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CONTENTS.

BY a typographical error we were made to announce the meeting of the Annual Convention of the American Institute of Architects, at Washington, as appointed to occur on November 10 next. The date should be Wednesday, November 16. We hope that this correction will be in time to save any inconvenience to our readers through our mistake.

THE burning of the Morrell storehouse has drawn much belated wisdom from the New York daily journals, on the subject of fire-proof construction, and, judging from the accounts of the mode in which that particular building was planned, it is quite time that the public should be enlightened in regard to such matters. Situated, as the Morrell storehouse was, on the opposite side of a narrow street from an enormous stable, it was not only pierced with many and large openings on that side, but these openings were totally unprovided with shutters, while a huge wooden sign secured to the wall facing the stables offered an admirable means for attracting the fire across the street, and ensuring the rapid communication of the flames along the whole front. The interior had once been divided into sections by brick walls, but many openings had been made, and there was practically no check to the spreading of the conflagration within the building. Evidently, the "absolute security" which its owner claimed for it was a mere pretence, without any reasonable foundation, and it is surprising that business men, who must have known something of the scientific and substantial mode of erecting such structures, as seen in the warehouses used by importers in the lower part of the city, should have been found willing to leave their property in it. For the future, the owners of valuable pictures, jewels or furniture will probably endeavor to find storage in fireproof buildings, and as the demand is very likely to be met by the simple process of putting up the sign "Fire-proof" on structures which would not resist a conflagration for ten minutes, it cannot be too often repeated that few and narrow openings to the exterior, and subdivision of the interior space by floors and partitions through which fire cannot rapidly make its way, form, in conjunction with efficient supervision, the essential and not very costly requisites of a construction in which such a catastrophe as that of three weeks ago would be impossible. More might be done; it is practicable to build a warehouse such that if a fire were kindled in every room but one, and allowed to rage at will until all the fuel within reach was consumed, the goods stored in that one room would remain uninjured, and the building itself would not be in the least impaired; but so long as insurance can be obtained at present rates, it is hardly probable that the art of fire-proof construction will be carried beyond its rudiments unless in exceptional cases.

THE burning of the Randolph Mills in Philadelphia may undoubtedly be attributed to sparks from the electric lights. One of the employés testified during the investigation that rags and yarn had been set on fire by these sparks on several occasions, and once, by some defect in the working of the carbons, the globe of one light got red-hot, to the terror of the girls working near by. On the day of the fire the lamps were proved to have been in bad condition, flickering, and almost going out at times, then growing as brilliant as ever. The foreman, noticing this, went down into the cellar to see if the dynamo-electric generator was in proper order, but found nothing out of the way, and started to return by the elevator. Before he reached the second floor, he saw the flames above him, and had just time to stop the platform and escape by a neighboring window. Those who were at work in the weaving-rooms could tell nothing of the origin of the fire; without a moment's notice the whole mill seemed to burst into a blaze. The stairways, narrow at the best, were immediately in flames, and the elevator-shaft of course acted as a mere chimney to spread the flames from story to story. A wooden bridge led from the third floor of the mill to a neighboring building, and many of the operatives, unable to escape to the street, endeavored to find safety by means of this, but found after crossing it that the door at the farther end was locked. Some of the poor girls who were the first to reach it, finding it impossible to force the lock, threw themselves in despair from the bridge, and were killed or severely injured. So quickly was escape cut off by the fire that out of thirty-nine persons at work on the upper floors of the building, thirty are reported to have been killed or maimed. It is gratifying to learn that the owner of the building was declared criminally responsible for the deaths of these helpless victims of avarice and neglect, and has been committed to answer to the charge of manslaughter; while the proprietors of factory-buildings of similar construction will do well to take notice that a civil suit has also been begun against him by the mother of one of the young girls burned to death, for damages in the sum of fifty thousand dollars.

THE new Wallack's Theatre, now building on Broadway near Thirtieth Street, is intended to be as far in advance of the other places of public entertainment in New York in security against fire as the Madison Square Theatre is in ventilation and mechanical appliances. The front, side and rear walls of the structure are of brickwork nearly three feet thick, the proscenium wall, between the stage and the auditorium, is two feet thick, and the exits are of unusual size. As only the rough walls are done, it is of course impossible to judge of the remaining part of the construction, but it may certainly be said that the skeleton of the structure has all the qualities that need be desired. This example proves that the additional cost of erecting such buildings in a manner at once solid, safe, and beautiful does not deter managers from their enterprises, and it would seem in every way desirable that the New York Building Department should seize the opportunity to adopt as nearly as possible those admirable regulations for the construction of theatres which have been recently promulgated in Paris. No hardship would be inflicted upon any one by the enforcement of these rules in relation to all future edifices of that class, while the ultimate saving of life and property would probably be of inestimable importance. The coming decade will undoubtedly witness the building of many theatres in the upper part of New York, and it is quite time to make sure that Mr. Wallack's example will be generally followed, and if possible improved upon.

SINCE the discussion regarding the last great fire in New York has revealed the fact that the city is now using ten gallons of water for every one that flows into the reservoirs, many persons have revived the idea brought forward years ago, of providing a separate supply for extinguishing fires, street-washing, and other purposes, so as to reserve the Croton for household use. It certainly seems hard that the mains should need to be so far emptied every night by closing the gates that the pressure is insufficient in case of sudden fires to carry the water into the engines without the use of a suction-pump, while in private houses it would be impossible to draw even a pailful in the upper stories to put out an incipient blaze, and the Fire Commissioners, convinced that with the present scanty water service a serious fire might become entirely uncontrollable, have actually purchased and stored five hundred barrels of gunpowder and two thousand pounds of dynamite for blowing up buildings in the track of a conflagration which they might have no other means of checking. All this seems in a certain sense discreditable to a city washed by the Hudson River on one side, and the East River on the other. The system of a double service, even for domestic use, is found to work well in Paris, and nothing would be easier than to introduce a supply of salt water, which is far more efficient than fresh in extinguishing fires, and could be placed always within easy reach, and in absolutely unlimited quantity. The value of the property lost by the burning of the Thirty-second Street storehouse would have been sufficient to pay for laying a line of pipes from river to river in every cross-street in the city, with hydrants at each corner, from which the whole Atlantic Ocean might be pumped upon a burning building, if necessary, and in the intervals of conflagrations the water would be of inestimable value for washing the pavements.

THE project for a World's Fair in Boston meets with general favor, and if the financial management is all it might be, the five-million-dollar guarantee fund will probably be raised. Meanwhile, however, certain capitalists and business men in New York have quietly undertaken to see whether it may not still be possible to have the Fair in that city instead of Boston. For many reasons, the Fair would be likely to meet with greater pecuniary success, regarded simply as an entertainment, in the metropolis of the Western world than in any provincial city, and if other important interests were promoted by such an enterprise, a sum which seems very formidable to the people of Boston could be easily raised in New York. So far as now reported, an offer has been made of one million dollars in cash for what is known as the Jumel property, a beautiful tract situated on the high land near the northern extremity of Manhattan Island, with the intention of offering it for use as a site for the exhibition, and the railroad companies whose lines pass near the spot are said to be disposed to lend effectual assistance. Whether the people of Boston, having gone so far, would be willing to give up their own Fair in deference to the superior resources of their richer neighbors it is impossible to say, but it would at least be an advantage to have the New York scheme, if there really is one, divulged as soon as may be, before the promoters of the other have proceeded too far to be able to retreat with credit if they should wish to do so.

THE question of placing telegraph wires underground has become an important one, and there is no doubt that before long the unsightly poles will be banished from the streets of our large cities. In Chicago an ordinance was passed some time ago prohibiting the erection of any more poles in the public thoroughfares, and the new Mutual Union Telegraph Company, whose lines have just reached that city, had its application for leave to erect some for temporary use met with an explicit refusal. A petition, signed by a large number of merchants, was presented to the city council, praying that its action might be reconsidered, but the press seems to favor the strict enforcement of the ordinance. In Philadelphia and New York the telegraph companies have long ago made up their minds that they must ultimately submit to the necessity of laying all their wires beneath the surface, and many are already so placed. The usual mode is to carry them through an iron tube, which, after receiving the requisite number of insulated wires, is filled with melted pitch forced in under pressure, and then laid in a trench deep enough to secure the pipes from being broken by the traffic in the street over them, or by the movement of the ground in deep frosts. Costly as all this is, the wires are so thoroughly guarded against harm, and the lines thereby rendered so reliable, that the subterranean service is said to be in the end the cheapest; and if to this advantage is added the promotion of public and private convenience which would result from the abolition of all telegraphs above the surface, the gain seems certainly worth a little temporary sacrifice.

THE German Government has for the last five years been engaged in carrying out a great enterprise, involving an expenditure of more than thirty millions of marks of public money, in burying underground all the principal telegraph lines in the Empire. Two hundred and twenty-one towns and cities are now connected with each other by subterranean wires, which traverse the territory of North Germany in various directions. The primary object in taking this important step is, as might be supposed, to protect telegraphic communication from interruption in case of war, but the saving in repairs will amount to enough, even in time of peace, to pay a moderate interest on the investment. It is rather surprising to find how small is the number of wires included in each cable, eighteen only out of the whole number having seven wires apiece, while the others contain five, but it is to be remembered that in the thickly settled regions of Europe, cities are connected by so many lines of communication that any particular place may be reached from any other by a dozen different routes. By way of comparison, however, it is interesting to note that the underground telegraph conduits now being rapidly laid through the streets of Philadelphia have capacity for one thousand wires, divided among twenty separate chambers. It is hardly probable that so many will be needed at present, but the company has certainly been wise in providing ample margin for future contingencies.

GENERAL DI CESNOLA, the Director of the Metropolitan Museum of Art, has returned from his visit to Europe, bringing many new and valuable objects to be added to the various collections. As before reported, his principal acquisition consists in the Charvet collection of antique glass which he was, through the generosity of Mr. Henry G. Marquand, enabled to purchase for the Museum at a cost of fifteen thousand dollars. This was afterwards increased by the gift from Mr. James Jackson Jarves of his private collection of Venetian and other glass, valued at least at an equal sum, so that the Museum, adding these to the treasures of Cypriote glass already in its possession, may justly boast of having the best collection of such objects in the world. General di Cesnola was also able to negotiate some advantageous exchanges between the Metropolitan Museum and some of those in Europe. By transferring to the Louvre and to the museums of Berlin, Vienna, and Munich certain of the Cypriote figures which were duplicated by others in the New York collection, he obtained many casts of important statues, such as the Venus of Milo and the Farnese Bull from the Louvre, and some eighty figures from Berlin. It is perhaps to be regretted that the Metropolitan Museum had not taken advantage of the opportunity offered some months ago to secure a complete set, not only of casts, but of moulds of these and all the other important sculptures in Europe at a nominal cost, without sacrificing any of the precious original statues in its possession, which, although they may closely resemble other examples in the collection, are in some respects not less valuable by the opportunity which they afford for critical comparison and study of minute differences in style or treatment; but in this case General di Cesnola has done so well for the Museum that it would be ungrateful to reproach him for having taken perhaps the only means in his power to obtain the important casts which private generosity had failed to secure.

UNUSUAL success has attended the efforts of the Yonkers company for the manufacture of water-gas for heating purposes. In place of attempting to load the gas with hydro-carbon vapors, so as to give it illuminating power, it is supplied in its unmixed state simply for heating purposes. For some reason the Yonkers gas contains an extraordinary and probably prejudicial amount of nitrogen, nearly one-fourth, we believe, which adulterates and weakens it, if nothing worse; but it is nevertheless found to be a convenient and economical fuel. Forges and smelting furnaces are now undergoing modification to adapt them to the use of the gas, and it would undoubtedly be equally applicable to domestic purposes. Although the explosive power of a mixture of water-gas and air is under ordinary circumstances less than one-third of that formed with common illuminating gas, the Yonkers company have successfully employed their product in driving a small gas-engine, and are in process of applying it to a larger one. The very low cost of the water-gas is greatly in its favor. Exclusive of interest and profit, the expense to the company is less than fifteen cents per thousand feet, but it is sold at fifty cents, with satisfaction to the consumers, and, we should imagine, to the company. For burning in furnaces and stoves such fuel as this must be exceedingly convenient, and considering the facility with which the consumption may be stopped at any moment, it need not, at such prices, be very costly. We have had more than one inquiry from persons who professed to be tired of the labor, dirt, and inconvenience attendant upon the use of coal as to the practicability of using ordinary gas to heat their houses, but have been obliged to reply that the cost would prohibit any such experiment. The new product may, however, solve the difficulty, and we advise all persons who have experienced the same disgust with the annoyances of solid fuel to watch the progress of the Yonkers experiment.

THE LARGE GROINED VAULT IN THE ASSEMBLY CHAMBER OF THE NEW CAPITOL AT ALBANY, N. Y.[1]

I. *Analytical Examination.* It is generally known that a crack appeared in the lower third of one of the ribs of this vault, and that a new stone had to be inserted. It is also known that the possibility that the whole vault might fall was discussed in various quarters, and even in the legislature itself. Now since the legislative business of the State of New York is carried on under this roof, it seemed to me of the utmost importance that a thorough examination into its stability should be made. This I have done; and now I offer to the public the result of my researches.

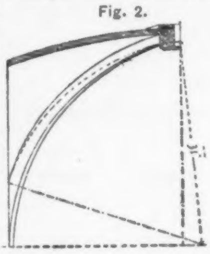


Fig. 2.

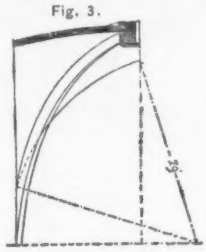


Fig. 3.

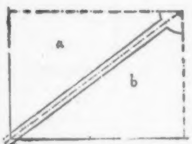


Fig. 1.

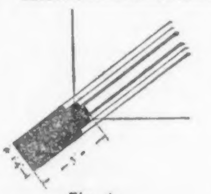


Fig. 4.

Fig. 1, shows the ground-plan of a quarter part of the vault; Fig. 2, a longitudinal section, and Fig. 3, a transverse section of the same. The plan of the vault is a rectangle, whose sides measure 54′ × 39′ respectively. The vault is a groined vault; the details of its construction are given in the diagrams. The vaulting surfaces are pointed, and the radius of one principal arch is 31′, while that of the other is 29′. The lines of the ridges of these vaults are not horizontal, but slope up from the apex of each principal arch to the key-stone of the vaulting; and this inclination is considerably greater in the long and narrow sections (Fig. 1 *a*), than in the others (Fig. 1 *b*); this can also be seen in Figs. 2 and 3. The diagonal rib which appears foreshortened in Figs. 2 and 3 is presented in its real form in Figs. 5, 6, and 7: while Fig. 4 shows a cross-section on a larger scale. Fig. 4 also shows the way in which the foot of the rib encounters the principal arch, the outline of which is here given. The rib forms a slightly pointed arch, as appears in Figs. 5, 6 and 7, the curves of which are not segments of a circle, but of an ellipse whose major axis measures 79′, and minor axis 64′, or its half 32′. The whole vault is supported at each of its four corners by a column which at the same time receives the arches and diagonal ribs of the smaller vaults which surround the principal one. Of these eight surrounding divisions shown in the plan (Fig. 8), only the four corner ones are vaulted; the rectangular spaces between them have a low flat ceiling, over which are placed the galleries for the public.

