2] Continued from page 139, No. 430.

5. *The Formation of the Casting Mould or Cope.* — The bust thus prepared is placed on the brick layer in the place in which it is to be fired; it is then surrounded by a wooden case, having the form of a four-sided truncated pyramid. This case, which must be sufficiently large to leave a space of from 15 to 20 centimetres between it and the greatest projection of the bust, is made of frames placed one upon the other, 23 centimetres in height, the whole, when placed together, having the form of a pyramid; the first frame, namely, that which rests on the brick layer, being naturally the largest. The case being ready, the cube measure of its capacity is calculated, and the upper frames are removed, leaving only the lower one resting on the brick layer.

The mould is made of precisely the same material as that forming the core of the wax bust; the requisite quantity is prepared as well as the proper number of measures of water required for mixing the *potin*.

As the operation of filling the frames must proceed rapidly, and once begun cannot be stopped, care must be taken to have a sufficient supply of the material at hand.

For the formation of the cope of a large-sized bust, three men are required for mixing the *potin*, two for pouring it into the frames, and two for throwing the mixture onto the bust, which is done with painters' brushes, and in such a way as to thoroughly fill up all the cavities of the sculpture.

The three mixers have each before them a vat or bucket containing one measure of water, into which they pour rapidly the dry *potin*, which is in the form of fine sand or powder, and this not all at once, but gradually, by allowing it to fall through their fingers; when the *potin*, is all in the water the men work it into a paste with their hands. As soon as it is ready the other men pour one after the other the contents of the three vats or buckets into the lower frame of the wooden case; in the meantime the mixers are preparing fresh vats of *potin*. As soon as the first frame is nearly filled, the second frame is placed above it, the joints being closed with *potin* that has become almost hard, and it is filled in the same way; at the same time the other two men, armed with brushes, have been sprinkling the bust with the mixture so as to fill up completely all the cavities of the wax bust; if this is not done with great care and exactitude, any cavity that is not filled with *potin* will retain a certain quantity of air, and when cast the cavity will be entirely filled up with a solid mass of bronze, which would require to be removed by the chaser at a considerable expense, or it may happen that the fault is one impossible to remedy. When all the frames have been placed one upon the other and filled with *potin*, the operation is completed, care having been taken to fill the upper frame only to the level of the top of the runner and the vent, so as not to cover them.

A third channel, required for draining off the melted wax, is formed in the same way as the other two, a stick of wax of 30 millimetres in diameter being placed at the base of the bust on the slant, so as to facilitate the issue of the liquid wax, the stick of wax being fastened by one end to the wax of the bust, while the other end touches the wood which forms the case. The *potin* having been allowed to harden, which it does very rapidly, the wooden frames are removed, and the cope appears in the form of a block of stone, on the upper surface of which is seen, on the right, the wax of the runner, and, on the left, that of the vent, and at the base that of the drain.

6. *Firing.* — The block is now ready for firing. A furnace of fire-bricks is built round it, two chimneys being placed on the runner, and the vent communicating with the outer air, and round this furnace a second is built, in which a coke fire is lighted. The fire should be moderate at first, gradually increasing until the mass is baked throughout, so that it is completely red hot to the very centre.

After baking for six hours the block is sufficiently heated to cause the wax to melt, which then escapes through the drain, which is in connection with an iron tube passing through the two furnaces, and communicating with a vat into which the wax flows. When the wax has ceased to flow, the opening from the drain must be carefully closed, in order to prevent any air from reaching the interior, which would be injurious to the process.

After thirty-six hours' firing puffs of blue smoke are seen issuing from the chimneys. This shows that the heat is sufficiently intense to cause the evaporation of any wax that may have remained in the block. After sixty or seventy hours the smoke changes from blue to a reddish hue; this shows that the wax is completely destroyed. The smoke is succeeded by a slight watery vapor, and the fire is increased until all moisture has disappeared. This is ascertained by placing a cold steel plate over the orifice, upon which the slightest vapor shows itself in the form of a veil of dewlike drops. If at this moment it were possible to look into the centre of the block, it would be found to be of deep red. When all symptoms of moisture have disappeared, the fire is covered up, no further fuel is added, and the fire goes out gradually.

The external furnace is pulled down as soon as the bricks have cooled sufficiently to enable the workmen to do so without burning themselves, and in order to hasten the cooling of the block some of the bricks forming the cover of the interior furnace are also removed. Later this is also demolished, and the moulding-block is allowed to cool. In a word, it is necessary to proceed gradually for the process of cooling, as well as for that of firing, sudden changes of temperature being fatal, and the success of the operation depending in great part on the regularity of the process.

The firing being now finished, the block has the same appearance as before, only in removing the chimneys the runner and the vent are found to be replaced by holes or channels, while another hole will be found at the base in the place of the wax drain. The wax in melting has formed these channels, and has left a hollow space throughout the block between the core and the mould.

Reference has been made above to the use of iron pins pressed into the wax bust.

As long as the core, the wax, and the mould had not been submitted to the action of the fire they formed a solid mass, but with the melting of the wax the core has become isolated, and, as it is formed of exceedingly friable earth, the least motion might throw it down and break it; this inconvenience is avoided by the employment of the pins above referred to, which, penetrating through the wax, on the one hand into the core, and on the other into the mould, renders the core immovable even after the disappearance of the wax.

7. *The Casting in Bronze.* — This is the last operation. The block having become sufficiently cool, it is surrounded with iron frames placed one above the other; the space between the block and the frames is filled by pressing into it ordinary moulding earth. This operation requires the greatest care; its object is to prevent the block from bursting when the liquid bronze is poured into it, by the pressure of the gas and the expansion of the air while the fused metal is flowing through the mould, a comparatively small quantity of metal in fusion being capable of producing effects of incredible force which it is difficult to account for.

The block being perfectly iron-bound, a basin of iron covered with baked clay, and pierced with a conical funnel, is placed over the runner, and closed with an iron stopper, from which projects a long stem. The hole of the basin communicates directly with that of the runner; the opening of the vent is left free, but in front of it a small basin is hollowed out of the block. Everything is now ready for the casting.

If the bust is calculated to weigh 50 kilograms, 80 kilograms of bronze are put into the melting-pot in order to be certain of having enough metal and it is necessary to allow for the runner, the vent, and the drain. The bronze which has hitherto given the best results is composed as follows: 70 kilograms red copper, 28 kilograms zinc, 2 kilograms tin.

The bronze being sufficiently melted, the crucibles are lifted out of the furnace and are emptied into the basin above referred to; a workman at the word of command takes out the iron stopper, the molten bronze flows into the runner, penetrates into the mould, fills up all the hollows, and returns to its level, the surplus metal flowing out at the vent into the basin that has been hollowed out of the block to receive it, preceded by the air and gas driven out by the entry of the metal.

If the operation has been made without producing noise, the casting may be considered to have been successful, but notwithstanding all the care taken to attain success, some fault may have occurred.

The natural curiosity to learn the result may soon be satisfied, for in a quarter of an hour the metal will have cooled sufficiently to allow the block to be broken up.

The workmen begin by lifting off the iron frames, and then removing the earth that was pressed round it, commence to break up the block with iron picks, proceeding with precaution, and as soon as any portion of the bronze shows itself the picks are laid aside for smaller and lighter tools, with which the *potin* that surrounds and conceals the work is at length removed, the bust gradually appears, and it is possible to judge whether the casting has been successful; the bust itself, however, is covered with a white crust from the *potin* still adhering to it, and which only partially detaches itself. To get rid of this crust entirely is a work of some time.

The runner, the vent, and the drain, which have been transformed by the casting into solid bronze, are now sawn off, the core inside the bust is broken up, and the bust is emptied; it is then placed for several hours in a bath of water and sulphuric acid, and when taken out is vigorously scrubbed with hard brushes, rinsed in clean water, and allowed to dry. The bust is now handed over to the chasers, who efface the traces left by the runners and vents, remove any portions of metal that may fill up the cavities into which the *potin* has not penetrated, stop up with bronze the little holes left by the iron pins, and in fact place the work in a perfect state, leaving, however, untouched the epidermis of the bronze, for in this consists the merit and value of the *cire perdue* process, which renders so completely every touch of the artist that it seems as if he had kneaded and worked the bronze with his fingers.

The bust, now completed, is placed in the hands of the bronze decorators, who give it a "patina" in imitation of that produced by oxidation. The color generally preferred for portrait busts is the brown tone of the Florentine bronzes. This artificial "patina" can be produced in a great variety of tones, light or dark, but in every case it is preferable that a well-modelled work should have a dead unpolished surface.