In order that the columns may withstand the great thrust of the arches and ribs of the great central vault, a *method of construction has been employed which must in the course of time become fatal to the stability of the structure.* Immediately over the principal arches of the square corner vaults great half-arches have been raised, which of course are not visible, but whose skew-backs continually press against the columns, as is shown in Fig. 9. The half-arches are held together at the top by iron tie-rods, which run through the wall above the great principal arches, and connect one half-arch with the other as is seen in Figs. 8 and 9. This method of construction is a dangerous one, because variations of temperature affect iron and stone so unequally that a constant vibratory movement is kept up in the arches and vaults, which in the course of time must necessarily destroy the stone. Among several examples of the danger of this combination, I recall that of the Cathedral of Frankfort-on-the-Main. When the tower was rebuilt, experts asserted that one row of columns had been made unsafe by the employment of a system of anchoring through their vertical axes. The expansion and contraction caused by changes of temperature were a perpetual cause of disintegration. An architect should in the case of monumental buildings scrupulously avoid the combination of stone and iron. There is never any necessity for such a combination, as an architect thoroughly acquainted with the construction of vaults can always make use of buttresses, flying-buttresses, arches, piers, etc. Only by following this principle can truly artistic works be produced; while on the other hand great stone domes, vaults, etc., which are held together by ironwork will always fail to satisfy either the constructive or æsthetic sense of the intelligent observer. Larger and smaller arches and vaults, however, which meet together upon one single point of support and resistance, do not necessarily require auxiliary construction of any kind; but, as I shall show at the conclusion of this paper, can be so treated that they will maintain their own equilibrium.

Fig. 5 shows the form of the rib, and the distribution of the load upon it. The thickness of the vault itself varies from somewhat over one foot at the keystone to somewhat under one foot at the principal arch; the average thickness is not quite one foot. The stone of which the rib is built is a somewhat heavier material than that used in the vault. The load of the vaulting surface which is supported by the rib, when reduced to the material of the rib, and equally distributed through its whole length gives, taking the average thickness as the uniform thickness of the vault, the line of load *c d*; but on account of the inequality of the thickness of the vault, the real line of load of the vault is seen in the line *c e*. As it must naturally always be desirable to make the load of a vault as small as possible, the line *c e* would in an ideal vault really be the line of load. In the vault under consideration, however, the load is in reality much greater, as it had to be in order to maintain the equilibrium.

The pointed arch is in itself a constructively weak line, because it has at the apex no radius which lies in the vertical axis of the arch, while every line of pressure at that point has a tangent which is horizontal. The natural tendency of the very flat line of pressure is to stretch far towards the base, since otherwise it would fall outside the section of the arch; and the consequence of this is, that the joint at the summit opens towards the top. If a similar effect is not observed in small arches and vaults, it is because the forces at work are too slight, in proportion to the thickness of the arch, to produce any noticeable effect. In the case of large vaults, however, some displacement of the stones inevitably results.

This was evidently what occurred in the case of the vault at Albany, and there was scarcely a point in it which did not seem to threaten danger. To obviate this difficulty, therefore, the first step taken was to load the vaulting surfaces at the summit near the principal arches; but it was also found necessary, in order to improve the equilibrium of the ribs, which likewise showed open joints above, to load the centre of the vault. Only a short space in the very middle of the arch of the rib remained free from this artificial load, as can be seen in the diagram Figure 5. Besides all this, the pockets of the vault have been so loaded with *béton* and walls that the result is the zig-zag line of load given in Fig. 5. That the load put upon the rib is perfectly enormous, and applied with very little system, a glance at the diagram is sufficient to prove.

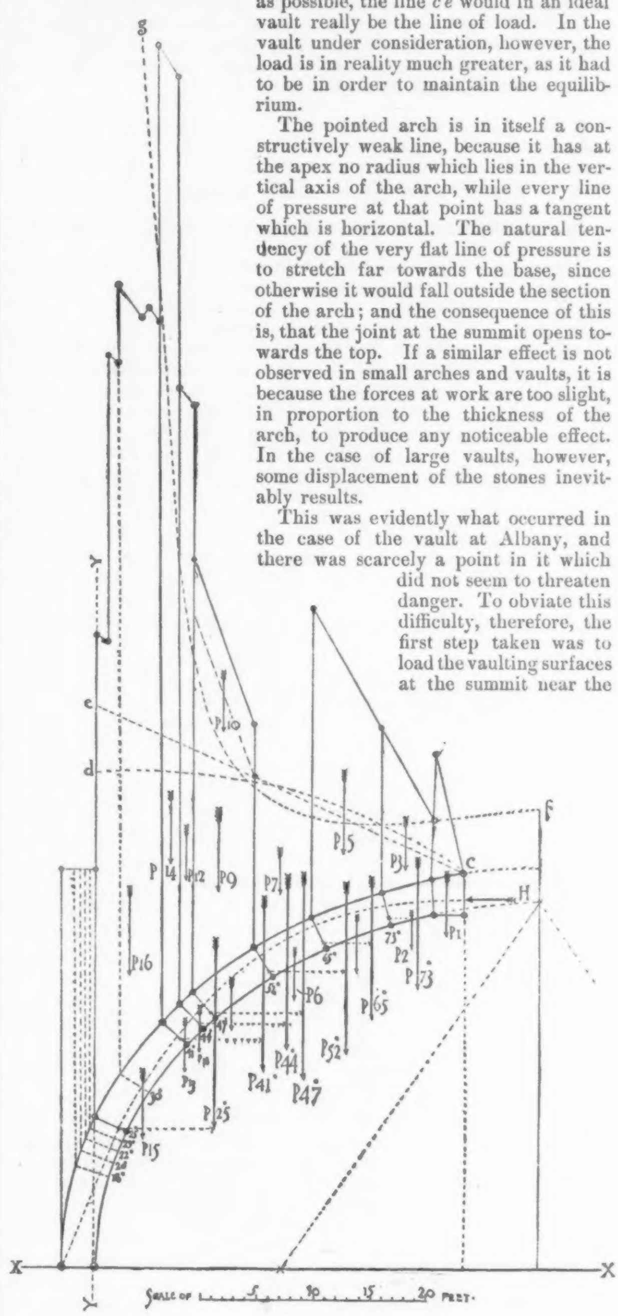


Fig. 5.

In my investigation of the stability of the rib, I first employed the analytical method, by which I found that the horizontal thrust at the summit could not have been higher than it is drawn in the diagram, since otherwise the line of pressure would at one spot have approached too near the *extrados* of the arch, this spot being about where the joint makes an angle (a) of 65° with the horizon.

I studied the arch first for the following angles: 73°, 65°, 52°, 47°, 44°, 41°, and 25°, which all, except 73°, correspond with the angles of the zigzag line of load. The direction of the joints in an elliptical arch is found, as is well known, by bisecting the angle formed

[1] By H. W. Fabian.

by the radii of the ellipse. The foci of the ellipse now under consideration are marked on the diagrams.

I next divided the whole area of the load into sections, whose dividing lines are seen on Fig. 5, and the vertical forces represented by them are designated by lines marked P_1 to P_{16}. (P_9 and P_{10} might have been combined; but I had based my calculation on the division of this force into two forces, and as this division had no influence on the result, I have allowed it to stand.)

This determination of forces I based on the drawing shown in Fig. 5, on a scale of $\frac{1}{24}$ of the natural size ($\frac{1}{2}'' = 1'$). Then taking $\frac{1}{4}''$, or half of this scale, as a unit of measure for these areas, there resulted the following values of forces: —

$P_1 = 87.5$	$P_5 = 510.9$	$P_9 = 544.3$	$P_{13} = 26.4$
$P_2 = 51.6$	$P_6 = 69.0$	$P_{10} = 85.8$	$P_{14} = 520.8$
$P_3 = 165.4$	$P_7 = 255.3$	$P_{11} = 18.0$	$P_{15} = 109.2$
$P_4 = 77.4$	$P_8 = 82.8$	$P_{12} = 249.6$	$P_{16} = 1436.4$

On the scale of Fig. 5, the unit of length here is naturally also $= \frac{1}{4}'$.

To determine the line of pressure it is first necessary to discover the amount of the horizontal thrust. As this is ascertained by dividing the moment of that part of the arch which rests on the weakest joint taken about the edge of the joint, by the arm of the horizontal thrust, we have first to establish the position of the weakest joint. Now this is at the point where the horizontal thrust has to be at a maximum in order to prevent the arch from falling in. To ascertain this maximum of the horizontal thrust, which is at the same time the real horizontal thrust, it is first necessary that for a number of joints the lines of weight of the loads resting upon them should be found. For the forces P_1 to P_{16}, these lines can be ascertained directly from the diagram (Fig. 5). They have the following distances (v) from the axis of Y measured on the axis of X. The axis of Y is here taken through the corner of the principal arch, a little outside of the inner initial point of the ellipse; and the axis of X lies in the major axis of the ellipse.

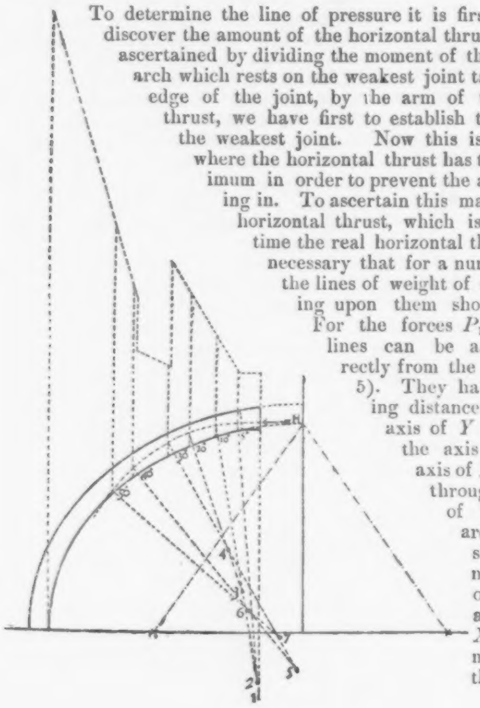


Fig. 6.

$v_1 = 61.7$	$v_5 = 43.8$	$v_9 = 21.5$	$v_{13} = 14.6$
$v_2 = 55.4$	$v_6 = 34.4$	$v_{10} = 22.3$	$v_{14} = 12.3$
$v_3 = 54.2$	$v_7 = 32.6$	$v_{11} = 17.2$	$v_{15} = 7.4$
$v_4 = 45.4$	$v_8 = 23.6$	$v_{12} = 15.2$	$v_{16} = 5.5$

I now calculated for the angles 73°, 65°, 52°, 47°, 44°, 41°, 25° of the joints, the lines of weight of the loads resting upon them.

I calculated for each of these joints the sum of the moments (ΣM) of all the superincumbent forces relative to the axis of Y, divided these values by the sum of the forces of the different sections (ΣP), and thus found the distances of the lines of weight from the axis of Y, and the sum of the several results. The following tables will make this more clear: —

ΣP	P	$P \times v$.	ΣM
87.5	P_1	87.5 × 61.7 = 5398.7	5398.7
139.1	P_2	51.6 × 55.4 = 2858.6	8257.8
304.5	P_3	165.4 × 54.2 = 8964.7	17222.0
381.9	P_4	77.4 × 45.4 = 3514.0	20736.0
892.8	P_5	510.9 × 43.8 = 22377.4	43113.4
961.8	P_6	69.0 × 34.4 = 2373.6	45487.0
1217.1	P_7	255.3 × 32.6 = 8322.8	53809.8
1299.9	P_8	82.8 × 23.6 = 1954.1	55763.9
1844.2	P_9	544.3 × 21.5 = 11702.5	67466.4
1930.0	P_{10}	85.8 × 22.3 = 1913.3	69379.7
1948.0	P_{11}	18.0 × 17.2 = 309.6	69689.3
2197.6	P_{12}	249.6 × 15.2 = 3793.9	73483.2
2224.0	P_{13}	26.4 × 14.6 = 385.4	73868.6
2744.8	P_{14}	520.8 × 12.3 = 6405.8	80274.4
2854.0	P_{15}	109.2 × 7.4 = 808.1	81082.5
4290.4	P_{16}	1436.4 × 5.5 = 7900.2	88982.7

For the corresponding joints we now have the values shown in the following table: —

a	ΣP		ΣM	$\frac{\Sigma M}{\Sigma P} = v$.
73°	$\sum_1^3 P$	304.5	17222.0	56.6
65°	$\sum_1^5 P$	892.8	43113.4	48.3
52°	$\sum_1^7 P$	1217.1	53809.8	44.2
47°	$\sum_1^{10} P$	1930.0	69379.7	35.9
44°	$\sum_1^{12} P$	2197.6	73483.2	33.4
41°	$\sum_1^{14} P$	2744.8	80274.4	29.2
25°	$\sum_1^{16} P$	4290.4	88982.7	20.7

The forces represented in the columns ΣP and $\frac{\Sigma M}{\Sigma P} = v$ are marked in Fig. 5, from P 73° to P 25°. As we now know their exact size and position, we are enabled to ascertain their moments for any point of attack we choose. If we had to do it with an absolutely solid material, the arch itself would still remain firm, even if the point of attack of the vertical force were the inner end of the weakest joint. But since the solidity of the material is simply mechanical, it follows that the break of the stone occurred very near to the two points in question.

Long and careful study of the subject of vaulted architecture has taught me that it is an *a priori* law *that of all the lines of pressure which are possible in an arch, that is the real one which is the most favorable one; that is, which deviates least from the middle line of the arch, and coincides with it.* The manner of loading and the form of the arch, as they have here been shown, inclined me in advance to the opinion that even the most favorable line of pressure possible under the circumstances would be a very bad one. Consequently I assumed that the distance of the point of attack from the inner line of the arch was very small, and fixed this distance at 7″. The distance

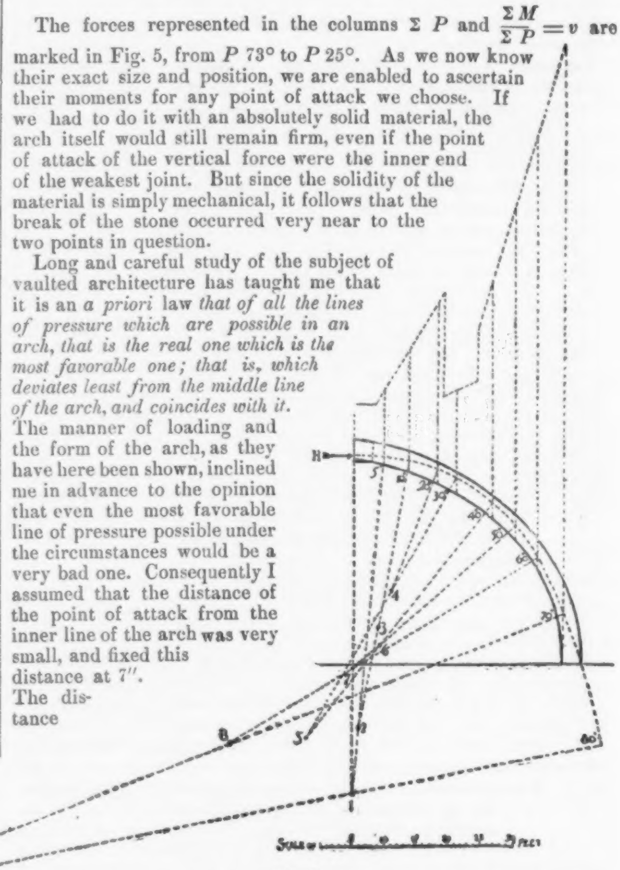


Fig. 7.

of the point of attack of the horizontal thrust (H), from the inner line of the arch at the summit, I fixed at 8″, since at a still smaller distance danger would certainly result. The width of the rib is 1′ 4″, and its thickness throughout is 3′. In order now to discover whether under these conditions a line of pressure is possible, it is important to ascertain how near to its outer boundary line such a line would come at any given point in the arch. For this purpose we must first determine the amount of the horizontal thrust and the position of the weakest joint. It follows from the foregoing, that the line of resistance of the moments tending to cause the arch to fall

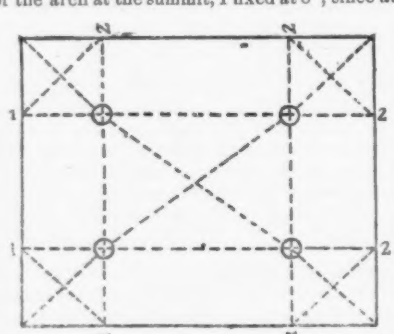


Fig. 8.

will be a line parallel to the inner line of the arch at a distance of 7″ from it. The points of attack for the forces P 73° to P 25° are marked in Figure 5, with an x on their corresponding joints; their arms are also marked in the same way.

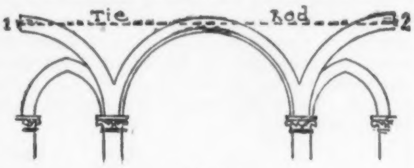


Fig. 9.

In order to calculate the moments of these forces (Ma) their arms (v) relative to the axis of Y must be reduced to the distances (Va) relative to their points of attack. This reduction, and the disposition of the moments is given in the following table: —

a	Va	$\Sigma\ P \times Va = Ma$
73°	56.6 — 51.9 = 4.7	304.5 × 4.7 = 1431
65°	48.3 — 40. = 8.3	892.8 × 8.3 = 7410
52°	44.2 — 30.4 = 13.8	1217.1 × 13.8 = 16796
47°	35.9 — 19.7 = 16.2	1930.0 × 16.2 = 31266
44°	33.4 — 17.5 = 15.9	2197.6 × 15.9 = 34942
41°	29.2 — 14.4 = 14.8	2744.8 × 14.8 = 40623
25°	20.7 — 4.5 = 16.2	4290.4 × 16.2 = 69504

In order now to determine for these moments the horizontal thrust which is able to keep them in equilibrium, it is simply necessary to divide their values by the arms (h) of the horizontal thrust relative to the corresponding points of attack. These arms and their corresponding quotients have the following values: —

a	h	$Ma \div h = H$
73°	3.3	1431 ÷ 3.3 = 434
65°	7.7	7410 ÷ 7.7 = 962
52°	13.1	16796 ÷ 13.1 = 1282
47°	21.0	31266 ÷ 21. = 1489
44°	23.1	34942 ÷ 23.1 = 1513
41°	26.2	40623 ÷ 26.2 = 1555
25°	40.6	69504 ÷ 40.6 = 1712

It follows that the horizontal thrust for the joints under consideration is at a maximum at $a = 25°$. To determine this maximum more precisely, however, it is necessary to examine a larger number of joints, and we will now proceed to examine the angles $a = 30°$, 23°, 22°, 20° and 18°.

$a = 30°$

$P_{30°} = P_{25°} - (P_{17} + P_{18})$;

if P_{17} is taken to signify the arc from 30° to 25° and P_{18} the part of the load resting upon it. $P_{17} = 33.0$ and $P_{18} = 255.2$. The arms of these forces are $Va\ 17 = (-3.1)$ and $Va\ 18 = -(5.6)$. Their moments will then be: —

$$\begin{aligned} Ma\ 17 &= 33\ \ \times (-3.1) = -\ 102 \\ Ma\ 18 &= 255.2 \times (-5.6) = -1429 \\ &\text{Together} = (-\overline{1531}) \end{aligned}$$

The moments of

$$\begin{aligned} P_{30°} = P_{25°} \times Va\ 30° - (-1531) = 4290.4 \times 13.5 &= 57920 \\ &+\ \ 1531 \\ Ma\ 30° &= \overline{59451} \end{aligned}$$

Therefore for $a = 30°$, $h = 36$; hence $H = \frac{59451}{36} = 1651$.

$a = 23°$ (same method): —

$P_{19} = 10.2$ and $P_{20} = 35.2$; $Va\ 19 = (-1.4)$ and $Va\ 20 = (-4.3)$

$$\begin{aligned} Ma\ 19 &= 10.2 \times (-1.4) = -\ 14 \\ Ma\ 20 &= 35.2 \times (-4.3) = -151 \\ &= (-\overline{165}) \end{aligned}$$

$$\begin{aligned} Ma\ 23° = P_{25°} \times Va\ 23° + (-165) = 4290.4 \times 16.9 &= 72508 \\ &-\ \ 165 \\ Ma\ 23° &= \overline{72343} \end{aligned}$$

$h = 42$, hence $H = \frac{72343}{42} = 1722$.

$a = 22°$:

$P_{21} = 19.2$ and $P_{22} = 63$; $Va\ 21 = (-1.2)$ $Va\ 22 = (-2.5)$

$$\begin{aligned} Ma\ 21 &= 19.2 \times (-1.2) = -\ 23 \\ Ma\ 22 &= 63\ \ \times (-2.5) = -158 \\ &= (-\overline{181}) \end{aligned}$$

$$\begin{aligned} Ma\ 22° = 4290.4 \times 17.6 &= 75511 \\ &-181 \\ &= \overline{75330} \end{aligned}$$

$h = 43.3$; hence $H = \frac{75330}{43.3} = 1740$

$a = 20°$:

$P_{23} = 30.0$ and $P_{24} = 103.7$; $Va\ 23 = (-1.0)$ $Va\ 24 = (-3.7)$

$$\begin{aligned} Ma\ 23 &= \ \ 30.0 \times (-1.0) = -\ \ 30 \\ Ma\ 24 &= 103.7 \times (-3.7) = -384 \\ &= -\overline{414} \end{aligned}$$

$$\begin{aligned} Ma\ 20° = 4290.4 \times 18.1 &= 77656 \\ &-414 \\ &= \overline{77242} \end{aligned}$$

$h = 45$; hence $H = \frac{77242}{45} = 1716$

$a = 18°$:

$P_{25} = 45.6$ and $P_{26} = 131.6$; $Va\ 25 = (-0.8)$ and $Va\ 26 = (-3.2)$

$$\begin{aligned} Ma\ 25 &= \ \ 45.6 \times (-0.8) = -\ \ 36.5 \\ Ma\ 26 &= 131.6 \times (-3.2) = -421.1 \\ &= -\overline{457.6} \end{aligned}$$

$$\begin{aligned} Ma\ 18° = 4290.4 \times 18.9 &= 81088.6 \\ &-457.6 \\ &\overline{80631.0} \end{aligned}$$

$h = 47.5$ hence $H = \frac{80631.0}{47.5} = 1697$

The maximum of all the values for H is according to this at $a = 22°$. This joint is consequently the weakest joint and $H = 1740$.

It still remains to calculate the line of pressure, of which now two points are known, namely: the point of attack at the summit and the point in the weakest joint 7″ distant from the inner line of the arch. Now since the moments of the horizontal thrust and the vertical forces must necessarily balance each other, we have the following equation, taking x as the distance of the line of pressure from the given points of attack, measured in the joint-line of the corresponding angle:

$$H\ (h - x\ sin.\ a) = P\ (Va + x\ cos.\ a).$$

From this general equation x, and consequently the line of pressure can now be found. We have from it:

$$\begin{aligned} Hh - Hx\ sin.\ a &= Pva + Px\ cos.\ a \\ Hh - Pva &= Px\ cos.\ a + Hx\ sin.\ a \\ Hh - Pva &= x\ (P\ cos.\ a + H\ sin.\ a) \\ x &= \frac{H\,h - P\,va}{P\ cos.\ a + H\ sin.\ a} \end{aligned}$$

All the following equations are solved by this formula.

$$a = 73° \quad x = \frac{\overbrace{1740 \times 3.3}^{5742} - 1431}{\underbrace{304.5 \times 0.29}_{88.3} + \underbrace{1740 \times 0.96}_{1670.4}} = \frac{4311}{1759} = 2.45$$

$$a = 65° \quad x = \frac{\overbrace{1740 \times 7.7}^{133.98} - 7410}{\underbrace{892.8 \times 0.42}_{375} + \underbrace{1740 \times 0.91}_{1583}} = \frac{5988}{1958} = 3.1$$

$$a = 52° \quad x = \frac{\overbrace{1740 \times 13.1}^{22794} - 16796}{\underbrace{1217.1 \times 0.62}_{755} + \underbrace{1740 \times 0.79}_{1375}} = \frac{5998}{2130} = 2.8$$

$$a = 44° \quad x = \frac{\overbrace{1740 \times 23.1}^{41194} - 34942}{\underbrace{2198 \times 0.72}_{1582} + \underbrace{1740 \times 0.69}_{1201}} = \frac{6252}{2783} = 2.25$$

$$a = 30° \quad x = \frac{\overbrace{1740 \times 36}^{62640} - 59451}{\underbrace{4002 \times 0.87}_{3482} + \underbrace{1740 \times 0.5}_{870}} = \frac{3189}{4352} = 0.73$$

The line of pressure in Figure 5 is drawn in accordance with these values, from the summit to the weakest joint, that is, to $a = 22°$. As it is however valuable to carry out the line of pressure as far as $a = 0°$, the calculation is continued to that point.

Pursuing the method followed in the foregoing examples, P_{27} denotes the arc from $a = 25°$ to $a = 0°$; and P_{28} the part of the load which rests upon this arc.

$P_{27} = 150$, $P_{28} = 250$; $Va\ 27 = (-2.4)$ and $Va\ 28 = (-3.6)$

$$\begin{aligned} Ma\ 27 &= 150\ (-2.4) = -\ 360 \\ Ma\ 28 &= 250\ (-3.6) = -\ 900 \\ &= -\ \overline{1260} \end{aligned}$$

It must be observed here that these moments are relative to the inner initial point of the ellipse, to which the collective moment also relates.

$$\begin{aligned} Ma\ 0° = 4290.4 \times 19.7 &= 84521 \\ &-\ \ 1260 \\ &= \overline{83261} \end{aligned}$$

According to this, x is likewise relative to the inner initial point of the ellipse.

$$a = 0° \quad x = \frac{\overbrace{1740 \times 63.8}^{111012} - 83261}{\underbrace{(4290.4 + 150 + 250) \times 1}_{4690.4} + \underbrace{1740 \times 0}_{0}} = \frac{27751}{4690.4} = 5.92$$

The line of pressure here given therefore approaches nearest to the lines of the arch at the following points and distances:

1. At the summit; 8″ from the inner line of the arch.

2. At $a = 65°$; $3' - (18\frac{1}{2}'' + 7'') = 36'' - 25\frac{1}{2}'' = 10\frac{1}{2}''$ from the outer line.
3. At $a = 22°$; $7''$ from the inner line.
4. At $a = 0°$; $\frac{1}{2}''$ from the outer line.

Such a line of pressure would be impossible without strong buttresses at the ends of the arches, because a distance of only $\frac{1}{2}''$ from the outer line of the arch far exceeds the bounds of possibility. This deviation of the line of pressure from its proper curve is not however especially dangerous in this case, as the pockets of the vaults are filled with solid masonry. The three first joints only, then, are dangerous, and the danger is greatest at $a = 22°$, since at this point the normal pressure is much greater than at the other two points. The three first distances given show, perhaps, that the line of pressure as it is here calculated is not absolutely the most favorable one; still it is easy to see that it would deviate very slightly from it. A second calculation of the line of pressure in which I followed the same method, resulted, with an almost identical line of load, in the following distances of the line of pressure from the lines of the arch:

1, at the summit,	$11''$	from the	inner	line.
2, at $a = 65°$,	$9\frac{1}{4}''$	"	outer	"
3, at $a = 25°$,	$7''$	"	inner	"
4, at $a = 0°$,	$\frac{1}{8}''$	"	outer	"

Here also, H = 1740. This line of pressure is more favorable than the other only in so far as this, that the weakest joint has been raised a little higher, where the normal pressure is less. As for the rest, the extreme limit is reached in the approach of the line of pressure to a distance of only $9\frac{1}{4}''$ from the outer line of the arch, though even this seems allowable, inasmuch as this distance is considerably more than one-third of the thickness of the arch, viz., 1'. *On this account the doubt remains whether in the arch with such a load laid upon it a line of pressure is possible which, at the most dangerous point, that is at the weakest joint, is more than 7'' from the inner line of the arch; at any rate a distance of more than 9'' is impossible.* In accordance with this, the dangerous point of the line of pressure is shown in the cross section in Figure 4; and an examination of this diagram shows that the danger of a break is even greater than it would otherwise be, owing to a perfectly unnecessary moulding of the arch, which weakens it considerably. In vaulted architecture it is a universal law, in order to secure the stability of the arch, that the line of pressure should remain throughout within the inner third of the thickness of the arch, and at no point pass beyond it, since otherwise strains would take place in the arch which would certainly destroy the stone. This universal rule is far from being obeyed in the ribs of the vault at Albany, and on this account, and considering also the enormous load, and the weakening of the arch by unnecessary mouldings, it is impossible to repress grave fears for the result. The danger is increased by the above-mentioned use of tie-rods, which cause a perpetual vibration in the arches, with most injurious results.

Since making the above calculations I have found that the load is in reality somewhat different from what it was assumed to be, but this difference is not sufficient to affect essentially the result, as I shall show; the weakest joint is removed a little nearer to the summit of the arch, and so far only is the change favorable. The weakest joint then will actually be found at about $a = 27°$; and indeed it was in this part of the arch, as the line of pressure required, that the break occurred and the new stone had to be inserted. The most extraordinary hypotheses have been advanced to account for this break of the stone, and avoid impugning the stability of the arch itself. One suggested that the columns had settled unequally; another that the rib was flattened by the pressure of the half-arches held together by the iron tie-rods; another that the arch had been warped by the inequality of the weight of the superincumbent vault, etc. *A closer examination, however, proves that all these hypotheses are untenable, and that the cause of the fracture can be found only in the vicious construction of the arch itself.*

II. *Synthetic construction of the Line of Pressure.* In order to place the result of the foregoing analytical examination entirely beyond question, I now pass to the synthetical method; and shall thus give additional weight to any further remarks I may make in regard to the possibility of a fall of the great vault.

The synthetical method depends upon a theoretical knowledge of the nature of every line of pressure; while the analytical method gives no special information about it. The general equation of the line of pressure is as follows:

$$\rho = \frac{r_0\ Z_0}{Z\ \cos.^3 a}$$

In this formula a denotes the angle which the radius of curvature of the line of pressure makes with the vertical; ρ denotes the radius of curvature; r_0 the radius of curvature at the summit; Z_0 the height of the load at that point; and z the height of the load at any given point of the arch. Also the horizontal thrust, $H = r_0\ Z_0$; hence, taking G as the vertical force of that part of the vault, including the load which belongs to a; $G = H\ tan.\ a$; and the normal pressure $N = \sqrt{G^2 + H^2}$.

Figs. 6 and 7 show the line of load as it exists at present, varying slightly from the line as it was at the time of the break, as some changes have been made. It is extremely difficult to determine the line of load with perfect exactness; but there is no doubt that the one given in Figs. 6 and 7 comes sufficiently near the real one for all practical purposes, and that the line of pressure dependent upon it is not more unfavorable than the real one.