The decoration of a bronze work is a question of taste or fashion for which there is no rule, though no doubt for many the success of a work depends very often on its decoration. — *The Architect.*

THE LAST OF THE BELT-LAWES CASE. — The Court of Appeal has rendered its decision in the Belt *vs.* Lawes libel case. It sustains the verdict of the lower court, which gave the plaintiff £5,000, and allows no new trial. In consequence of this Mr. Lawes has presented a petition in bankruptcy.

THE ILLUSTRATIONS.

TOWN-HALL, BELMONT, MASS. MESSRS. HARTWELL & RICHARDSON, ARCHITECTS, BOSTON.

THIS building is situated upon the easterly slope of Wellington Hill, at the junction of Concord Avenue and Pleasant Street. The lot falls sharply toward the south, and advantage is taken of this to place the rooms for town officers in a story which, while it forms a basement to the public library above, is at the same time wholly out of ground; the base of the tower containing a large vault of masonry for storage of records, etc. The principal story contains the town-hall, with a seating capacity of 585, with a gallery and the usual ante-rooms at front, and a stage, stage fixtures and dressing-rooms; and to the right of the hall, separated from it by a brick wall, and occupying the space above the town offices, as before stated, are the apartments of the public library. Over these is a large room chiefly used as a practice-room by the local musical society. A memorial to Belmont's fallen heroes stands under the large arch of the main entrance. The building is of brick and terra-cotta, and is finished internally with ash, the hall having an open-timbered roof. The cost of the structure, which was completed two years since, was, in round numbers, $42,000. The arrangement of the building, its adaptation to the site, and its general attractiveness, are proving of great value to the town, by calling out and drawing to it social elements which had not before been developed, and is a striking example of the advantage of money judiciously expended in a public building of this character.

HOUSE FOR GEORGE EVANS, ESQ., ALBANY, N. Y. MR. ROBERT W. GIBSON, ARCHITECT, ALBANY, N. Y.

THIS building was commenced last summer, and is now being finished. The materials used in exterior work were, for the basement, light-red Potsdam sandstone, with rock face; walls of bright-red Croton brick, with Potsdam-stone finish having tooled face, parts of it carved; roof of red Akron tile with terra-cotta cresting.

Contractors, Eaton & Co., of Albany, for the whole work, except steam-heating and elevator. Stone-cutting sublet to McMurray & Brooksby, Albany. Machine wood-work to F. A. Gilbert, New Haven, Conn; steam-heating by Bates & Johnson, Albany; elevator by Otis Bros., New York. Cost, thirty cents per cubic foot, exclusive of steam-heating and elevator.

ACCEPTED DESIGN FOR A MONUMENT TO THE VICTIMS OF THE NEWHALL HOUSE FIRE, MILWAUKEE, WIS. MR. HENRY O. AVERY, ARCHITECT, NEW YORK, N. Y.

THIS monument, entirely of granite, is to be erected in the Forest Home Cemetery, Milwaukee, Wis., to the seventy-two victims of the Newhall House fire. Twelve mounds with six names on each in incised letters radiate from a drum, on which is a sentiment in flat-faced polished letters, raised one-sixteenth of an inch; from this drum to top the work has eight sides, four of which are double the width of the others; this (octagon at base) penetrates into a truncated cone. Total height of monument twenty-six feet.

HOUSE FOR DR. F. A. DUNSMOOR, MINNEAPOLIS, MINN. MR. M. P. HAPGOOD, ARCHITECT, HARTFORD, CONN.

COLORED GLASS.[1] — I.

IN my last lecture I treated of marble as being the most perfect of all opaque materials, because we can not only get refinement, lustre, and a wide range of color, but we can construct with it, as the Romans and Italians did when they wanted strength as well as color and polish.

We can scarcely call glass the most perfect transparent material, as it is but the imitation of a gem, though in point of translucent color glass is probably equal to any gem.

I do not know that glass has ever been used structurally, though it might be. Nero built a temple of diaphanous marble, and we read of palaces built of gems in the "Arabian Nights."

It is, however, absurd to compare marble with colored glass; for, though in the former you get lustre and dignified color, in the latter you *can* get their apotheosis, — effects that outrival the rainbow and vie with the flame, that plunge you into ectasies and ineffable bliss; effects so lovely and marvellous that for a time they banish the thought that they can be the results of man's imperfect endeavors.

The mediæval founders — who evidently felt the rapture of color, and knew the fascination it had for the multitude — made their churches and cathedrals mere picture-galleries to display this heavenly light.

Unfortunately for us, we mostly see these galleries without their pictures.

Although colored glass is not architecture, I did not think it out of

[1] From a lecture by Mr. G. Aitchison, A. R. A., delivered at the Royal Academy on Monday, February 25.

place to speak of it, as I not only hope you will hereafter have to build for it, but it has the making or marring of a building in its power; in fact, I may say more: if the colored glass is of the finest quality, it will, like charity, cover a multitude of sins.

I propose to give you a short account of what is known of the origin and history of glass, a substance that has added so much to our comfort, refinement, pleasure and delight, to offer you my opinion on the merits of the different styles of colored, stained, and enamelled glass, to drop some hints on its proper employment in buildings, and to say something about its future prospects.

How glass was discovered is hidden in prehistoric darkness, for the chemist tells us that we may dismiss as fabulous Pliny's well-worn story of how it was first made in the open air; but as tradition has so hallowed the story that no treatise on glass is without it, I will repeat it. Some merchants had moored their vessels on the seashore, by the mouth of the River Belus, and supported their cooking-pots with some of the blocks of cubic nitre with which their vessels were laden; the fires melted the sand and soda, and glass was the result.

A more probable account is given by Josephus, who tells us that the art of making glass was discovered by some Jews, who set fire to a wood on a mountain, that the heat melted the sand and caused it to run down the mountain. We have all heard of lumps of dark glass being found amongst the ashes of burned haystacks, and in large fires I have seen the face of brickwork fused, so that dark-green tears had run down it. After the burning of the Armory at the Tower, the gun-flints were found partially fused into masses, and covered with a green glass-like glaze. As it would have been too expensive to burn down a forest every time glass was wanted, we may rather suppose that the constituents and qualities of glass became known in the prehistoric furnaces where metals were smelted and new fluxes tried.

Glass was not only known to the ancient Egyptians, but they became most skilful workers in it, and have left most beautiful objects in parti-colored glass. They left representations of glass bottles with wine in the two thousand years before our era. The Greeks knew glass; they could scarcely fail to do so when they had such intercourse with Egypt, although it is not mentioned in Homer.

Herodotus, who died about 408 B. C., speaks of the columns he saw in the Temple of Hercules at Tyre, each of which was cut out of a single emerald, and at night threw out a marvellous light. They were probably of hollow green glass into which the priests had put lamps. We know that the Santo Catino, or holy grail, now at Genoa (an engraved plate of green glass), was, for many centuries, believed to be an emerald.

Glass cups are spoken of in the "*Acharnians:*" "We drink against our wills from cups of glass and golden chalices;" and the "burning glass" is mentioned in the "*The Clouds.*" Aristophanes died B. C. 380. Glass was also known to the Assyrians, and probably to the Chinese, for Pliny's description of the glass of India made out of broken crystal corresponds to a Chinese method of making glass, and they imported it into India for enamels.

In our version of the Old Testament glass is not mentioned; but Michaelis, writing in 1754, says the word "crystal" in Job xxviii: 17, is "Zechucketh," which all learned Rabbis before Christ translated as glass. The date of Job is said to be 1520 B. C.

It is needless to say that the Romans used glass, for, to every boy who has learned Latin, "*O Fons Bandusiæ, splendidior vitro*"[1] is familiar. Horace died in the year 8 B. C., aged fifty-eight, and Vitruvius, who was born 80 B. C., speaks of glass, called Ὕαλος by the Greeks. About the date of our era glass mosaic was used to decorate vaults, ceilings, and other portions of buildings at Rome and in the Roman Empire.

Pliny tells us that Sulla's son-in-law, M. Scaurus, "During his ædileship, and only for the temporary purposes of a few days, executed the greatest work that has ever been made by the hands of man, even when intended to be of everlasting duration; his theatre, I mean. This building consisted of three stories, supported upon three hundred and sixty columns. . . . The ground-story was of marble; *the second of glass*, a species of luxury which ever since that time has been quite unheard of, and the highest of gilded wood." (Lib. xxxvi, cap. 24.)

It is curious that Pliny gives us no hint of how this glass was used, whether structurally, as windows, or as wall ornaments; but it is believed that slabs of opaque glass were used in this theatre as wall linings. At any rate, opaque glass slabs came into vogue for that purpose later, and were even used as paving in the shape of tiles, and amongst marble mosaic.