In constructing the line of pressure in Figs. 6 and 7 from the radius of curvature, small portions of the line of pressure were treated as arcs of a circle. Fig. 6 shows first a line of pressure which is impossible. As the unit of length the measure of 8' is taken. According to that $r_0 = 5.25$, and $Z_0 = 1.1$; hence $H = 5.25 \times 1.1 = 5.78$. From the formula for ρ given above, we obtain the following values for ρ:

$$a = 5° \mid \frac{5.78}{1.2 \times 0.988} = \frac{5.78}{1.18} = 5$$

$$a = 10° \mid \frac{5.78}{1.9 \times 0.955} = \frac{5.78}{1.81} = 3.2$$

$$a = 20° \mid \frac{5.78}{2.95 \times 0.83} = \frac{5.78}{2.45} = 2.36$$

$$a = 30° \mid \frac{5.78}{1.75 \times 0.65} = \frac{5.78}{1.14} = 5$$

$$a = 40° \mid \frac{5.78}{3.63 \times 0.45} = \frac{5.78}{1.63} = 3.5$$

$$a = 50° \mid \frac{5.78}{5.15 \times 0.265} = \frac{5.78}{1.36} = 4.3$$

It is evident that the construction on paper must keep pace with the calculation, as only in this way can the values of z, which correspond to the angles a, be obtained. As the unit now used is 16 times as large (8') as that upon which the diagram of Fig. 5 was based ($\frac{1}{2}'$), H here represents an H there of the value $5.78 \times 16 \times 16 = 5.78 \times 256 = 1480$. Although this horizontal thrust is not very much smaller than the former one of 1740, still the construction of the line of pressure proves that the real horizontal thrust must be greater than 1480 (that is, than 5.78), since the line of pressure in Fig. 6, even at $a = 50°$, begins to pass beyond the arch on the inner side. In Fig. 7, therefore, a second construction of the line of pressure has been undertaken. In this, $r_0 = 6.5$ and $Z_0 = 1.1$; hence, $H = 6.5 \times 1.1 = 7.15$, which corresponds to a former H of $7.15 \times 256 = 1830$, which is somewhat higher than 1740. Hence, we have the following values for ρ:

$$a = 5° \mid \frac{7.15}{1.4 \times 0.988} = \frac{7.15}{1.38} = 5.2$$

$$a = 10° \mid \frac{7.15}{2.3 \times 0.955} = \frac{7.15}{2.2} = 3.25$$

$$a = 20° \mid \frac{7.15}{3.5 \times 0.83} = \frac{7.15}{2.9} = 2.5$$

$$a = 30° \mid \frac{7.15}{1.9 \times 0.65} = \frac{7.15}{1.24} = 5.8$$

$$a = 40° \mid \frac{7.15}{4.5 \times 0.45} = \frac{7.15}{2.03} = 3.5$$

$$a = 50° \mid \frac{7.15}{6.4 \times 0.265} = \frac{7.15}{1.7} = 4.2$$

$$a = 60° \mid \frac{7.15}{8.3 \times 0.125} = \frac{7.15}{1.04} = 7$$

$$a = 70° \mid \frac{7.15}{12 \times 0.04} = \frac{7.15}{0.48} = 15$$

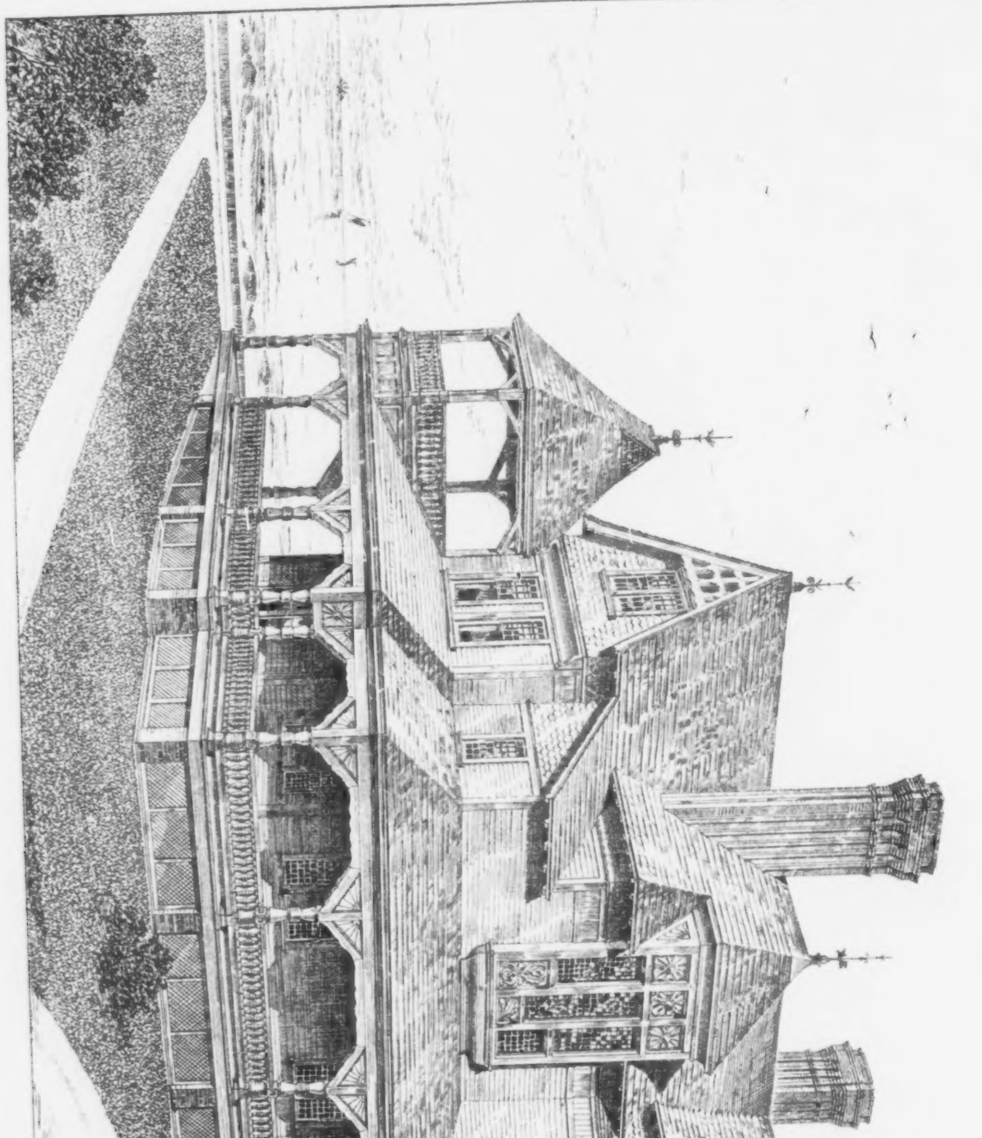
Fig. 7 shows that such a line of pressure does not to be sure at any point pass outside the bounding lines of the arch, but that at the summit and at $a = 30°$, it comes very near to them. It is therefore probable that the horizontal thrust is in reality a little smaller, and may be assumed to be 1740, the figure which was obtained by analysis. Accordingly the horizontal thrust at the summit will be somewhat higher than it is drawn in Fig. 7; and the line of pressure will then at $a = 30°$ be somewhat farther away from the outer line of the arch, and come nearer to the inner line at the weakest joint than is shown in Fig. 7. But if this is so, then the synthetical construction of the line of pressure exactly corroborates the result of the analytical examination, and the following details may serve to assist in the formation of an opinion as to the probability of a fall of the vault.

Horizontal thrust = 1740.

Distance of the line of pressure at the summit from the inner line of the arch	$8\frac{1}{2}''$
Distance of the line of pressure at $a = 65°$ (*circa*) from the outer line of the arch	$9\frac{1}{2}''$
Distance of the line of pressure at 27° (*circa*) from the inner line of the arch	$9''$
Distance of the line of pressure at $a = 0°$ from the outer line of the arch	$\frac{1}{4}''$

As has been mentioned, however, it is not at all improbable that the distance at the weakest joint reaches 7'', and at all events, the figure 9'' given here cannot be considered as more unfavorable than the reality. As has likewise been observed, this position of the line of pressure in the weakest joint in no way prevents the occurrence of strains, and *it is therefore probable*, taking into consideration the other injurious circumstances, viz., the construction with tie-rods, and the injudicious moulding of the rib, that *sooner or later a wider destruction of the ribs, and consequently of the whole vault, will take place.*

With the want of system in the loading of the vault is naturally connected a want of system in constructing the line of pressure



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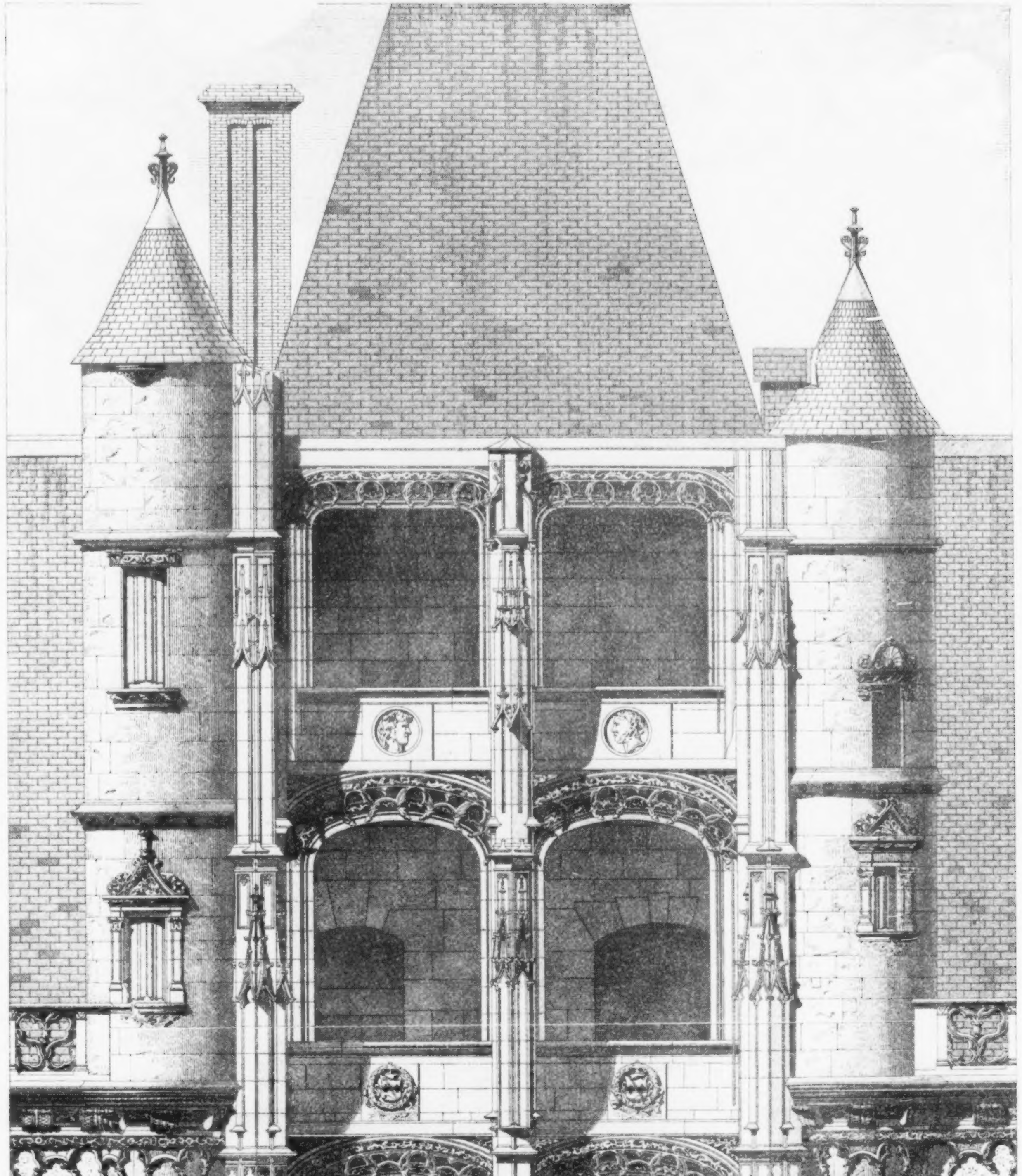

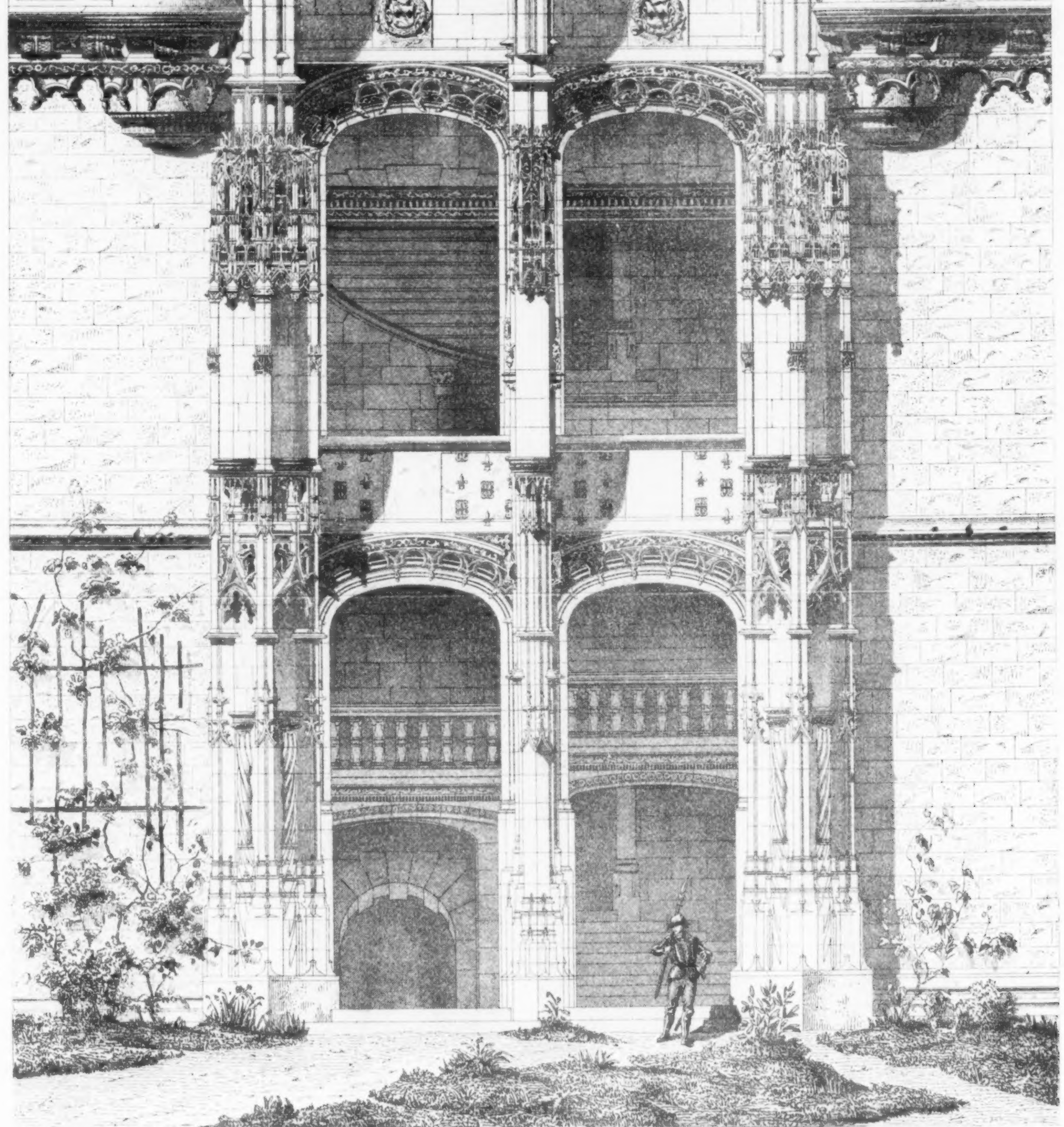

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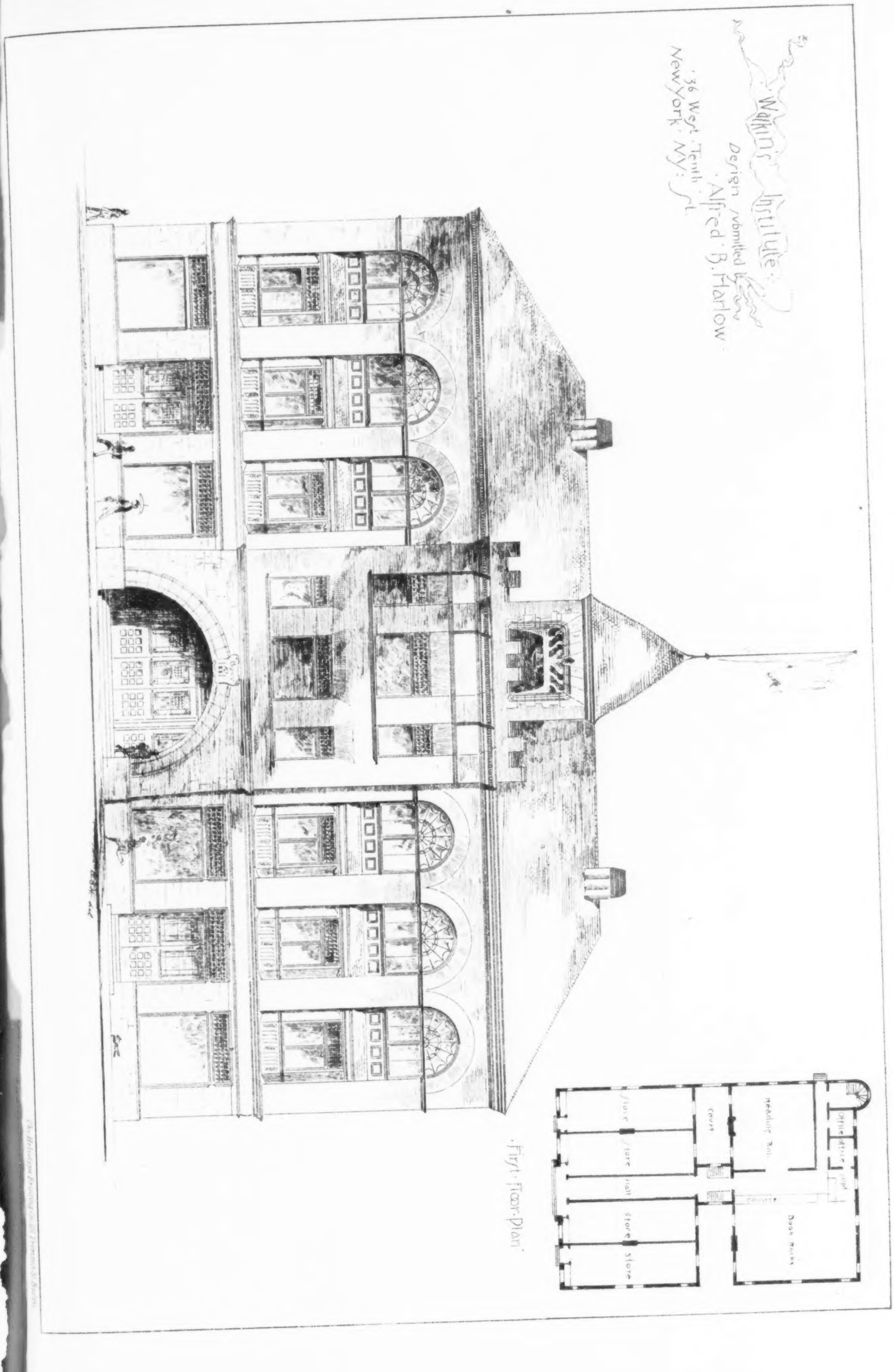
CHATEAU DE CHATEAUDUN FACADE DE L'ESCALIER DU CARDINAL DE LONGUEVILLE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from the radii of curvature. Figs. 6 and 7 show in this connection that the radii grow first shorter and then longer, then again shorter and again longer, whereas they ought only at first to have shortened, and then, after reaching their minimum, should have steadily lengthened.

To obtain the working of the forces and the pressure acting on the material in pounds requires the following calculation.

The load weighs to the cubic foot 147 pounds. For one foot in depth of the rib then, the horizontal thrust will be expressed as follows, since $\frac{1}{2}'$ is taken as the unit of length.

$$H = 1740 \times \frac{147}{2 \times 2} = 1740 \times \frac{147}{4} = 1740 \times 36.75 = 63945 \text{ lbs.}$$

The figure which is produced when a solid is destroyed by pressure, is, as is well known, a double-cone, whose axis lies in the direction of the pressure, and where the two cones meet at the apexes. Hence follows, that for practical purposes it has to be assumed that the area of resistance in vaults is twice as large as that which reaches from the bounding line of the arch to the line of pressure.

In the present case the area of resistance at the summit $= 2 \times 8.5 \times 12 = 204\square''$, whence the pressure per square inch on the material amounts to $\frac{63945}{204} = 313.5$ lbs.

The weight of the vault with its load at the weakest joint between P_{25° and P_{30° (Fig. 5), is expressed in the following equation:

$$\frac{2 \times 4290.4 - (33.0 + 255.2)}{2} = \frac{8580.8 - 288.2}{2} = \frac{8292.6}{2} = 4146.3.$$

The normal pressure, therefore, is $\sqrt{4146.3^2 + 1740_2} = 4500$, or expressed in lbs., $4500 \times \frac{147}{4} = 165375$ lbs. for one foot of thickness of the rib. Since the area of resistance in the weakest joint amounts to $2 \times 9'' \times 12'' = 216\square''$; the pressure on the material per $\square'' = \frac{165375}{216} = 765.7$ lbs.

For sandstone the allowable load per $\square''$ is generally reckoned at just 260 pounds, and the breaking load at 800 pounds. Hence it follows that in the vault at Albany the allowable load is far exceeded, and that at the weakest joint even the breaking load is reached. The sandstone which has been employed is certainly extremely firm; if this were not the case, more symptoms of disturbance must already have appeared in the rib; and it is therefore beyond question that a fall is far from impossible, especially when we remember that in the calculation of the area of resistance, its weakening by the moulding of the rib has been entirely disregarded.

Even if the line of pressure coincided throughout with the middle line of the rib, the load would still be the greatest allowable. The pressure per $\square''$ would then be $\frac{765.7}{4} = 191$ pounds; or, taking into account the moulding of the rib, about 200 pounds.

The question now arises whether anything can be done to obviate the danger of a fall. To obtain complete security seems impossible, as little can be taken from the load without bringing the equilibrium of the vault again into danger.

Nothing definite could be stated on this point unless every single arch in the vaulting were examined as thoroughly as I have examined the rib. But even if it could be assumed that by a diminution and better distribution of the load the line of pressure at the weakest joint could be carried 1″ farther away from the inner line of the arch (10″ that is, in the whole), even then very little would be accomplished.

If the arch were a perfect ellipse, sufficient stability could be obtained provided the load were arranged according to the line of load $f\,g$, Fig. 5, which is deduced from the formula for ρ. Nothing, however, can be done to supply the place of the missing piece at the summit, as not only the vertical forces but also the points of weight which are represented in it influence the line of pressure.

There is no ideal line of load for the pointed arch, and in that respect round and elliptical arches will always be preferred, even though they have not such lines of load as are practically possible, since they require at the skew-back a load-height of an infinite ordinate Theoretically, then, these arches also are on this account to be avoided. Logically, also, they would be condemned, because infinite load-heights imply infinite thickness of skew-backs, which of themselves are inconsistent with the nature of the arch.

The weakness resulting from the variance between the line of the arch and the line of pressure is so great in the arches of the great vault in the Assembly Chamber of the new Capitol at Albany, that a fall sooner or later is seriously to be feared. *Absolute security can be obtained only by tearing down the whole vault, and building another in its place.*

THE ILLUSTRATIONS.

STAIRCASE OF CARDINAL DE LONGUEVILLE, IN THE CHATEAU DE CHATEAUDUN, FRANCE.

WE reproduce from the last issue of the *Moniteur des Architectes* the exterior view of the staircase lately restored by M. Boudier, architect, two interior views of which were published in the *American Architect* for September 17.

COMPETITIVE DESIGN FOR WATKINS INSTITUTE. BY MR. ALFRED B. HARLOW, NEW YORK, N. Y.

"WHITECAPS," MARINE RESIDENCE OF J. M. DUNBAR, ESQ., MONMOUTH BEACH, N. J. MR. F. C. WITHERS, ARCHITECT, NEW YORK, N. Y.

THE BRIDGEPORT HIGH SCHOOL.

THE many readers of the *Sanitary Engineer* will remember the discussion which recently took place in the columns of that journal in regard to the ventilation of the new Bridgeport High School building. Opinions were obtained from the most distinguished experts, and the structure, whatever might have been the success with which its arrangements were carried out, gained at least the reputation of being one of the most carefully planned buildings in the country in regard to ventilation and other sanitary requirements.

A little pamphlet description, written by the architect, and accompanied with plans, elevations and sections, has been reprinted from the Third Annual Report of the Connecticut State Board of Health, and forms an interesting and valuable contribution to the literature of the profession. Although we are disposed to question the value of certain features in the construction, we cannot but applaud the earnest care with which every detail has been studied, not through the aid of books alone, but by comparison of actual examples and inquiry into practical needs.

The plans and elevations show a quiet, well-studied design, with some peculiarities of arrangement, as for instance the placing of the teachers' platforms in the corners of the school-rooms, instead of in the middle of the short side, but in certain particulars of material and workmanship the building differs from any with which we are acquainted.

To begin at the foundation, the cellar floor, after concreting, is covered with two coats of asphalt, which extend not only over the area upon which the building stands, but are continued over the whole internal surface of the walls to the very top, where they are carried over and form a bed for the coping. This impervious lining, as Mr. Briggs truly says, forms a more effectual protection against dampness from the outside than would be afforded by a hollow wall, but it must have the effect of totally preventing that reciprocal transpiration of interior moisture and exterior air through the masonry which is so much promoted by hollow-wall construction, and which is now considered to play a considerable part in the aeration of buildings. Such a wall as Mr. Briggs has provided must, we should think, condense streams of unwholesome moisture upon its interior surface during the winter, to run down and saturate the edges of the floors. The architect, indeed, has apparently anticipated trouble from condensed dampness, for the walls, instead of being plastered directly on the brick-work as is usual when hollow walls are employed, are furred with wooden strips in the same manner as if no precautions whatever had been taken against the entrance of water.

The interior walls which include the halls and stairs form a singular exception to this rule. Here the brick-work is laid of the best material, with fine joints, and after completion is treated with patent wood-filler paste, and then varnished in two coats, so as to secure a clean, easily washed surface.

The arrangement of the closets and urinals merits the highest commendation. The latter, particularly, are entirely constructed of slate, and surrounded by walls, partitions, floor and ceiling of stone, so that the whole can be washed out by the janitor with a hose at the close of each day. The lavatories are placed under the outside steps and porches, so that even if abandoned to total neglect no effluvium can be drawn through the floors into the rooms above; and they are warmed by stoves set in a special shaft, with walls of open brickwork, through which sufficient radiation can take place in winter, while a simple screen cuts off the heat in summer without interfering with the ventilation.

The heating of the main building is, almost as a matter of course, accomplished by indirect radiation from steam coils, but in the disposition of these several new features are adopted. That which has called forth the most comment and criticism is the placing of the coils near the centre of the building, and the introduction of the fresh warm air from them by registers at the interior corner of each room, about nine feet from the floor, withdrawing it again by exhaust registers in the same corner, at the floor level. Mr. Briggs's opinion, with which we are strongly inclined to agree, is that the most effective circulation is secured in this way. By throwing the warm fresh air into the room directly over the exhaust, the impetus with which it arrives at the registers is utilized to counteract the deflecting influence of the exhaust, and its superior buoyancy also keeps it out of reach near the ceiling, along which it travels with great rapidity, urged by its own initial motion in addition to the acquired movement of circulation, to the outer walls, where it becomes slightly cooled, descends, and sweeps back along the floor to the exhaust register, the currents thus reaching every part of the room, without any interference or any danger that direct currents may be set up, crossing the room from one register to the other without moving the atmosphere on each side.

This part of the school-house plan has, however, received more criticism than any other. The practice of placing direct radiators near the outside walls, under the windows, has become so generally approved, and with reason, since the chilled currents descending from the window are thereby intercepted and warmed before they pass into the room, that a similar position for warm air registers is very commonly adopted, on the theory that it is necessary to mix, as it were forcibly, the cold air next the outer walls with the warm inward current in order to obtain a uniform temperature all over the room. This inevitably creates a certain conflict and confusion of currents near the outside walls, while by Mr. Briggs's plan all the forces, direct and indirect, which affect the atmosphere of the room act in unison to sustain a single steady movement, which sweeps over every portion of the apartment. The chilling influence of the windows, by accelerating the general circulation, brings the warm air rapidly towards them, and in practice the thermometer is found to be always one or two degrees higher at the outer wall of the room than directly under the warm-air register. The placing of the stacks and registers at the inner corners of the rooms greatly promotes economy and efficiency in the first cost and permanent working of the apparatus, while the situation of the exhaust registers in the same corners gives opportunity for immediately collecting all the outward currents into two main shafts of large size, with obvious advantage in regard to certainty and economy of power in withdrawing the vitiated air.

Mr. Briggs has, however, permitted himself one unusual expense to secure the important point of controlling the temperature of the warm air supply. As every one knows, the most serious defect in steam-heating, either by direct or indirect radiation, consists in the impracticability with the ordinary apparatus of maintaining a temperature above or below a certain limited range, so as to obtain from an apparatus suited to midwinter heating the gentle warmth only which is required for the cool days of spring and autumn, without nearly closing the registers in the rooms, and then shutting off the fresh air as well as the heat. Some attempts have been made to obviate this difficulty by providing a double air-supply to each register, one of cold and the other of warm air, and arranging the valves so that the total amount of inflowing air shall be always the same, but mixed in varying proportions of cold and warm as desired. Such a device works well if a thorough mingling of the currents can be obtained before permitting them to enter the room, but this is not always easy. Mr. Briggs therefore adopts the more efficient plan of dividing the stacks at the foot of each warm-air pipe into five separate portions, each supplied from the main steam-pipe through its own valve. The volume of air passing through the shaft, and into the rooms which it supplies, remaining always the same, a single division only of the stack of radiators may be employed for mild weather service, warming the air which passes by it in only a small degree, while in colder weather two, three, four or five radiators may be employed, increasing the heating effect to any desired extent.

ST. SOPHIA.

IN more than one respect the great church founded by Justinian at Constantinople upwards of thirteen centuries ago may be considered to be one of the most typical buildings in the world. Regarded from a purely architectural point of view, it is the great example of the domed style, the finest of all styles for interior effect, carried out in a complete and homogeneous manner. It is also the most marked illustration of the employment of architecture purely as a source of interior effect. In this respect, in regard to the degree in which exterior and interior effect respectively has been consulted, the leading architectural styles of the world are very various in their principle and practice. In some, internal and external effect seem to be about equally balanced, as in the mediæval cathedrals. In some great buildings, such as St. Peter's, there is practically a failure in effect externally which was not intended, which resulted from the mistakes of some of the architects concerned. In modern Western architecture we not unfrequently find the whole of the architectural effect external, and the interior of the building merely arranged for practical purposes, as in many of our town-halls and municipal buildings. This extreme is the one peculiar to Western architecture, as the opposite extreme is peculiar to Eastern architecture. In the domestic architecture of the East, we find that dwellings of the richest and most sumptuous decoration internally present not a feature externally, a fact which has been sometimes taken as indicative of the social selfishness and isolation of Eastern life. But the great church at Constantinople stands as a solitary example of the erection of a building on the largest scale and of the most magnificent internal effect, in which external architecture is absolutely wanting, and no attempt seems to have been made to render the exterior anything beyond a rough shell to protect the precious kernel of the interior. Even the evidence of design arising from good construction is wanting. Immense masses of matter have been piled up outside in what, even from an engineering point of view, must be called the rudest manner, to hold up by their sheer weight and *vis inertiæ* the beautiful internal construction — masses which are absolutely unsightly, and the work of which might have been done by half the materials scientifically arranged, and of course with infinitely better effect. Yet, entering within this misshapen mass, we find one of the most complete pieces of masonic construction, and one of the most effective and gorgeous interiors, which architecture has ever produced, and we may look all over the world without finding any other example of such a contrast between the outward promise and the interior result. In another respect, too, St. Sophia occupies an exceptional position, as the chief link between the classic and the Gothic schools in regard to architectural detail, the centre from which radiated the beautiful types of carved ornament, in the shape more especially of capitals, which were to be modified and worked out in France into the more delicate and logical forms of the complete Gothic capital. In this respect the influence of St. Sophia has differed very much in regard to general design as compared with detail. In general design, internally, it was the culmination, the complete working-out of the domical system first suggested by the Romans; and hardly anything so complete in this respect has been achieved since. In detail, on the other hand, it was still tentative, and was a *point de départ* rather than a culmination. To add to its other points of singular interest, St. Sophia has had the remarkable fate of having been built for the celebration of the most characteristic and strongly defined form of Christian ritual, and of having been transformed into the principal home of the ritual of the strongest and most uncompromising rival of the Christian religion.