He also says: "There is an artificial obsian [obsidian], made of colored glass for services for the table; and there is also a glass that is red all through, and opaque, known as 'hæmatinum.' A dead-white glass, too, is made, as also other kinds, in imitation of murrhine color, hyacinthine, sapphire, and every other tint; indeed, there is no material of a more pliable nature than this, or better suited for coloring." (Lib. xxxiv, cap 67.)

That the Romans brought it to such perfection need hardly surprise us when we know that in the time of Nero £50,000 was paid for a pair of cups.

As far as I can find out, no one has as yet been sufficiently interested in colored-glass windows to dig out the accounts of their first introduction from the writers of antiquity or of the Dark Ages. We learn from Pliny that almost any color could be given to glass, and, in his description of gems, he says, speaking of the opal, that "There is no stone that is imitated by fraudulent dealers with more exactness than this, in glass." (Lib. xxxvii, cap. 22). If the Romans set their gems transparently in rings this might have suggested stained-glass or the casual holding up of pieces of colored glass for mosaic on any perforated material.

Pliny uses a strong argument to prove that glass mosaic was not known in B. C. 27, when Agrippa built the Pantheon, and either glass must have taken a rapid stride between that time and Pliny's death in A. D. 79, or else glass mosaic must have been introduced from some country where this mode of decoration was practised, for we find glass mosaic used in fountains at Pompeii.

Mr. Nisbett, quoting from the Chronicles of the Singhalese Kings, about B. C. 386, says, "Windows, with ornaments like jewels, which were as bright as eyes." This may mean stained-glass windows, but it may not.

We know from Pliny that talc and various sorts of translucent substances were used for windows, and traces of talc have been found in the rabbets of the windows at Sta. Prassede, at Rome. I give you Martial's epigram on the subject of windows and conservatories: —

> "Your oranges and myrtles, with what cost,
> You guard against the nipping winds and frost!
> The absent sun the constant stoves repair;
> Windows admit his beams without the air.
> My garret, too, hath windows, but not glasses,
> Where Boreas never stays, but often passes.
> For shame! to let an old acquaintance freeze!
> I had much better live amongst your trees."
> Lib. viii, e. 14 (Hay).

But we have ocular proof that uncolored glass was used in Pliny's time for windows; the pane of glass found in a bronze frame in the house of the Faun at Pompeii; the large square in the bath, 3′ 8″ x 2′ 8″; a window described by Sir W. Gell as containing four panes divided by cruciform bars of copper, fastened with nuts and screws to remove the glass; and in a Roman two-storied villa on the Herculaneum road a large glazed window was found. The glass was very thick and greenish, and *set in lead like a modern casement.*

Prudentius, 337, A. D., says of St. Paul beyond the walls of Rome: "In the windows are displayed glass of varied colors as brilliant as the fields of flowers in spring."

And in 398 St. Chrysostom praises the high glass windows of various colors. It is believed that Justinian, who built St. Sophia in 532 A. D., ornamented it with colored windows of cast glass.

I am loth to quote from the "*Arabian Nights,*" because it is supposed to have taken its present form in the sixteenth century, though some of its stories are as old as Homer; but in the City of Brass, a story supposed to be of the time of the Caliph Abd-El-Melik, the son of Marwán, who reigned from A. D. 685 to 705, there is this passage, which may refer to glass: "Around which were lattice windows, decorated and adorned with oblong emeralds, such as none of the kings could procure" (Lane's Translation of "*One Thousand and one Nights,*" vol. iii, p. 134).

Mr. Hendrie, the English translator of Theophilus, informs us that "Fortunatus of Poitiers," in the sixth century praises the bishops who ornamented their churches with stained-glass windows;[2] and Euracius, of the eighth, ninth, or early part of the tenth century, gives directions for making colored glass; there is also a MS. given by Muratori, and said to be of the eighth century, where directions are given for making it. Theophilus, of the eleventh century, or, as Viollet-le-Duc thinks, of the twelfth century, in his essay "*Upon Various Arts,*" gives directions for making and painting colored glass, and was evidently well versed in the art of enamelling it. Unfortunately his recipes for colored glass have been lost, although from the index to his MSS. he must have given them. Yellow and purple glass he speaks of, but only as found accidentally when white glass was being made; but he speaks of blue, white, red, green, and all kinds of colors, and gives the recipe for making gold mosaic; he also tells us that the opaque glass of the Pagan mosaics was used as gems, and says, "Divers small vases are also found, of the same colors, which the French, most intelligent in this work, collect, and some melt the sapphire in their furnaces, adding to it a little clear and white glass, and make costly plates of sapphire, very useful in windows." (Lib. 2, cap. 12.) In his recipe for white glass he tells us it was made with washed sand, and the ashes of dried beech-wood.

In a MS. on the subject (*Sloane Collection*, No. 3,661), the following notice is found: "This book pertayneth to me John Elyot, which was written out of an old copye (xxx) in Anno 1572: which copye seemeth to be above 200 years old." In it is given the recipes for making blue, violet, emerald, bolass-ruby, ruby, carbuncle, sapphire, hyacinth (reddish-brown or blood-red), topaz (yellow, saffron yellow, brownish yellow, and reddish pink), garnet, chrysolite (olive green), turquoise, and carnelian glass; the blue owes its color to cobalt; the violet to manganese; the emerald to copper; bolass-ruby and ruby to copper and iron; to gold for the carbuncle; to lapis-lazuli for sapphire; to gold and iron for hyacinth; to gold and lead for topaz; to gold and hematite for garnet; to zinc for chrysolite; to gold and lapis-lazuli for turquoise; to tin, mercury, and golden mercasite (iron pyrites) for carnelian.

Colored-glass windows may be divided into two grand divisions, the

[1] Oh, Bandusian Fountain! more brilliant than glass.

[2] An essay upon various arts, in three books, by Theophilus, called also Rugeus, priest and monk, forming an encyclopædia of Christian art of the eleventh century—translated, with notes, by Robert Hendrie, 1847.

Eastern and the Western; the Eastern formed by the insertion of thin unshaded colored glass in, or onto patterns cut in stone, marble, plaster, or wood; and the Western where the glass is fitted into leaden frames, and shaded, although I believe the clear glass roundels of the lower windows in Eastern houses are set in lead, both methods having been used in Rome.

In Oriental work the wide chamfered bars of plaster forming the pattern not only act as a dark separation confining the radiation to their own chamfers, but when seen at a proper angle the effect of shading is produced. One bright jewelled spot of the pure glass is seen, and the remainder of the color is but the reflection on the chamfer. The ground is formed in this wise: the plaster is thinned and pierced with round holes, which are glazed with one color, though often modified in tone and tint; from the small size of the holes the radiation would be more confined, yet the light reduces this large area of blank space to a fine network. Although I have never seen it done, I should think this mode of glazing might even be adapted to figures. Of course, in Mussulman countries figures are inadmissible. I believe no complete colored-glass window in the West is older than the twelfth century, though some of the tenth and eleventh centuries are spoken of.

It seems a contradiction to speak of grisaille windows under colored glass, but in old glass the grisaille was not white, but of varied light tones, such as sea-green, pale blue, fawn, pink, pale brown, and such pale tints, and the glass was more like onyx, agate, or alabaster than like clear glass. The Cistercians eschewed color, but tried to make amends for its absence by the choice of rich patterns in the lead-work. In many cases the early grisailles are almost equal in beauty to the finest colored glass.

I once had a glimpse of the grisaille windows in the cathedral at Poitiers towards dusk, and the impression of the soft and varied loveliness of their pearly hues impressed me only a degree or two less than did the windows of Florence or Chartres.

When grisaille is made of pure white glass, even if it be ground, or rough and full of bubbles, nothing more vapid can be imagined, and the introduction of one such window amongst colored ones utterly spoils their effect in a building.

Even when the glass was of the thickest and best quality, and was greatly varied in tint and tone, it was found advisable to insert colored bands and jewels, so as to lead the eye to the colored windows, and to prevent a sudden break of continuity, but there was a general inclination to mingle colored subjects with jewelled grisaille, or to alternate it with them.

We hear from Theophilus that he had seen, admired, and tried to imitate the colored-glass windows of Sta. Sophia, and we may well believe, from what we know of the mosaics at St. Vitale, St. Apollinari, and the tomb of Galla Placidia, that these stained-glass windows were not less lovely in color, and that the laws of harmony were as fully understood.

To whatever cause we may attribute it, the fact remains that the glass of the twelfth and early part of the thirteenth centuries is the most splendid that yet remains to us; the gorgeous color indulged in by the Romans at Byzantium had, no doubt, its effect, for that was the centre from which all the arts had flowed. The Roman emperors found the mosaic for the mosque at Damascus as well as for the Kaabeh at Cordova, they found the architect for St. Mark's, and we hardly know when Byzantine influence was absolutely at an end before the final extinction of the Roman empire in 1453, by Mohamet II.

The splendor, too, of the Court of the Caliphs must have had its influence on mankind, and doubtless the magnificent stuffs and tapestries made for it found their way into Europe, even if it were only in the shape of presents. The account of the presentation of the Ambassador of Constantine IX to the Caliph-el-Muktedir, A. D. 917, gives us some notion of the wealth and display then existing at Bagdad; and about this time Arab art and learning began to affect the West, though the forms in these twelfth and thirteenth century windows are still mainly Byzantine.

The glazier's art was then, too, at its zenith, and it is also possible that at this time the color sense was exceptionally developed.

We know that Theophilus was a monk, and he apparently wrote his treatise for another monk. If he lived in the twelfth century his being a monk may account for some of the excellence of the work, but whether the windows were done by monks or laymen, the same qualities would, and will produce similar effects, when the natural gifts exist and grand opportunities for their exercise; I mean a strong desire for the perfection of the art (for the art's sake alone, apart from all selfish considerations), combined with acute observation, untiring industry and patience.

The twelfth and thirteenth century windows were of the deepest and richest colors, the ground generally being of crimson and azure, and only rarely of emerald, the figures and objects in the pictures were paler in tone than the grounds, often strikingly original in their harmonies, and between the pictures there was a fully-colored diaper, and white was used as a jewel so precious, indeed, that the narrow strips were often painted to form strings of pearls.

In the aisles of churches patterned windows were generally adopted — I mean by this a window formed into a pattern with the circles, oblongs, or cusped spaces filled in with figure-subjects, — and in the clerestories gigantic figures. If you stand in the round part of the Temple Church you will observe the beauty of the east windows, and particularly the marvellous effect of the main forms of the patterns; but it is in the nave of Chartres that we find patterned windows that exceed in magical beauty any other manifestation of color that man's hand has achieved. Some notion of their beauty may be got from those at Canterbury. I was unfortunately unable to get some tracings of these done in time.

When we look at Titian's "Entombment," Bonifacio's "Finding of Moses," or some of the sketches of Schiavone or Paul Veronese, we think it impossible to find greater beauty of color; but these masterpieces, as far as their color goes, leave us comparatively emotionless when put in the scale with these windows of Chartres. We say what geniuses these men were; but when we look at the windows it seems as if some divinity had melted every lovely jewel and every tone of mother-of-pearl, and poured out a cascade of colored glory that flames, sparkles, and throbs, that raises us to ectasies, and makes us thankful that the tempter of mankind is not there to offer us the power of making such for his usual fee, and we ask ourselves if they were really made by men, and not sent down to us direct from heaven to give us a taste of its delights. We have the apotheosis of color, and though, on close inspection, we may find the composition ludicrous, and the drawing childish, though the saints have purple or green hair, we are no more disturbed by that than a musical devotee when he hears the most exquisite song sung by a woman with the loveliest and most cultivated voice because she is singing nonsense in an unknown tongue.

After this apogee of the glazier's art two or three causes combined to drag it down; it is undoubtedly the case that this full and rich-toned glass did produce, not merely "a dim religious light," but almost gloom, and this rich-colored glass was probably very dear, the want of funds and of cheerfulness probably combining to urge the introduction of white glass.

PREHISTORIC ART IN AMERICA.

MONUMENT TO ISABEL THE CATHOLIC — MADRID SPAIN

THE *Popular Science Monthly* for March contains the following paper by the Marquis de Nadaillac, translated from the *Revue des Deux Mondes*: —

The world of science was astonished a quarter of a century ago by the discovery made in the caves of Vézère, France, of works of art executed by the prehistoric troglodytes. The specimens consisted of representations of mammals, birds, fishes, and of man himself, sculptured in relief or engraved upon elephants' tusks, bears' teeth, the shoulder-blade of a reindeer, the long bones of deer, or on stones or beach-pebbles, and included the huge cave-bear, the mammoth with its heavy mane and upturned tusks, the seal, the crocodile, and the horse. These drawings, the first efforts of man, are crude in shape, but suggestive of vital action. One of the stag-horns, engraved with representations of reindeer and fishes, is almost a masterpiece. The deer are following one another, and one of them has turned to look back, doubtless so as to see her fawn. The heads are all drawn in profile and without foreshortening, as in the Egyptian paintings and sculptures; sometimes the lines are light, at other times they are cut deeply to bring out certain parts. By a curious caprice, the artist, after having completed his first design, has put fishes in all the vacant spaces, and they too are wonderfully truthful. M. Massenat has discovered, at Laugerie Basse, a piece of reindeer-horn about ten inches long, on which was plainly engraved an aurochs running from a young man who is about to shoot an arrow at it. The animal has its head down, with its horns in a position of menace, expanded nostrils, and tail raised and curved, all being signs of terror and irritation. The man is naked, and has a round head, with coarse hair, which is brought up over the top of his head, and an obvious beard on the chin. His whole physiognomy expresses joyousness and the excitement of the chase. The women have flat breasts and prominent hips. One of them, very hairy, is drawn between the legs of a deer, and wears a collar around her neck; unfortunately, her head is wanting.

A considerable number of engraved stones and bones have been brought to light in the excavations of the cave of Thayngen, Switzerland. Among them is a reindeer, standing with its head inclined toward the ground, and drawn with a precision showing a really remarkable acquaintance with the form of the animal. The artist had attained such perfection that observers were at first tempted to ask if they had not been invited to look at one of the archæological frauds that have unhappily become so common. But the excavations had been watched with unremitting care; the witnesses of the discovery were honorable men of science; the calcareous deposit of more than a yard thick had been taken up under their eyes; there were found in the cave reproductions of animals which had disappeared centuries ago — the musk-ox, for instance; and the engraving was so faithful that it could have been made only from nature. It was necessary, then, to surrender to the evidence. Away back in the quaternary ages, in the midst of the hardest conditions of life, of the struggle for existence, and of incessant conflicts against the great pachyderms, the bears, and the feline animals that swarmed around him, man already had the feeling or the instinct of art. He tried to draw the likenesses of the animals he saw and of the trees that shaded the cave he lived in; and the productions of his industry, found again after so many ages, are all the more interesting from the fact that the extemporizing artist had, to assist him in his work, only some wretched flints or roughly-sharpened bones. The inquiry whether these discoveries made in the west of Europe are verified in other countries, and whether this art-feeling was innate in man and has characterized him always and everywhere, is one of much interest. The excavations in Asia and Africa are still too few, and the discoveries that have been made there are of too little importance, to warrant the drawing of serious conclusions respecting those quarters. We must, then, turn to America, where eminent archæologists and enthusiastic collectors have eagerly studied all that relates to the past of the human race. With the aid of their publications and the photographs they have distributed with rare liberality, we are able to follow the ancient populations in their migrations from the shores of the Atlantic and the Pacific, to study their habits and their progress, and to show that among them also art was born at a very early epoch and that it grew up with the generations.

It has now been ascertained that man lived in America during the quaternary ages, contemporaneously with the mastodons and the huge edentates and pachyderms, which had no other resemblances with the mammals of the Eastern continent than those of size. Like their contemporaries in Europe, the primitive Americans wandered in the solitary wilderness, and disputed with animals for the prey on which they fed and the caves that sheltered them, having for weapons of offense and defense only the flints that lay at their feet. Their barbarism appears to have been lower than that of the troglodytes of Europe, and to have been destitute of all artistic feeling and taste for ornament. Ages passed, the duration of which we cannot compute; the quaternary animals disappeared, and man became sedentary; and he has left as evidences of his long abode in the same place the heaps of refuse exemplified in the shell-mounds and kitchen-middens of the Atlantic coast, the Gulf of Mexico, the banks of the Mississippi and the Amazon, the Pacific coast, and Terra del Fuego. Excavations made at several points have brought out hatchets, knives, harpoons, and tools of every shape, of stone, bone, and horn, all bearing witness to a backward social condition, fragments of carbonized wood, bones of animals, and fish-bones, all having evidently been accumulated by men who knew nothing of agriculture and lived by hunting and fishing. Occasionally a few shards of pottery have been found among the remains, made of clay mixed with pounded shells, fashioned by hand and dried in the sun. Sometimes plaited vines or canna-stems have been impressed on the wet parts, or lines have been scratched on the vessel with the point of a shell or a flint. These are the first efforts at ornamentation, and are singularly like those of the most ancient potteries of Europe. Ornaments designed for the decoration of the person are more rare than the potteries. We can only cite a few bears' or cats' teeth and shells bored for the purpose of being hung from the neck, except in the *sambaquis* or kitchen-middens of Brazil, where a few figures of fishes and idols in gold and silver have been found in very ancient deposits of guano.