It is a question to be asked, in regard to the extraordinary discrepancy between the exterior and interior effects of St. Sophia, whether Justinian or his architect in reality intended the exterior to be finished at some future time, just as the façades of the Italian churches were often left to be finished by future generations; whether the original founder adopted the idea of getting a grand interior for the performance of the ritual at once, leaving the less important construction of the exterior out of consideration for the time? It would have been more possible to gain some idea about this from the actual study of the exterior before it was restored under the direction of Fossati in 1847 and the following year. He so far altered and renewed the exterior surfaces of a considerable part of the building that it can no longer furnish much evidence in the matter; and perhaps it never could have furnished this. But it seems to us very improbable that any man who had shown such ambition to produce a gorgeous interior should have been entirely indifferent about the exterior effect, and we lean to the impression that the exterior was never regarded as complete.

It is a common misapprehension to regard the church as dedicated to some special "Saint Sophia" of the calendar, a view which our usual way of translating the dedicatory title of the church serves to foster. But, literally, the church is dedicated not to any individual "saint" in the ordinary sense, but to "Sacred Wisdom," as opposed to the profane wisdom of which the goddess Minerva was the type. The recollection of this is not insignificant when we regard the general architectural style of the church; its large open area, its abundant light, seem quite opposed to the mysticism and gloom which subsequently gave the key-note to the aspect of the buildings of mediæval Christianity; and such an effect is in accordance with the wider and grander idea suggested by the dedication. In regard to the form of plan adopted, we want the links which would enable us to connect it with its originating forms. The real history of the plan and section of St. Sophia is connected, there can hardly be a doubt, with the Etruscan forms of architecture which so largely influenced the Romans, and the results of which, as far as that people were concerned, culminated in the Pantheon. It is probable that a good many Eastern churches between this and St. Sophia perished by fire, owing to the extensive use of wood made in their construction. We have St. George at Thessalonica as an early specimen, in which the plan of the building, with the circular form showing itself on the exterior, and the section of the dome, bear a very considerable resemblance to the Pantheon, with the difference, however, that the dome form is not shown externally, but is covered by a wooden roof, the outer walls being carried considerably above the springing of the dome. Mr. Fergusson classifies this as "Eastern Romanesque," a title which comprehensively expresses the historic relation of such a building. He assumes that it was erected by Christians, at about the approximate date of A. D. 400. The next known specimen after this, the church of SS. Sergius and Bacchus at Constantinople, brings us to Justinian himself, and may be regarded as a kind of trial on a small scale of the architectural scheme of St. Sophia; not that it was so intentionally, but under the circumstances, after the burning of Constantine's original St. Sophia, it might very well have been so regarded. Like the Pantheon, it exhibits the dome externally, and shows the tendency to the flatter section of dome which was afterwards adopted in the great church; and in plan it exhibits the principal characteristics of St. Sophia in a simple form; the square surrounding the dome, and the galleries and two-storied narthex. The main difference in St. Sophia is the lengthening out of the central space from a square to an oblong by the bold and happy introduction of the semi-domes from which the great dome springs, and which gives to the interior a unity of constructive effect such as hardly any other domed church possesses. In fact, the practical elements of architecture are as remarkably displayed in the interior as its æsthetic elements, and it is noticeable that the rebuilding of the church having been rendered necessary in the first instance by the burning of the previous basilica, it was made a *sine quâ non* by Justinian that it should be built exclusively of non-combustible materials, so that St. Sophia takes rank as the first fire-proof structure we know of that was intentionally so built. All the records of the construction of the building are indeed creditable not only to the ambition but to the practical good sense of the man who called it into existence, and boasted (probably quite within the mark) that he had surpassed Solomon.

In speaking of the historic position of the building in architecture, we may observe that recently a writer in *L'Art*, M. Léon Hugonnet, has started a somewhat fanciful theory in regard to the supposed influence of Egyptian upon Byzantine architecture. The architecture of Justinian, he says, seems to him to be "*l'architecture Egyptienne rentrée dans l'architecture grecque;*" and he traces this assumed fact to the influences of the solitary saints of the Thebaïd, whose opinions governed the Christian world, and who introduced or recommended the introduction into Christian architecture of the forms they were familiar with in Egypt. It does not appear to us that this theory has more claim to serious consideration than a good many others which have been developed by French theorists on architecture, who have a great tendency to construct architectural relationships and theories of this kind out of their inner consciousness. That there is a connection to be traced all the way back from the Gothic column to the Egyptian is true enough, but certainly the immediate connection of Byzantine detail is with Greece and Rome, and the immediate connection of its general scheme of building is with Rome. The only partial countenance that may seem to be given by St. Sophia to this Egyptian theory is in the battering of the lines of the masses of the external walls and counterforts; but considering how nervously anxious Justinian and his architects obviously were in regard to the stability of the building, from the way they piled mountains of buttresses against it, the idea of buttressing might have been sufficient to lead to this adoption of sloping lines, without any hints from Egypt or from the hermit saints, who we should imagine were about the last people to give much attention to architecture: and at all events, this portion of the building is architecturally the least important of all. Any critic who can trace direct Egyptian influence in the interior must, we should imagine, be very strongly biassed by a preconceived theory.

We have observed that the detail of St. Sophia was dependent on Greece as well as Rome, and it is curious that in the treatment of the carved capitals there is in many cases a much closer approximation to Greek feeling and forms than to Roman, and at the same time that the method of using, reproducing, and modifying these forms is, as we shall have occasion to observe, exceedingly capricious, even in contiguous parts of the same building. Some of the preliminary forms of capital a century earlier than St. Sophia are to be found in the basilican church of St. John at Constantinople, where there are capitals with a distinctly Roman or classic outline, but with foliage assuming a tendency towards what were afterwards known as Byzantine forms. In some of the St. Sophia capitals, on the other hand, there seems to be a mingling of the old and new element in an opposite manner: the general forms of some of the capitals are Byzantine; for instance, they are longer in proportion, straighter lined, and less elegant than the Greek and Roman types of Corinthian capital on which they are founded, but the foliage bears a stronger resemblance to the Greek acanthus than to the Roman, and in some cases may fairly be said to be superior to either in its treatment, and the combination it exhibits of flowing line with sharp and crisp character and outline.

The transition of the building from being a Christian church to becoming a Mohammedan mosque took place in 1453, under the sultanship of Mohammed II, who built the first of the four minarets of curiously mongrel style, which now mark the four angles of the building externally, the one at the southeast angle. Rather more than a century later Selim II, built the northeast minaret, and his successor, Amurath III, built the two at the western angles, adding also a great deal to the external buttressing, with well-meant but clumsy solicitude for the security of the structure. The building, however, towards modern times, was gradually sinking into a somewhat dilapidated and precarious state, and in 1847 the then sultan called in the architect Fossati to superintend a thorough repair of the building. Fossati, fortunately for himself, lived before the existence of a society for the protection of ancient buildings, under whose *régime* the Church of Sacred Wisdom would probably, by this time, be level with the ground. As far as regards the interior he seems to have used good judgment; there may be some question as to his treatment of the exterior. He found the church with many sinkings in the large dome arising from settlements in the substructure or in the buttresses, and not a few of the interior columns dangerously out of the perpendicular from the same cause, — in one or two cases columns which bear integral parts of the structure. All these were brought back to the vertical position except one, the handling of which was interfered with by the proximity and pressure of one of the minarets and its base and buttress. Portions of the large buttresses were rebuilt or re-cased, but the flying buttresses from them to the lowest ring of the great dome, which cut very awkwardly into the lines of the dome, were removed, and an iron chain put round the base of the dome instead. The lead over all the cupolas and other roofs was repaired or renewed. The surfaces of the great buttresses were finished up with a kind of imitation of coursed rusticated work in cement, and they were given also a new finish at the apex, a kind of semicircular saddleback with a circular ornament inserted in the front of the buttress, concentric with the lines of the capping. Fossati has preserved the original appearance of the exterior before he touched it in what purports to be an accurate view; and it must be admitted that in the building as it was previously there was a distinctly Oriental appearance which harmonized with its history and surroundings, and that the hand of the Western architect is somewhat too manifest in the external appearance as Fossati has left it. In the interior the ancient splendor was altogether dimmed. The inlays were dull with time, and the mosaics had been covered over with layers of plaster and other coverings to hide from the eyes of the faithful the idolatrous figures which they contained. The fact is perhaps a tribute to the permanent character of mosaic work, for it may be presumed that the Mussulman enthusiasts would have destroyed the mosaics altogether if they could easily have done so. Fossati, discovering accidentally the presence of some mosaic figures under the plaster in the vault of the northwest angle of the aisle, had other portions of the vaults uncovered, and it was then seen that the whole had been sumptuously decorated with gold mosaic, the gilding and ornaments on which were now renewed, while the obnoxious figures were ingeniously obliterated by powdering which could at any time be easily removed should the building pass into other hands, or should the followers of the Prophet relax their rule in regard to figures. In the same way there were found on the wall of the outer porch, over the door leading into the narthex, portraits in mosaic of Constantine and Justinian, and these have been covered again with a lightly-painted ornament in quasi-Arabic style, which at once conceals and protects them. The building thus came out in something like its old splendor so far as color effect was concerned; and the furniture was renewed in a sumptuous manner. The effect of this cannot be well realized in an engraving; the gilt chandeliers, for instance, stand out in reality with great brightness in the total effect, while neither that nor the effect of the mosaic can be conveyed in black and white; but the illustration gives correctly the grouping and effect of the architectural details (of which a word more just now) and of the principal objects in the building, which, indeed, are not many; the simplicity of Mahommedan worship having its advantage from an architectural point of view in this way at least, that it leaves opportunity for a large extent of open and unencumbered floor-space, nothing being needed for the majority of the worshippers beyond a spread of carpets over the floor to kneel on. The octagonal erection on the left is what in English would be called the Sultan's pew, which is also a sumptuous erection covered with gilding, and surrounded to the greater part of its height by rich tracery, which avails to hide the royal worshipper from the view of the people, though leaving him with a full view of everything. It need hardly be observed that this is a modern addition. Two remarks may be made, before quitting this part of the subject, in regard to the effect exercised by Mohammedan arrangements and furniture on the interior of the building. One of these arises from the fact that the building, not having been built as a mosque, does not front towards Mecca. The Mahommedan conquerors could not alter the orientation of the building; but as your true Mussulman always prays kneeling or standing on a mat or carpet, it occurred to them to right the matter by arranging the carpets in reference to Mecca, and at right angles with the true Mahommedan orientation, so as to run in oblique lines across the floor. This method being religiously carried out in every part of the building, and arresting the eye at once, gives an idea of the whole structure having been built askew; but, though a rather provoking effect architecturally, the incident is so interesting in its associations and suggestions that perhaps no one would wish it otherwise. The other point is a very different incident, too prominent in every view of the interior, namely, the hideous effect of the great circular panels, with texts from the Koran inscribed upon them in colossal characters, which are painfully conspicuous. They cut up the architecture most cruelly, and greatly injure the scale of the building; and it is a marked instance of the essentially Puritan character (except in one particular) of the Mahommedan faith, that it exhibits so strongly in this case that absolute indifference to artistic effect as compared with spiritual and moral enlightenment, which is one of the leading characteristics of all Puritanism.

Running over, in conclusion, some of the points in the architectural scheme of the building, we are struck with the curious mingling of classic with Christian associations in the architecture of this once Christian temple. We enter the narthex, at the south end, through a porch with an almost purely classical cornice, Roman in style, and through a door of bronze in an almost pure Greek style, evidently brought from some Pagan shrine. The shafts of the columns in one corner come, so tradition has it, from some disused temple at Ephesus; in another we find reputed spoils from Baalbec, in some cases various sized drums of shafts joined by metal rings. In the arcades on the upper story over the central part of the nave, we have the front row of columns, those which form the screen visible from the body of the church, with quasi-Corinthian capitals, retaining very much the general outlines and character of the Corinthian capital, only with smaller volutes and somewhat different type of foliage. Immediately behind these, the columns which carry the springers of the vaulting have a compound capital, consisting of the straight-lined carved block peculiar to Byzantine architecture mounted on an almost pure Roman Ionic capital. Everywhere there is this curious transformation of old forms, or mingling of old details with new combinations, proclaiming that architecture was at this time entering, or preparing to enter, on a new path.

Going back for a moment to the door between the entrance-porch and the narthex, mentioned before, we find in the simple yet rich architecture of the narthex another application of classic forms. Here the supports are massive square pilasters, with a capital in three stages, which somewhat suggests the idea of a portion of a classic architrave, with its crown moulding and its two facets, only all elaborately carved. This is, at least, far better than the Roman idea of twisting the whole members of an entablature round the top of a column. The roof is a simple quadripartite vault; a domical roofing would have been more completely in keeping with the character of the main portion of the building. The treatment of the angles of the plan, with their screen of columns arranged in a quadrant separating them from the main area, is most happy, both above and below; it includes something of the real poetry of architecture, giving at each new turn a new view of the structure, — a new perspective effect. This would strike even the unlearned spectator, but the architect derives still greater pleasure from the beautiful and architecturally truthful treatment of the great piers and the interspaces between them; the piers are almost unbroken solid masses, only diversified by inlay; the arcades between filling up what is constructionally a void in the most appropriate and graceful manner, giving breadth and unity to the whole while clearly defining the supports of the building. The advantage in the way of internal effect, from the low pitch of the dome, which enables the eye to take in at once and appreciate its real size, has been often remarked on and contrasted with the less satisfactory internal effect of the loftier dome of the great Latin cathedral; but not so often has the peculiarly beautiful lighting of the dome been commented on, the manner in which light has been poured in through what is the heaviest part of the section of the dome, yet without obliterating the appearance of constructive security. The whole idea of the treatment and roofing of the great central compartment is one of the most noble architectural conceptions that has ever been carried out, and the interior is not less remarkable for its grandeur as a whole than for its picturesqueness in detail, and the interest and beauty of its decoration. — *The Builder.*

STRAWBERRY HILL.

If Parliament were not sitting, says the London *Globe*, and if the Irish Land bill, and the Wimbledon gathering, and the Brighton Railway murder did not engross the attention of the public at present, to the exclusion of other subjects, the announcement just made to the effect that Strawberry Hill, the favorite "home and haunt" of Horace Walpole, and, in matter of fact, his creation, is about to pass under the hammer of the auctioneer, would have produced what the French term "a profound sensation." When, in the autumn of 1842, it was noised about that Mr. George Robins was "instructed" by the late Lord Waldegrave to sell the mere "contents" of that historical — we will not say classical — edifice, everybody rushed off post haste to Twickenham to see it before it was dismantled. The catalogues were published at a high price, and advanced in value as the days of the sale approached. The muse who presides over auctions was propitious on the occasion; at all events, the catalogue was well prepared and attractively "got up." The Gothic mania was just then at its height, having been fanned into flame by the Cambridge Camden and the Oxford architectural societies, or by the writings of the elder Pugin and Sir Gilbert Scott. And so it came about that the sale was the "event" of the "silly" season of the year, and that "everybody who was anybody," from royalty downwards, possessed himself or herself of one or other of the art treasures, great or small, which were declared to be "Going, going, gone!" The Queen herself, through Sir Charles Murray or Sir John Conroy, became the purchaser on that occasion of a magnificent clock, the same which had been given three centuries before to Anne Boleyn by her Royal suitor and master, and which now graces the grand drawing-room of the Royal apartments at Windsor Castle.