We can form only the most imperfect estimates of the dates of these remains. Geological evidences give no definite clew. The growth of trees over the kitchen-middens may fix dates previous to which they certainly existed, but when we have admitted the five or six centuries it took the trees from the time the wind wafted the seed to the spot, how are we to compute the number of generations of plants that were required to furnish the soil on which they could grow? One point only is ascertained, and that is that no bones of quaternary animals have been met under the kitchen-middens, and, with the exception of the figures we have mentioned, no metallic objects. The remains must, then, have been accumulated between the period of the disappearance of the larger animals and the time when the metals came into habitual use. Must we say, then, that during that long series of ages no artistic tendency revealed itself in man? Yes, if we judge by the individual objects that have been collected; no, if we attribute to that epoch the pictographs, or the figures, scenes, hieroglyphics, or rebuses, as we might call them, which are painted, engraved, and sculptured on the cliffs, the sides of caves, the boulders and erratic rocks, or wherever a vacant space may have been offered to the artist. Men have at all times with a childish vanity endeavored to delineate their migrations, their contests, their hunts, and their victories. Egypt has transmitted its ancient history to us on granite; the rocks of Scandinavia still wear the likeness of the Vikings' vessels; and those around the *lac des Merveilles*, near Nice, bear pictures of men extremely primitive in design; curious engravings have been noticed in Algeria; the Bushmen, who are among the most degraded populations of the globe, have drawn on stone, with wonderful fidelity, their hunting scenes and their loves; and the rock-paintings of New Zealand, the work also of a barbarous race, but evidently superior in execution to the scratches of the Bushmen, have been described before the London Society of Anthropology. These are isolated facts, though curious ones; but in the two Americas the number of pictographs and the extent of surface they cover give them an exceptional importance. The desire, not only to reproduce striking events, but also to give precision to their sense by conventional signs, by graphic strokes, or by hieroglyphics or phonetic or symbolical characters, is one of the most remarkable traits of the different races that have succeeded each other on the new continent. Although the initial date of these engravings is unknown, we can nevertheless affirm that they continued to be executed through many ages, and that while the most ancient ones ascend to remote epochs, in some instances these historic drawings only a little while preceded the arrival of the Europeans. Pictographs are especially abundant in the regions that formerly constituted Spanish America; in Nicaragua, near the extinct volcano of Masaya; in the United States of Colombia, on the banks of the Orinoco; and in Venezuela, where in consequence of their antiquated condition they will soon cease to be distinguishable. The rocks of Honduras are covered with sharply-cut designs; the *conquistadores*, in 1520, remarked similar works in the Isthmus of Darien; and in the State of Panama entire cliffs were charged with hieroglyphics that might afford matter for very interesting studies. In the Sierra Nevada, between Columbus, Nevada, and Benton, California, are hosts of figures of men and animals and uninterpretable signs. About twenty miles south of Benton, the road follows a narrow defile, bounded on both sides by nearly perpendicular rocks, and these are covered with figures in respect to which no clew exists as to the people that designed them.

Pictographs are little less numerous in Arizona, New Mexico, and Colorado — in parts of the country which, though now desolate, were formerly inhabited by a considerable population. The glacier-polished boulders of the valley of the Gila River have figures that may be compared with those of Thuringia. On the banks of the Mancos and the San Juan, and in the deep cañons stretching up toward the east, the figures are visible at dizzy heights, some deeply engraved, others drawn in red or white. Among them is a procession of men, animals, and birds with long necks and legs, all going in the same direction. Two of the men are standing on a sledge drawn by a deer, while others direct the march of the drove. The artist evidently intended to represent a migration of his tribe. In another pictograph on the banks of the San Juan, among figures of strange forms, and of drawing incorrect but full of movement and life, may be recognized a number of flint hatchets, exactly similar in pattern to the symbolical hatchets that are cut on the megaliths of Brittany.

At another spot a cliff is covered, for a space of more than sixty square feet, with figures of men, deer, and lizards; and M. Bandelier has seen, near the ruins of Pecos, pictographs, the high antiquity of which is attested by the degree of effacement they have undergone. They represent the tracks of men or children, a human figure, and a tolerably regular circle. On the banks of the Puerco and the Zuñi, two of the affluents of the Colorado Chiquito, designs have been remarked having the appearance of hieroglyphics, but their significance is unknown, and we can not even affirm that they had any. The cliffs near Salt Lake in Utah are adorned with sculptures, among which are human figures of the natural size, cut in a hard rock more than thirty feet above the ground. All together show an amount of labor of which the Indians are incapable, and a sum of difficulties which they could not have overcome; and the height at which some of the sculptures appear allows the supposition that some geological phenomenon, perhaps a depression of the lake, may have occurred since they were executed. Many drawings on stone have also been observed in the eastern parts of the United States.

Pictographs to which we are disposed to accord a great antiquity are to be seen on the sides of caves in Nicaragua. Some grottos in the mountains of Oajaca also bear witness to the labor of man, in the shape of coarse paintings in red ochre. Among them is frequently repeated the imprint in black of a human hand. This imprint, which is probably borrowed from some myth, seems to have played a great part in America. It is found reproduced in regions very remote from one another, standing out on the potteries, sometimes in red on a black ground, sometimes in black on a red ground. In our own days it is occasionally found in use among Indians as a totem or coat-of-arms.

All that we have just said bears witness to a still primitive condition of art. The men who executed the works, barbarous as they seem to have been, were capable of rising higher. This is proved by works of a manifestly later epoch. Guatemala, the ancient land of the Quiches and the Cakchiquels, abounds in ruins. Bas-reliefs, statues, and monoliths covered with arabesques to the height of twenty feet, meet the traveller frequently. At Quirigua, a small port on the Bay of Honduras, a statue of a woman has been found, footless and handless, with a crowned idol on its head; excavations by the side of it have brought to light a tiger's head in porphyry. At Santa Lucia Cosumalhuapa, at the foot of the Volcan de Fuego, among the cyclopean stones and the statues of tapirs and caymans, lie colossal stone heads, of a strange type, hitherto unknown. Two of these heads wear the immense ear-rings peculiar to the ancient Peruvians, and a head-dress similar to the Asiatic turbans. Farther on are bas-reliefs in hard porphyry, larger than nature, representing personages as odd in conception as in execution, and mythological scenes that have no relation to any known form of worship. The most interesting bas-relief represents a human sacrifice. The principal personage is a priest; he is naked, and, according to the custom of the Aztec priests, wears a garter around his left leg; only the left foot is shod. The head-dress is a crab. One hand holds a flint, doubtless the sacrificial knife, while the other hand grasps the head of the victim to be slain. On a second plane, two acolytes are carrying human heads. One of them is a skeleton, a sinister symbol of death. Its head is of a simian shape, mingling the grotesque with the terrible. To cite more similar facts would merely involve unpleasant repetitions. We shall only add, then, that the figures are of a grinning aspect and a repulsive ugliness. The ancient American races did not seek for the beautiful, or, rather, did not comprehend it as we do, who have been taught by the immortal creators of the high art of Greece.

We have just occasion to be surprised when we think of the time that was required to execute these works, and consider what inefficient mechanical means the artists had to use. They had to detach blocks of hard stone by means of wretched tools of quartzite and obsidian, and to saw granite and porphyry with agave-fibres and emery. A coarse outline design indicated the part to be removed. The labor was executed either by sawing partly through the stone and deftly breaking off the fragment, or by pecking it away with a flint-point. Lastly, the surface of the planes was rubbed with flat stones or polishers, to remove the traces of the chippings. Other processes also appear to have been employed. The artist drew his figure in coarse tracings, and covered with ashes the lines he desired to bring out in relief. The whole surface was then heated with fire; the parts which were subjected to the direct action of the flames were decomposed, and left hollow places, while those that were protected by the ashes remained intact.[1]

For finishing his work, the sculptor had nothing better than a flint-point or a copper chisel,[2] the only tools in use, for iron was unknown. He was obliged, in order to execute those colossal figures and the bas-reliefs which now make such an impression of astonishment upon us, to cut with those imperfect tools in a very hard rock to a depth of three or four centimetres. The fact of the performance of a labor of such length is a certain indication of the infancy of the society in which it was done, where man had not yet learned to appreciate the value of time.

The region of the *piedras pintadas* (painted stones) in South America extends from Guiana to Patagonia. They are found in the wilds of Brazil and La Plata, as well as in the more civilized districts of Peru and Chili, and they betray everywhere a remarkable analogy. In the solitudes of Pará and Piauhy, Brazil, are numerous intaglio-sculptures, executed by unknown peoples; they represent animals, birds, and men, in various attitudes. Some of the men are tattooed, others wear crowns of feathers, and the picture is finished off with arabesques and scrolls. At la Sierra da Onça are drawings in red ochre, isolated and in groups, without apparent order, and the rocks of the province of Ceará and those of Tejuco are covered with tracings not unlike those on the rocks of Scandinavia. Humboldt describes intaglios on the right bank of the Orinoco, representing the sun and moon, pumas, crocodiles, and serpents, ill-formed figures, defined most frequently by a simple outline and declaring little advancement in art. Nevertheless, since they are cut in the hardest kind of granite, it is impossible to attribute them to the barbarous tribes that inhabited the country at the time of the arrival of the Europeans. These tribes were incapable of executing works of this kind, and even of comprehending any art, however crude it may appear to us. Who, then, were the peoples to whom we can attribute the painted stones? What was their origin? The illustrious German traveller tells us nothing that can diminish our ignorance on this point.

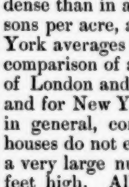
There are mentioned as among the works in the country of the Chibkas, in the United States of Colombia, a stone probably designed for sacrificial purposes, and sustained by caryatides, a jaguar sculptured at the entrance to a cave near Neyba, and gigantic llamas. In the land of the allied tribe of the Muiscao, the granite and syenitic rocks are adorned with colossal figures of crocodiles and tigers, guardians, doubtless, of the images of the sun and moon, the supreme gods of the South American natives. All of these figures are coarsely executed, and betray, like the North American figures, an extreme absence of taste and an absolute inability to reproduce objects faithfully.

Abundant examples occur on the Pacific coast of an art which we can best compare with that of Guatemala. A granite block near Macaya, known as the Piedra de Leon, is covered with sculptures which all are agreed are very ancient. The most important group represents a face-to-face struggle of a man and a puma. The figures suggest movement, and the man and the animal appear to be really struggling. Near the little city of Nepen may be seen a colossal serpent; a short distance from Arequipa, trees and flowers; farther on, bisons with bored noses are wearing movable rings cut in the same stone. At the Pintados de las Rayas, geometrical figures, circles, and rectangles, the meaning of which cannot be defined, take the place of figures from life. In the province of Tarapacá, considerable surfaces are covered with figures of men and animals, mostly fairly good specimens of work, and with a kind of characters arranged vertically. The lines are from twelve to eighteen feet long, and each character is quite deeply engraved. This is not an isolated instance. Inscriptions very much worn have been found near Huara, and between Mendoza and La Punta, Chili, is a large pillar on which letters have been imagined analogous in some respects with the Chinese alphabet. These evidences are very vague, and, however well disposed to discover in them the beginnings of graphic art, we can not as yet found so important a conclusion upon them.

The use of colors was certainly known to the Americans from the most remote antiquity. The ochres, soot-black and lime doubtless furnished them their first coloring elements, and there was nothing in the idea of using these pigments above the most primitive conceptions. Experiment induced a rapid progress, and men learned to extract vegetable colors from leaves, fruits, roots, stems and seeds. A coloring-matter was also borrowed, like the Tyrian purple, from sea-mollusks. The Peruvians and the Mexicans knew how to place the colors upon their cloths. The goods were then exposed to the action of the light, and tints varying from a delicate rose-color to a dark violet were obtained. The colors were so well fixed that they were not even modified by the decomposition of dead bodies. In the collection of cloths from the Peruvian *huacas* at the museum of the Trocadéro, in Paris, wrappings of mummies that have been buried for centuries still retain the primitive color on their time-eaten threads.

The Mexicans probably obtained the remarkable brilliant coloring of their pictographs by somewhat analogous processes. These pictographs, manuscripts of which only a smaller number have reached us, embrace the history of the country, its national traditions, the genealogies of its kings and nobles, the rolls of provincial tributes, the laws, the calendar, religious festivals, and the education of the children — a complete summary, in fact, of all that concerns the manners, customs, and life of the people. They were painted in various colors, on cotton cloth, on prepared skins, or on a strong and tough paper made from the fibres or the agave. At times the artist depicts scenes from real life; at other times he records facts by means of hieroglyphical, symbolical or phonetic characters, conventional signs that have been handed down for generations, and on which innovation is prohibited. Another series of pictures illustrates the education of children and their food and punishments. The father teaches his son to carry burdens, to steer a canoe, or to manage the fishing-tackle. The mother instructs her daughter in domestic duties; she sweeps the house, prepares *tortillas*, and weaves cloths. These pictures present the distinct outlines and bright colors which the Americans sought first of everything. Evidently we must not ask them for models of decorative painting. Their complete ignorance of proportions and the laws of perspective demonstrates that their art was the exclusive product of their own genius, or of the instinct of their race, and that they had not been subject to any foreign influence.

FIRES IN NEW YORK AND LONDON.



AT a meeting of the American Society of Civil Engineers held March 19, a paper by E. B. Dorsey, M. Am. Soc. C. E., on "The Comparative Liability to, and Danger from Conflagrations in New York and London," was read by the author.

The following were among the reasons given for the comparatively smaller number of fires in London as compared with American cities, and especially with New York. The comparatively damp climate of London, which prevents sparks or weak flames from igniting wood; the much higher temperature of the winter months, and consequently the smaller number of domestic fires. Statistics were given showing that lower temperature always largely increased the number of fires. The population of New York south of Fortieth Street is more dense than in an equal area of London, New York averaging 208 persons per acre, and London 191½ per acre for the same area. New York averages for the same area 16¼ persons per dwelling. Another comparison of about 750 acres of the most densely populated portions of London and New York, gives for London 249 persons per acre, and for New York 352 persons. The size of the houses in London is, in general, considerably less than in New York. Many London houses do not exceed 15 feet wide, 25 feet deep and 22 feet high, and a very large number do not exceed 16 feet wide, 30 feet deep and 40 feet high. All the London houses have fire-proof roofs, and in all cases there is proportionately much less wood, and more brick or stone than in New York buildings. There are also fewer and smaller windows than in New York. The walls are short, low, and generally well tied together, and so built that they will not fall after the little wood-work in them has been burnt, thus rendering it easier to confine a fire to the house in which it begins. There are no wooden roofs on buildings, and but little wood in the yards, in fences or out-buildings. The ash-barrel or ash-box, so frequent a cause of fire in New York, is unknown in London, each house being required to have a vault built of masonry for ashes. Lumber-yards, large stables, carpenter-shops, furniture-makers, wood-manufacturers, places for storage, the manufacture of combustible material are not found in the thickly built portions of London. The River Thames and the Parks

[1] Mr. Wiener saw the natives excavating an irrigation canal in the valley of Chicama de Sausal, through a rock which stood in the way. The workmen piled ashes along the line of the edges of the canal, covered them with dried manure and burned it. After eight days they succeeded in forming by this process a channel through a granite rock containing a vein of basalt 1.20 metre wide, 0.80 metre deep, and 2.30 metres long.

[2] There has been found near Quito a chisel that was used in working the large blocks of trachyte employed in paving the road of the Incas' empire. It weighed 198 grammes. The surface was worn, the edge was nicked, and the head appeared to have been hammered upon, all indicating that it had been subjected to long use. An analysis of a piece of it by M. Damour gave ninety-five parts of copper, a little more than four parts of tin, and slight traces of iron, lead and silver.

divide London in such a way as to greatly aid in preventing the spread of conflagrations. The numerous railroads running into London form effective barriers against the spread of fires. These railroads, with the exception of the Metropolitan and District Underground roads, are built upon heavy viaducts of brick or earthen embankments not less than 60 feet wide, or are in open cuts not less than 80 feet wide. There are also many wide streets in London, and numerous squares, crescents, church-yards and private grounds.

Some explanations of the unsatisfactory state of the laws in regard to structures in New York were given by Mr. Wm. P. Esterbrook, Inspector of Buildings, who was present.

METROPOLITAN SEWAGE DISCHARGE, LONDON.

THE first report of the Royal Commission on Metropolitan Sewage Discharge has been issued. It was appointed on June 22, 1882, and has limited its inquiry to two of the subjects laid before it. These are (1) the systems under which sewage is discharged into the Thames by the Metropolitan Board of Works, and (2) whether any evil effects result therefrom. The general conclusions are summarized by the Commissioners as follows: —

"1. That the works of the Metropolitan Board for the purpose of carrying the sewage of London to the respective outfalls at Barking Creek and Crossness have been executed in a highly creditable manner, and have been of great benefit to the metropolis.

"2. That the storm overflows allow the occasional discharge into the river within the metropolis of considerable quantities of solid fæcal matter accumulated in some of the sewers; but this has not caused, under present circumstances, serious damage or offence.

"3. That the sewage from the northern outfall is discharged partly over the foreshore, and not, as was originally intended, 'through submerged pipes terminating below low-water mark,' this arrangement increasing the risk of nuisance from the discharge.