Since that time, as most of our readers are aware, the taste and liberality of the late Lady Waldegrave led her, as soon as she became the uncontrolled mistress — or rather "queen" — of the place, to endeavor to rehabilitate Strawberry Hill, and to glean back a portion at least of the art treasures in which it once abounded. One by one many of these treasures came back to her hand — some as gifts from friends, others as costly purchases. Pictures were restored to the walls on which they had hung in the days of Horace Walpole and of his neice, Mrs. Damer, to whom he bequeathed the spot; books, missals, breviaries, coins, cabinets, rings, and drinking cups found their way back to shelves from which they ought never to have been torn; and a quarter of a century ago, had the shade of Horace Walpole been able to revisit the place, it would have been pleased, on the whole, to see that no greater devastation or destruction of his favorite abode had occurred. Soon afterwards her ladyship began the task of building on to the original lath and plaster castle — for such it was — a new mansion, or rather palace, also in the Gothic or semi-Gothic style. But she furnished it in strict accordance with the taste and plan which had approved itself to its original founder; and though the new drawing-room and music-room are gorgeous in gold and coloring, the eye will recognize in the ornamentation that it is made to harmonize most completely with the pensive and almost monastic effect which the original villa was intended to produce. It is not a little singular that "Strawberry," as the place was always called by its owners and their immediate friends, was the toy of Horace Walpole, and that it was bought by him from some ladies who had made their fortune by a toy-shop in the West-end of London — the Misses Chenevix, who had obtained a lease of the pleasant spot and the tiny cottage which stood upon it from the coachman of Lord Bradford, then residing hard-by as a country squire at Teddington. Ill-natured wags declared that the aristocratic Jehu had bought the cottage by selling his master's hay and giving his horses chopped straw instead; whence it was christened "Chopped Strawberry." But the name and the accusation died out soon after Horace Walpole took up his abode there, much about the time when George II was called to his fathers and George III came to the throne.

As a boy Horace Walpole had been bored and annoyed by the stately grandeur of his father's seat at Houghton, and avowed himself a "snapper-up of unconsidered trifles," in other words an antiquary. He was well-born, well-bred, a bachelor, a man of taste; and he resolved to gratify that taste in a dilettante manner. He commenced by collecting autographs, old scraps of letters, old legal documents, old seals, old coins and metals, old prints and pictures, and whatsoever falls under the category of "curiosa." These he collected and hoarded, till his little cottage, or as he called it his "tub," at Windsor was full to overflowing. In the cottage of the Chenevix's at Twickenham, he saw, or thought he saw, a capacity for enlargement and improvement, and that too in a manner in accordance with his own taste. This taste he had probably acquired whilst travelling abroad with Gray, when he visited most of the fair cities of the sunny South, and made drawings of their Gothic cathedrals. Their pointed architecture, though styled by so disparaging a name, exactly caught his taste, quite apart from any religious awe which their long-drawn aisles and fretted vaults may have inspired in the companion of his travels. His eye also was weary of the straight and formal Italian gardens which had been the fashion in all country-houses of England since the first days of the Renaissance. He would be his own architect, and his own gardener, too. He would not, perhaps, produce anything very original; for had he not gleaned this arch from Canterbury, that spire from Lichfield, and that window from York, and that shrine from Westminster Abbey? and had not Gloucester suggested those crockets and finials? and had not the Abbey of St. Albans' been laid under contribution for that elaborate doorway? It must be owned that the erection of Horace Walpole was an amateur effort, and a very crude and imperfect one; but it was at all events a step in the right direction. Insensibly and without intending it, he went back, and led back his friends, to antiquity for the model of a style which should correspond with the poetic and meditative side of human nature, and appeal to our affections rather than court our admiration. His style was neither Saxon, nor Norman, nor Early English, nor Decorated, nor Perpendicular, but a strange medley of all in turn. His "Castle of Otranto," as he termed it in jest, was a sad jumble of all styles, and would never have received the approval of Welby Pugin or of Gilbert Scott. But we honestly think that if there had been no Horace Walpole at work at Twickenham a century ago, familiarizing the minds of royal and learned persons, of dukes and duchesses, of lords and ladies, and of members of Courts and Cabinets, with the Gothic "style," in all probability Dr. Milner and Mr. Sydney Hawkins, and even Rickman, might have written and preached in vain. In fact, his tentative effort, slight and artistically poor as it may have been in itself, was the first step, if rightly viewed, in the direction of that great modern revival which has rejoined architecture to religion, and brought the face of Nature into our landscape gardening.

Of late years Society has known Strawberry Hill as one of the most charming of town houses; for Twickenham is now little more than a suburb of the great metropolis. Here, whilst Holland House and Devonshire House were suffering from an interregnum, and especially after Cambridge House lost its gracious and clever mistress, Lady Palmerston, the late Lady Waldegrave reigned as a "Queen of Society," and entertained Royal personages and ambassadors, dukes and duchesses, just as Horace Walpole had done, only on a larger and more liberal scale. Her death, a couple of years ago, once more threw a cloud over the place, and "Strawberry" has since been once more practically in abeyance. Lord Carlingford, her husband, has other country seats, and has lately been made Lord-Lieutenant of Essex, between which county and Somersetshire he means to divide his time. The recollections of "Strawberry" must be indeed painful to him; and no wonder that the fiat has gone forth for its sale. It is only to be hoped that it may fall into worthy hands, and that a place associated with the names of Walpole, Clive, Deffand, Damer, Waldegrave, and Orford, may be rescued from the sad lot of falling — like Cremorne or Vauxhall — into the hands of the speculative builder.

THE NEXT ANNUAL ADDRESS BEFORE THE A. I. A.

The following correspondence relating to the opening address to be delivered at the approaching convention of the American Institute of Architects has been forwarded to us for publication, by the secretary of that body:

[Mr. Walter to Mr. Latrobe, July 25.]

Philadelphia, July, 25, 1881.

My dear Mr. Latrobe:

It has been decided to hold the next annual convention of the American Institute of Architects, commencing on the 16th of November next, in Washington, D. C., you will observe, by referring to the By-Laws that "the annual address shall be delivered by the President, or by an alternate appointed by him." I have performed that duty, as best I could, *four* years in succession, and I am very anxious to have you take my place at the next convention. I mentioned the matter at the last quarterly meeting of the Board of Trustees, and they were delighted at the prospect of hearing you on that occasion.

Washington was the scene of many of your venerable father's triumphs in architecture, in the earliest years of the practice of that art, as a profession, in this country, and there is many a form in that old Capitol that bears the impress of your own genius, it is therefore particularly fitting that you should make the opening address at the first meeting of our Convention in Washington; I therefore ardently hope that you may accept this invitation, and thus give force to our art, and gratification to the profession throughout the country.

I send you by mail such copies of the proceedings of the Convention, as I have by me, also a copy of our Constitution and By-laws.

I remain, my dear sir, very sincerely your friend,

Thos. U. Walter.

John H. B. Latrobe, Esq., Baltimore, Md.

[Mr. Latrobe to Mr. Walter, July 25.]

Saratoga, N. Y., Aug., 2, 1881.

My dear Mr. Walter:

You see the place to which your letter of the 25th has followed me. You have paid me a great compliment, and given a great gratification, one that I cannot resist the temptation of accepting. Do you know that there is but one difficulty that occurs to me; I cannot, fond as I am of your great art, which you have so nobly illustrated, hope to say one single word about architecture that you have not already said, far better than I could hope to say it.

What my utterances would be then, having reference to my personality, and what, as an old lawyer, I would call the *locus in quo* of the address, would turn in a very great degree upon what I myself knew of Washington in the earlier years of the present century, and of my father's works there, the condition in which he found them, the condition which the war that interrupted his connections with them left them in, and their restoration to far, far more than their pristine condition; and this would necessarily savor so much of what might be criticised as mere egotism; — that I hesitated, on reading your letter, whether it would be becoming for me to say to an audience that knew not my father so much about him and his works; and yet I know that I could not avoid doing so, carefully as I might avoid a violation of good taste. Still weighing the pros and cons, I determined to venture, unless on stating my difficulty to you, you said you wanted more of Bramante and Michael Angelo, with a glance at Phidias, and Praxiteles, than of B. Henry Latrobe and his works, even though there would be a somewhat close connection with art in the United States and the city of Washington.

The truth is, my dear Mr. Walter, old as I am, I have yet to learn to write in generalities, and unless I can write about the visible and the practical I cannot write at all.

You will be able to gather from this the scope of my address, and if you should think such an address would do, I would like to make it, and rescue if I could, some names that should not perish — such as Consici, Andrei, Franzoni, Giardella, and others of the sculptors whose works are to be seen in the Capitol, and all of whom I knew.

Write me candidly, and if you think what I would do *would do*, I will do it *D. V.* when the time comes.

Can you not send me, or lend, me copies of your own addresses, that I may get the hang of the thing you want me to do?

And believe me, faithfully yours,

John H. B. Latrobe.

[Mr. Walter to Mr. Latrobe, Aug. 6, 1881.]

Philadelphia, Aug. 6, 1881.

John H. B. Latrobe, Esq., Saratoga N. Y.

My dear Sir, — Your letter of the 2d inst. afforded me a great deal of pleasure. I am very much gratified with your decision to accept our invitation to deliver the opening address at our next annual Convention.

The line of thought you indicate in your letter is one that cannot fail to interest the profession generally, and to broaden the public esteem of our art.

If any of your audience "knew not your father," so much the worse for them; it is high time they were enlightened.

You will find in the documents I mailed to you in Baltimore *four* of the annual addresses I delivered before the Convention, copies of which you desired me to send you, that you might get "the hang of the thing," but judging from your excellent letter before me, you are already fully imbued with the subject.

Thanking you for your kind consent to address us on the occasion referred to, I remain my dear Mr. Latrobe,

Very sincerely yours, Thos. U. Walter.

NOTES AND CLIPPINGS.

An Alleged Art-Find at Venice. — An important rumor comes from Venice. It is to the effect that Signor Baccelli, the Minister of Instruction, had given orders that the pictures lying rolled up and uncared for in the Ducal Palace and the Academy of Belle Arts should be brought to light, and that there have been discovered among them Carpaccios, Tintorettos, Giorgiones, Giovanni Bellinis, Palma Giovanes, Vivarinis — many of them in excellent preservation and quite unknown to fame. The news seems too good to be true (writes our correspondent at Rome), and I give it on the faith of a Venice correspondent of *Capitan Fracasse.* —*St. James's Gazette.*

Stonehenge. — Restorations at Stonehenge have already been undertaken, but with results which will seriously impair the impressiveness of the ancient monuments there. The one trilithon which remains on the north-eastern side of the wings, has been bolstered up by a gallows-like wooden structure, placed transversely beneath the upper stone. It is of very substantial form, and is said completely to destroy the picturesque effect of that side of the ruin. On the south-western side there is a huge pillar which inclines inward. This will next be taken in hand, and it is believed that in time all the stones will have been buttressed into safety in a similar manner. —*New York Times.*

Effects of Removing Mountain Forests. — Attention has long been given to devising means to limit the ravages of these torrents, which ruin the land, threaten estates, destroy roads, and sometimes even compromise the existence of villages. Walls have been built along the banks to protect them, or across the streams to allay the force of the waters. The most efficacious means, however, as yet discovered has been to maintain the woods on the slopes of the mountain. The effect of cutting away the trees in promoting the formation of torrents has not been doubted by the inhabitants of mountainous regions, and is clearly set forth by M. Surrell, who says: "When we examine the tracts in the midst of which torrents of recent origin have been formed, we perceive that they have in all cases been despoiled of their trees and bushes. If, on the other hand, we examine hills whose sides have been recently stripped of wood, we observe that they are cut up by numerous torrents, which have evidently been formed very lately. Here is a remarkable double fact: wherever there are recent torrents there are no longer forests, and wherever the ground is cleared these torrents are formed; and the same eyes that see the woods fall on the declivity of a mountain may see appear there immediately a multitude of torrents." The disastrous consequences of removing the woods from the Alps began to attract attention in the last century, and have since been discussed in many publications and official reports. In 1853 the prefect of the Department of the Lower Alps said, in a report to the Minister: "If prompt and energetic measures are not taken it will be almost possible to designate the precise moment when the French Alps will become a desert. The period from 1851 to 1853 will produce a new diminution in the number of the population. In 1862 the Minister will remark a continuous and progressive reduction in the number of hectares devoted to agriculture; each year will aggravate the evil, and in a half-century France will count more ruins and one department less." The departments of the Upper and Lower Alps actually lost thirty thousand inhabitants, or one-ninth of their population, between 1851 and 1876. A law for re-covering the mountains with wood, which had been prepared by M. Forçade de Rouguet, director general of the administration of the forests, was adopted by the legislative bodies in 1860, and was put in operation shortly afterward. — *M. J. Cleve, in Popular Science Monthly.*

Painting on Cement and Plaster. — Much difference of opinion prevails respecting the question of painting Portland cement, and we have seen work painted a few weeks after the cement has set, which has stood well. There is one point which has a great deal to do with the question of successful painting, namely, the absorbency and dryness of the brickwork itself. Many new walls, saturated with moisture, are cemented, and in this condition no paint can possibly stand if laid on too soon. It is a good and safe rule to enforce that Portland-cement work should not be painted within a year of its completion, to allow it to dry thoroughly; but we are safe in saying the majority of new fronts are painted before they have been finished three months. A very desirable precaution seems to be to coat the work with linseed oil first. The painting of plaster-work requires the same care, and the lime works out in small bubbles, destroying the paint. In painting plaster, white lead and linseed oil, with a little dryer, is recommended by one authority. This coat should be of the consistence of thin cream, so that the oil is absorbed into the plaster in a few hours. In a day or two another thicker coat may be applied, and a third a few days after rather thicker, followed by the finishing coat. Four coats are not too much for good work. By the absorption of the oil into the plaster the surface becomes hardened, and may be washed. Another method to facilitate this absorption is followed by painters, which is to give the plaster two or three coats of boiling linseed oil, and then to apply the other coats of paint. We are inclined to think the application of the oil before the paint a better plan, to insure a thorough saturation of the material. The color of Portland cement and the uneven tints it sometimes assumes is the main reason why painting it is resorted to. For this reason we think it may be worth the attention of manufacturers to turn their consideration to the subject, and those using cement as a stucco might also prevent a blotchy and uneven tint by attending to the preparation of the wall and the sand they use with the cement. —*The Building News.*

Cost of Gas in American Cities. — The Buffalo *Express* gives an interesting table of the prices paid for illuminating gas in some of the principal cities in this country. In five of the seventy-three cities on the list, private consumers pay the same as in New York, — $2.25 per thousand; in twenty-one cities the price is less, and in forty-seven it is more. Pittsburgh stands first, with gas at $1.00 per thousand, and Ithaca next at $1.20. Then follow Allegheny $1.25, Cleveland $1.65, Poughkeepsie $1.75, Columbus, O., $1.80, and so on. There seems to be no fixed ratio between the size of the town and the price of gas. In most cases gas is sold to cities at a somewhat lower rate than to private consumers, but Dubuque, Ia., is a very noticeable exception, for there the city pays $7.00 per thousand, while the consumer is charged $3.50.

Fires in Prussia. — By direction of the Chamber of Deputies in 1880, the Minister of the Interior of Prussia caused statistics of fires to be prepared, much more exact than any previously made. The results for the last quarter of the year 1880 are as follows: During those three months, 2054 communes of Prussia had only 3109 fires, of which 1035 occurred in October, 1107 in November, and 967 in December. In 1844 cases the causes were unknown, being about 60 per cent of the whole. There were 245 cases of incendiarism, 722 from carelessness, 123 from use of matches, and of 24 the cause was lightning. Of the buildings damaged or destroyed, 1144 were of stone, 2222 of wood and stone mixed, 698 of wood, and 128 of other materials. There were 1,113 buildings taking fire from adjoining buildings, 4222 buildings being attacked, with 3109 fires, of which buildings 1583 had thatched roofs. Of the whole number of buildings fired, 3860 were insured for $8,225,000. The actual losses payed by the companies amounted to $1,475,000, or about 17 1-2 per cent of the sums insured — an average of $409 per fire. — *Fireman's Journal.*

BUILDING INTELLIGENCE.

(Reported for The American Architect and Building News.)

[*Although a large portion of the building intelligence is provided by their regular correspondents, the editors greatly desire to receive voluntary information, especially from the smaller and outlying towns.*]

BUILDING PATENTS.

[*Printed specifications of any patents here mentioned, together with full detail illustrations, may be obtained of the Commissioner of Patents, at Washington, for twenty-five cents.*]

248,288-289. BUILDING BLOCK OR TILE. — Augustine Campbell, Metuchen, N. J.

248,324. ASBESTOS MATERIAL AND PROCESS OF MANUFACTURING THE SAME. — Henry W. Johns, New York, N. Y.