"4. That the discharge of the sewage in its crude state during the whole year without any attempt to render it less offensive by separating the solids or otherwise is at variance with the original intention and with the understanding in Parliament when the act of 1858 was passed.

"5. That the discharge from the main outfalls becomes very widely distributed by the motions of the water both up and down the river, being traced in dry seasons through the metropolis and almost as high as Teddington; and that it oscillates for a long period before getting finally out to sea.

"6. That the dilution of the sewage by the land and sea water, aided by the agitation produced by the various motions in the river, effects a partial purification of the sewage by oxidation; and that this purification is carried further by the action of animal and vegetable organisms.

"7. That the sewage which becomes distributed to the higher and to the lower portions of the river thus gradually loses its offensive properties. The limits above and below the outfalls where this purification becomes efficient vary with the meteorological conditions, but it may be stated that in general above Greenwich and below Greenhithe the river does not afford ground for serious complaint.

"8. That between these limits the effects of the sewage discharge are more or less apparent at all times.

"9. That in dry seasons the dilution of the sewage is scanty and ineffective, especially at neap tides.

"10. That it does not appear that hitherto the sewage discharge has had any seriously prejudicial effect on the general healthiness of the neighboring districts; but that there is evidence of certain evil effects of a minor kind on the health of persons employed on the river, and that there may reasonably be anxiety on the subject for the future.

"11. That in hot and dry weather there is serious nuisance and inconvenience, extending to a considerable distance both below and above the outfalls, from the foul state of the water consequent on the sewage discharge. The smell is very offensive and the water is at times unusable.

"12. That foul mud, partly composed of sewage matter, accumulates at Erith and elsewhere, and adheres to nets, anchors, and other objects dropped into it.

"13. That sand dredged near the outfalls, which used to be obtained in a pure state, is now found to be so much contaminated with sewage matter as to be unusable, compelling the dredgers to go farther away.

"14. That for these reasons the river is not at times in the state in which such an important highway to a great capital carrying so large a traffic ought to be.

"15. That in consequence of the sewage discharge fish have disappeared from the Thames for a distance of some fifteen miles below the outfalls and for a considerable distance above them.

"16. That there is some evidence that wells in the neighborhood of the Thames are affected by the water in the river, and although there is no such proof of actual injury due to the sewage that anxiety may be felt on that point.

"17. That there is no evidence of any evil results to the navigation of the river by deposits from the sewage discharge, but that this discharge adds largely to the quantity of detritus in the river, and so must increase the tendency to deposit.

"18. That the evils and dangers are likely to increase with the increase of population in the districts drained.

"19. That it is desirable we should inquire further 'what measures can be applied for remedying or preventing' the evils and dangers resulting from the sewage discharge.

"20. That before we proceed to this further branch of our inquiry we should allow some time for the consideration of this our first report, and of the remedies which may be suggested for the evils which we have pointed out."

"A FAIRLY GOOD TRUSS."

BOSTON, March 17, 1884.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Gentlemen, — I am surprised at your comment under the above heading, upon "Subscriber's" communication of last week. You say "It is evident that the present truss, if the joints are securely fastened, cannot spread except by tearing A or D asunder." Theoretically trusses of this form cannot spread. Practically they not only can but do; slightly in some cases, considerably in others. There is a certain amount of *elasticity* in all of them.

Now suppose the trusses of the roof in question to have been set in position, the ½-inch rods adjusted under every third truss (as the article states) and the nuts turned up to a bearing. Next come the boarding and roof covering, and in due time wind and snow; there is considerable thrust to a rather flat roof of this width.

What is to hold it? Not the trusses, for they have not yet settled down to their work — being prevented from so doing by the "½-inch rods 10 feet apart."

It is the ½-inch rods which are to do the work — until they give way — which they will when about one-half the probable load has come upon the roof. And what then? It is altogether likely that the "trusses," unable to withstand the shock (whatever they might have done had the load been gradually applied), will follow the example of the rods and the building will be a wreck.

H. W. HARTWELL.

[WE do not wish to set up our single opinion against that of so skilful an architect as Mr. Hartwell. The point he makes as to the danger of tightening the iron rods so as to take the strain properly belonging to the truss, a strain which, as he says, they are not half strong enough to resist, is a very good one. Concerning the stability, not, it must be remembered, the economy, of the truss, independently of the tie-rod, we should be glad to have the ideas of other experts. — EDS. AMERICAN ARCHITECT.]

A BIOGRAPHICAL SUGGESTION.

March 12, 1884.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Gentlemen, — Your publication in a recent number of your journal of "A Group of American Architects," emboldens me to lay before you a suggestion I have had in mind some time. Many, if not all, of your readers and all persons who take an interest in the architecture of the present day would, no doubt, appreciate a series of portraits, accompanied with biographical sketches, of the leading architects of this country. You will probably recollect that the *Builder* some time since published such a series of the principal architects of England. The proposed plan might be extended in its scope so as to admit the portraits of celebrated architects of other countries. The portrait of Charles Garnier appeared in your journal a year or two ago, and being a great admirer of the literary works of Viollet-le-Duc, a portrait of their gifted author would be greatly prized by me, as it probably would be by his other admirers. Most respectfully, C. X. I.

[As we hold in utter abhorrence the modern analytical method, so-called, in which the magazine writer of the day delights to treat the work of a living celebrity of any sort, putting forward criticisms and opinions too generally negative and colorless, when not absolutely fulsome in their flattery, there is little likelihood that any such series as C. X. I. suggests will make its appearance in our pages. But if any "leading architect" will provide us with a photographic negative of his bodily presence, and a short autobiographical sketch, he may rest assured that in the fulness of time it will happen that we, with a sombre gladness, shall turn to our well-stored pigeonhole and make use of this material in a way to meet with C. X. I.'s approval, and so, too, as to free ourselves from all reproach that we have written with any *arrière pensée.* — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS.

FLOODING THE SAHARA. — In view of the recent project to fill up the Desert of Sahara by connecting it with the Mediterranean Sea, a correspondent, E. L. B., writes to us enclosing a few figures, the result of some calculations. According to the latter it would require 4,000 years for the waters from the Mediterranean to fill the valley of the Jordan, which is 1,000 feet below the former, the water to flow through a passage 100 feet wide by 25 feet deep, with a velocity of four miles an hour. With a channel 100 times this capacity it is possible, he says, to limit the period of filling to forty years. At the same rate it would take 40,000 years to fill up the Caspian Sea to the sea level, and thousands of years to fill up the Sahara. — *Scientific American.*

The Rotch Travelling Scholarship.— The examination for the Rotch Travelling Scholarship which was advertised to be held at the Boston Art Museum, April 3d, will be postponed until April 4th, owing to the appointment of the former date as Fast Day in Massachusetts.

The Competition for the Victor Emmanuel Monument, Rome. — At the second competition for this monument, the designs of Signori Sacconi, of Rome, and Manfredi, of Piacenza, and Herr Schmidt, of Düsseldorf have been awarded premiums of 10,000 lire each. The three successful competitors have also received each 5,000 lire for preparing the clay models. After the execution of the latter, the artist whose work is placed first will be charged with the execution of the monument.— *The Builder*.

Crushing Strength of Ice.— At the March meeting of the Engineer's Club of Philadelphia, President Ludlow described tests of the crushing strength of ice which were made by him in order to learn, approximately, the strength required for an ice harbor of iron screw-piles, in mid-channel, at the head of Delaware Bay. Eighteen pieces were tried with Government testing-machines at Frankford, Philadelphia, and at Fort Tompkins, Staten Island. The specimens were carefully prepared six-inch and twelve-inch cubes, and roughly-cut slabs about three inches thick, of different qualities and from different localities. For pure Kennebec ice the lowest strength obtained was 327 pounds, and the highest 1,000 pounds per square inch. For inferior qualities the strengths varied from 235 to 917 pounds. The higher results were obtained, generally, when the air temperature in the testing-room was from 29° to 30° F., as against 55° to 68°F. for the lower results. The pieces generally compressed one-half to one inch before crushing.

Shaking Minarets of Ispahan.— "But perhaps the most curious and peculiar structure of all that we saw anywhere in Persia was shown us after a ride of some five miles through a perfect sea of gardens and irrigating kanats, and was no less than the shaking minarets — two tall columns of masonry some seventy feet high from the ground, rising half-way up in the two front corners of an old, inferior-looking mosque. These minarets, after reaching the roof of the mosque, raise their tapering heads some thirty feet or more higher still, as isolated columns, and distant from each other about twenty-five feet. A narrow spiral staircase winds up inside these columns, which we ascended to the top. Here, by dint of exertion, we could get the minarets to shake as though trembling from the effects of an earthquake, and what was still more surprising than this, we got a couple of Persians, who make a gain out of visitors by showing off their mosque to them, to ascend one of the minarets, while we went to the top of the other. Here we sat down, perfectly still, and notified the Persians opposite to shake the column they were on. They did so, throwing it nearly a couple of feet, I should say, out of the true vertical on each side. This shaking, by some mysterious connection through the solid masonry of the mosque, communicated itself to our column, and it in turn began shaking so violently as to oblige us to descend and seek relief in lessening the height between us and Mother Earth. How columns of solid masonry, from seventy to eighty feet high, and some twenty-five feet apart, can be made to shake and communicate the motion to each other, are questions that I am unable satisfactorily to solve, though many were the inquiries I made on the subject. The Persians, in the most matter-of-fact way, told me that the 'sympathetic motion' of the minarets was due to the restless, disturbed spirit of their departed saint, buried way below in the cellar of the vault of this mosque." — *Ballantine's Midnight Marches through Persia*.

Bronze in Prehistoric Times.— No doubt native copper, says an exchange, attracted the attention of primitive man before any of its alloys; but the difficulty of working it for a long time prevented its general use. How the metal came to be associated with tin in various forms is entirely unknown to us. Arms and implements of bronze in Egypt, Greece and Gaul present a constant proportion of tin — 12 per cent. The bronze of cannons is 8 to 11 per cent; of bells, 20 to 30 per cent. Recently at Réalon (Hautes-Alpes), a peddler's pack of bronze objects has been unearthed, showing 18 per cent of tin. The founders of prehistoric times seem to have had three methods of procedure: 1. The alloy was poured into a mould of stone or metal in two pieces. The ridge formed by the juncture was afterward hammered down. 2. A model of wood was pressed upon a layer of sand in a box, to obtain a negative of one side; a corresponding operation gave a mould of the other side. Two boxes fitted together completed the mould. There were still seams requiring to be hammered. 3. A model of wax was surrounded with soft clay. The clay was then heated to harden it and to melt the wax. The metal was introduced at the opening left for the escape of the wax. Soldering was unknown to the men of the bronze age; mending was done by riveting. The art of softening bronze was known to the ancients. Proclus says that "in ancient times men used bronze in cultivating the ground, just as they use iron now, but that copper being soft in its nature they hardened it by immersion." Eustathius also says that they tempered the bronze when using it in place of iron. The chemist Darcet, at the end of the last century, showed: 1. That pure copper, heated to redness and plunged into cold water, is neither hardened nor softened. 2. Bronzes having only tin alloy, and that less than 30 per cent, heated and cooled in air become weak and brittle. 3. The same bronzes, heated and cooled in water are softened, and become very tractable. It is nearly certain that the men of the bronze age tempered their implements in taking them from the mould. Those destined to stand a blow were left in this state. Arms and tools needing more temper were heated over and cooled in the air. Another prehistoric art rediscovered by the engineers of Alexandria, and recently again brought to light from the Orient, is rendering bronze flexible. This property of flexibility is certainly possessed by some very ancient specimens. The engineer Philo, who lived in the century before our era, describes, in his "*Treatise on Artillery*," the fabrication of springs of bronze needed in some of his machinery. The author from whom the foregoing notes are taken, A. de Rochas, has compiled a work on the origin of industry, and the first application of the sciences.

A Subterranean River in Austria.— One of the recent publications of the Austrian Tourists' Club contains a description of the "Recca Cave," which it is claimed must be ranked among the greatest natural curiosities of the Austro-Hungarian monarchy. The cave is situated near the middle of the Karst mountain-land, in the bare and sterile plateau that spreads out above Trieste, in a region rich with caves, and has been formed by the flow of the Recca River under the cretaceous hills. Similar river excavations are common in the region, but that made by the Recca surpasses all the others in extent. Near the railroad station of Vistrica-Ternovo, the Recca is a stream some fifteen or twenty paces broad, and two or three feet deep. Thence it flows along the border of the chalk and tertiary formations in a deeply-cut but pleasant valley, till it comes to a point where the chalk crosses its course in a semicircular range, and seems as if it would stop its further progress with a dam nearly four hundred feet high. The river has, however, conquered this wall by boring under it a tunnel fifty feet high and half as wide, through which it rushes in a very lively torrent. In the course of a little over a hundred yards it passes a chimney-shaped shaft which extends to the whole height of the mountain, and presents an opening more than thirty feet in diameter at the surface. After another hundred yards the stream crosses the floor of a *doline* (or sinkhole) four hundred feet broad, and then, after crossing a narrow ledge, enters the great *doline* of St. Cauzian. Here the steep, frequently impending rocks on three sides form a gigantic kettle, the western wall of which falls perpendicularly more than five hundred feet. On the southern side a turf-covered slope descends toward the bed of the river, to end abruptly in a precipice of nearly two hundred and fifty feet. Having twice bored the hills for relatively short distances, the Recca continues its course till it meets the rock wall a third time and excavates a third subterranean channel, this time of thirty-five kilometres, or twenty-two miles. This is the Recca Cave proper, and from it the stream emerges near San Giovanni di Duino into the important river, though a short one, the Timavo, the mystery of the origin of which has been solved by this tracing of the course of its main current.— *Popular Science Monthly*.

Poetsch's Freezing Process for Excavations in Quicksands.— Engineers have discovered a new use for ice machines. The idea is to convert the quicksand or any soft, water-soaked soil into solid rock of convenient hardness for excavation by means of a freezing mixture. Iron pipes eight inches in diameter, and closed at the lower end, are forced down into the soft sand and mud. Inside of each pipe is an open pipe of smaller diameter to afford circulation for the cooling liquid, which is forced down through the inner pipe and returns through the larger one surrounding it. The cooling liquid is a saturated solution of chloride of calcium, which is cooled to 30° or 49° below zero by means of an ice-machine. In a short time each tube becomes surrounded with a conical mass of frozen soil about as hard as fluorspar. As the work progresses the whole space between the pipes becomes solid, and can be removed like any other rock. This process has been used successfully in deepening a shaft at the Archibald Brown coal-mine. A shaft 15′ 8″ x 10′ 6″ was driven through a strata of quicksand 18 feet thick. The cold was produced with an ammonia ice-machine built by Kropff, in Nordhausen. It is also proposed to use this process instead of caissons with compressed air for ordinary submarine foundations. In this case a series of tubes are driven into the soil in such a manner as to form a circle several feet in diameter; when this annular mass has been frozen the centre can be excavated, and a pier built there, the workmen being fully protected by the wall of frozen earth surrounding them. Brennecke suggests that it would be an improvement on the method used at the tunnel under the Hudson River. —*Centralblatt der Bauverwaltung*.

The Two Milos.— The celebrated Venus of Milo seems destined to be an eternal stumbling-block to writers rather ready than correct. An English author is reported to have spoken of "this masterpiece of the sculptor-athlete." It appears that he thought Milo of Croton was the artist who carved the Aphrodite out of marble. Milo, the boxer, was an accomplished man. He did not, however, use the sculptor's hammer, but rather the "auctioneer" of the late Thomas Sayers. M. Cassagnac, in the *Pays*, seems to repeat the blunder so strangely that his remark rather reads as if it were used in irony. Some one, according to M. de Cassagnac, was once Minister of Fine Art without knowing that Milo never made the famous Venus. As this, of course, means that Milo did not make the Venus, the taunt sounds like a roundabout way of saying that the person alluded to did believe in the "sculptor-athlete." Milo, or Melos, is of course the island where the Venus was found — not any sculptor or athlete at all. As quaint a blunder was once made by Scribe, the dramatist, and noted down by Gustave Flaubert, who kept a register of human folly. Scribe complained of the want of actuality in Molière's plays. "From Molière we should never have heard of the Revocation of the Edict of Nantes," said Scribe. As Molière died several years before the Edict of Nantes was revoked, Scribe was really too hard on his great predecessor in dramatic authorship.—*London Daily News*.

Deceiving the Elect.— It is said that M. Edouard Détaille, the eminent war-painter, was lately struck by seeing a water-color drawing of his own in a shop window day after day as he went to his studio. Sometimes it would disappear for a day or two, but it would always reappear. At last, unable to bear this irritating apparition any longer, he burst brusquely into the shop one morning, and said: "Since you can't persuade anybody to buy that drawing I will buy it myself." "Oh but, sir," they replied, "It is having a very large sale." "What do you mean?" said the painter. "How can a water-color drawing have a large sale?" "It is the Goupil fac-simile of your drawing, sir;" and when he examined it closely in his hands he found that it really was the fac-simile. When it is possible thus to deceive even the very elect, the errors of the poor art-critics should be more leniently dealt with.—*The Saturday Review*.