248,328. EAVES-TROUGH. — Chas. Kaltenbach, Chicago, Ill.

248,334. COMPOUND FOR FILLING THE PORES OF WOOD. — Henry W. Mattick, Lawrenceburg, Ind.

248,345. FIRE-ESCAPE LADDER. — John Phipard, Brooklyn, N. Y.

248,346. COCK AND COUPLER FOR PIPES. — John Porsch, Jr., Erie, Pa.

248,359. FASTENER FOR MEETING RAILS OF SASHES. — G. B. Smith, Cleveland, O.

248,365. DOOR-FASTENING. Benjamin F. Stultz, White Pigeon, Mich.

248,369. FIRE-ALARM. — Gustav W. Ulmar, Newton, Mass.

248,371. LATHE. — Frank Whaley, Pawling, N. Y.

248,375. FIRE-ESCAPE. — Joseph Whitley, Flint, Mich.

248,364. AUTOMATIC BRAKE FOR ELEVATORS. — Joseph H. Baird, Oakville, Conn.

248,397. SMOKE-FLUE. — Constantine L. Brady, St. Louis, Mo.

248,401. SELF CLOSING AND LOCKING HATCHWAY-DOOR. — Josephus C. Chambers, Cincinnati, O.

248,412. TENONING-MACHINE. — William H. Doane, Cincinnati, O.

248,442. BOILER-COVERING. — Gilbert C. Fowler, San Francisco, Cal.

248,460. WEATHER-BOARD GUAGE. — Isaac A. Harris, St. Charles, Minn.

248,463. SAW-SET. — Noah S. Harvey, Detroit, Mich.

248,469. PIPE-JOINT. — Chas. W. Isbell, New York, N. Y.

248,470. BIT-STOCK. — William A. Ives, New Haven, Conn.

248,492. WINDOW-REFLECTOR. — And. G. Moodhe, Stillwater, Minn.

248,493. HEATING-FURNACE. — William H. Moore, Portland, Oreg.

248,494. ATTACHING WINDOW-SHADES TO ROLLERS. — Charles C. Mosher, Seneca Falls, N. Y.

248,508. BORING-MACHINE. — Nathan Saunders, Westerly, R. I.

248,517. APPARATUS FOR TRANSFERRING WOOD-GRAINING. — Benjamin C. Smith, Searsport, Me.

248,526. MANUFACTURE OF COMPOSITE PAVEMENT. — Peter Stuart, Edinburgh, County of Mid-Lothian, North Britain.

248,539. SAFETY ATTACHMENT AND GOVERNOR FOR ELEVATORS. — Aretus A. Wilder, Detroit, Mich.

248,547. ARTIFICIAL STONE. — John E. Wynkoop, Pottsville, Pa.

248,551. REVERSIBLE LATCH. — Joseph P. Baumgartner, Philadelphia, Pa.

248,559. DISINFECTING ATTACHMENT FOR SEWERS, ETC. — James D. Jackson, Washington, D. C.

248,562. ELEVATOR. — Norton P. Otis and Rudolph C. Schmidt, Yonkers, N. Y.

SUMMARY OF THE WEEK.

Baltimore.

BUILDING PERMITS. — Since our last report twenty-six permits have been issued, of which the following are the more deserving of notice: —

Dennis Sullivan, two-st'y brick building, Madison St., between Greenmount Ave. and Forrest St.

St. James House for Boys, four-st'y brick building, 29' x 33', n e cor. High and Low Sts.

Joshua L. Reed, 8 three-st'y brick buildings, Lanvale St., beginning at the s w cor. of Mt. Royal Ave.

E. Hurley, two-st'y brick building, Frederick Ave., in rear of 951 West Baltimore St.

Jacob Saum, 9 three-st'y brick buildings, Gilmor St., between Cook and Presstman Sts.

Aug. Herginroter, 2 two-st'y brick buildings, Castle St., 125' s of Fayette St.

Geo. Bunnecke, 2 two-st'y brick buildings, Calverton Road, between Frederick Ave. and Smallwood, and 2 two-st'y brick buildings in rear of the above.

Baltimore Permanent Building and Land Association, 3 three-st'y brick buildings, Harford Ave., between Biddle and John Sts.

H. G. Stewart, 3 three-st'y brick buildings, Madison St., s of Madison Ave. church.

Estate of Jacob Kierzle, two-st'y brick building, n e cor. McEldery St. and Bradford Alley.

Robert Stewart, 5 two-st'y brick buildings, Hudson St., between Patuxent and Curley Sts.

HOUSES. — Nine houses are in process of erection on John St., near Lanvale St., for Mr. Lawrence Turnbull. They are being built of pressed brick and North River bluestone, with half-timbered gables, etc., and have a frontage of 16' each; cost, about $4,500 each; Mr. Samuel Black, builder; Messrs. J. A. & W. T. Wilson, architects.

Boston.

BUILDING PERMITS. — *Brick.* — *Beacon St.*, 316, rear of, for Geo. N. Dana, stable, 26' x 34'; Vinal & Dodge, builders.

Harwich St., near Yarmouth St., for J. L. Lamprey, 4 dwells., 20' x 32', three-st'y; J. F. Mead, builder.

Unnamed St., nearly opp. Stark St., for Richard S. Bartlett, dye house, 40' x 100'; N. M. Hunnewell, builder. Also, boiler house, 15' x 30'.

Commonwealth Ave., No. 226, for Asa H. Caton, dwell., 25' x 65', three-st'y and mansard.

Newbury St., near Hereford St., for H. L. Daggett, dwell. and stable, 22' x 92', two-st'y; Webster & Dixon, builders.

Wood. — *Washington St.*, rear of near Lexington St., for Daniel McKenney, stable, 26' x 30', two-st'y.

East Fifth St., near I St., for Wm. Devine heirs, 3 dwells., 20' x 30' 6", three-st'y; M. Beatty, mason; Wm. Peard, carpenter.

Cobden St., near Walnut Ave., for Wm. B. Quigley, dwell., 21' x 41', two-st'y; W. B. Quigley, builder.

Border St., near Central Sq., for John S. Weeks, blacksmith shop, 30' x 60', two-st'y; Leonard Pickering, builder.

Pond St., rear of near Rockwood St., for J. I. Bowditch, greenhouse, 22' x 42'; W. K. Melcher, builder.

Colony St., Nos. 36, 38, *and* 40, for Leander H. Jones, 3 dwells., 21' x 38', three-st'y; Delano & Little, builders.

M St., near East Seventh St., for Wm. T. Eaton, 4 dwells., 20' x 32', two st'y; Wm. T. Eaton, builder.

Saratoga St., No. 470, for Carl Schuler, stable 28' x 30', two-st'y; M. Coffin, builder.

HOTEL. — A new hotel is soon to be built on the present site of the Adams House. It will be seven stories high, and contain some 200 rooms. Plans are now being made by Wm. Washburn, architect, of this city.

Brooklyn.

BUILDING PERMITS. — *Franklin St.*, n w cor. Java St., 2 four-st'y brick stores, tenements, lodge-rooms, etc.; total cost, $22,000; owner and builder, Jonathan K. Fairbank, 314 West Twenty-fourth St., New York.

Lafayette Ave., northerly cor. Tompkins St., 2 three-st'y brick and brownstone dwells.; owner and builder, S. C. Phillips, 623 Willoughby Ave.

Gates Ave., n s, 190' w Reid Ave., 8 three-st'y brownstone flats; cost, each $6,000; owner, architect, and builder, C. G. Hall, 63 Patchen Ave.

Monroe St., n s, 336 w Ralph Ave., two-st'y brownstone dwell.; cost, $4,000; owner, Patrick Butler, 364 Hart St.; architect, J. E. Dwyer; builders, T. Phalon and J. Ehrest.

Bushwick Ave., No. 111, w s, 46' n McKibben St., three-st'y frame store and tenement; cost, $4,000; owner, P. Kruse, Bushwick Ave., cor. McKibben St.; architect, Th. Engelhardt; builders, S. Preiss and J. G. Hoepfer.

Luquer St., n s, 89' w Clinton St., three st'y brick tenement; owner, Martin Carroll; architect, T. F. Houghton; builder, P. J. Carlin.

Vanderbilt Ave., e s, s Willoughby Ave.; one-st'y brick greenhouse; cost, $20,000; owner, C. Pratt, Clinton Ave.; architect, H. J. Farquhar; builders, J. Lock and Sims & Cook.

Morgan Ave., s w cor. Ten Eyck St., one-st'y brick factory; cost, $4,000; owner, L. Waterbury & Co., Morgan Ave.; architect, B. Cozine; builders, J. McQuaid and B. Cozine.

Tenth St., n s, 100' e Fifth Ave., 3 two-st'y brick dwells.; cost, each $4,000; owner, Peter Kelly, Van Brunt St.; architect, Jno. Kelly; builders, P. & J. Kelly.

Monroe St., s s, 200' e Nostrand Ave., 4 two-and-a-half-st'y brownstone dwells.; cost, $4,500; owner and carpenter, Joshua M. Brush, 391 Nostrand Ave.; mason, E. Van Voorhis.

Marcy Ave., n w cor. Hancock St., 2 four-st'y brownstone apartment-houses; cost, each $6,000; owner, Frederica M. Kinney, 418 Third St.; architect, J. G. Prague; builder, J. P. Kinney.

Dean St., s s, 75' w Sixth Ave., four-st'y brick flat; cost, $9,000; owner, M. M. Vail, 346 Broadway, N. Y.; architect, M. J. Morrill; builder, Thomas Ward.

ALTERATIONS. — *Henry St.*, between Amity St. and Pacific St., raised one-st'y; also two-st'y brick extensions, interior alterations, hospital; cost, $25,000; owner, Long Island College Hospital; architect, F. E. Lockwood; builder, F. D. Norris.

Chicago.

BUILDING PERMITS. — R. Bezugelson, three-st'y brick flats, 24' x 58', Evergreen Ave., near Park St.; cost, $6,000.

Union Iron & Steel Co., addition to wire-factory, 60' x 65, Ashland Ave., near Archer St.; cost, $7,000.

W. Groh, one-st'y brick cottage, 21' x 46', Maxwell St., near Waller St.; cost, $2,500.

Mrs. M. B. Hewett, three-st'y and basement brick dwell., 26' x 68', Adams St., near Laflin St.; cost, $20,000.

J. G. Owsley, 6 two-st'y and basement brick dwells., 59' x 130', Adams and Robey Sts.; cost, $20,000.

Thos. Devine, two-st'y brick dwell., 20' x 48', Dearborn St., near Thirtieth St.; cost, $2,700.

Charles Yunge, four-st'y and basement brick store and dwell., 912 Milwaukee Ave., 24' x 72'; cost, $9,000.

John Johnson, Jr., four-st'y and basement brick factory, 60' x 110', South Canal St.; cost, $23,000.

U. S. Rolling Stock Co., one-st'y brick shed, 100' x 230', Blue Island Ave. and Robey St.; cost, $6,000.

A. B. Harris, four-st'y and basement brick store and dwell., 25' x 95', 338 State St.; cost, $12,000.

John McVey, one-st'y brick factory, 75' x 100', 23 to 27 Michigan St.; cost, $7,500.

Cincinnati.

BUILDING PERMITS. — Since our last report the following building permits have been issued: —

Adam Stiefel, two-st'y brick, Spring Grove Ave.; cost, $2,500.

F. Schuerman, four-st'y brick, Pearl St., bet. Elm and Plum Sts.; cost, $5,000.

Fred Luckey, three-st'y brick, Western Ave., bet. Dayton and Bank Sts.; cost, $4,100.

Lippelman & Co., one-st'y brick warehouse, on Grist St.; cost, $5,000.

J. L. Hayden, repair of two-st'y brick, Plum St., near Commerce St.; cost, $4,000.

Twenty-two permits for repairs; total cost, $12,950.

Total permits, 28.
Total cost, $34,850.
Total cost to date, $1,635,650.
Total permits to date, 529.

New York.

BUILDING PERMITS. — *Robbins Ave.*, w s, 20' n One Hundred and Forty-first St., 17 two-st'y brick dwells.; cost, each $4,500; owner, John G. Heintzer; architect and builder, Chas. Bornkamp.

Ninety-Fourth St., s s, 75' w Lexington Ave., 5 four-st'y brownstone tenements; cost, each, $10,000; owners, Emeline and Elizabeth Johnston, 443 East Eighty-fourth St.; architect, A. B. Ogden.

One Hundred and Forty-second St., s s, 156' e Alexander Ave., two-st'y frame cottage brick basement dwell.; cost, $4,000; owner, W. H. Moadinger, One Hundred and Forty-third St. and Third Ave.; architects, W. H. Hanlon & Sons.

Washington Ave., e s, 50' n One Hundred and Sixty-fourth St., 3 two-st'y frame dwells.; cost, each $2,000; owner, Wm. Roland, Washington Ave., between One Hundred and Sixty-fourth and One Hundred and Sixty-fifth Sts.; architect, W. W. Gardner.

Washington Ave., e s, 150' s One Hundred and Sixty-fourth St., 2 two-st'y frame dwells.; cost, each $2,500; owner, Adolph Speck, Washington Ave., between One Hundred and Sixty-third and One Hundred and Sixty-fourth Sts.; architect, W. W. Gardner; builders, Wm. MacPherson & Son.

East One Hundred and Seventeenth St., No. 342, four-st'y brick tenement; cost, $12,000; owner, Chris. Keys, 2155 Third Ave.; architect, J. McIntyre; builder, — Walker.

Pearl St., Nos. 324 *and* 326, five-st'y iron and brick stores and lofts for factory; cost, $30,000; owner, Jas. Callery, Alleghany City, Pa.; architect, W. Kuhles; builders, A. Eberspacker and W. F. O'Connor.

One Hundred and Twenty-third St., s s, 200' e Eighth Ave., 6 four-st'y brick tenements; cost, each $15,000; owner and architect, Alfred Kehoe, 318 East One Hundred and Twenty-fifth St.; builder, Isaac A. Hopper.

Sixty-fourth St., s s, 250' w Fourth Ave., four-st'y brownstone dwell.; cost, $20,000; owner and builder, Gideon E. Fountain, 153 East Sixty-second St.; architect, Jas. E. Ware.

Second Ave., s w cor. One Hundred and Eighth St., 5 four-st'y brick stores and tenements; cost, each $9,000; owner, Wilhelmina Juch, One Hundred and Fourth St. and First Ave.; architect, Frank S. Barus.

Second Ave., s e cor. One Hundred and Fourth St., 4 four-st'y stores and tenements; cost, each $9,000; owner, Wilhelmine Juch; architect, Fr. S. Barus; builder, W. Juch.

One Hundred and Fourth St., s s, 75' e Second Ave., four-st'y brick and Ohio stone dwell.; cost, $8,000; owner, Wilhelmine Juch; architect, Fr. S. Barus; builder, W. Juch.

One Hundred and Sixth St., n s, 150' e Second Ave., 3 four-st'y brick and stone dwells.; cost, each $8,000; owner, Wilhelmine Juch; architect, Fr. S. Barus.

One Hundred and Eighth St., s s, 75' w Second Ave., 8 four-st'y brick and stone dwells.; cost, each $8,000; owner, Wilhelmine Juch; architect, Fr. S. Barus.

One Hundred and Nineteenth St., n s, 190' e Fourth Ave., 5 four-st'y brick flats; cost, each $12,000; owner, Lottie L. Dean, 319 East One Hundred and Twenty-first St.; architect, R. Rosenstock; builder, H. N. Dean.

East Fifty-eighth St., No. 145, three-st'y brick and brownstone restaurant; cost, $9,000; owners, M. & E. C. Shaefer, 16 East Fifty-fifth St.; architect, J. Kastner; builders, R. Huson and Hoffman & Schwartz.

East Fifty-eighth St., Nos. 147 *to* 153, one-st'y iron pavilion; cost, $12,000; owner, M. & E. C. Schaefer, 16 East Fifty-Fifth St.; architect, J. Kastner; builders, R. Huson and Hoffman & Schwartz.

Fifty-ninth St., s s, 131' w Ave. A., 2 four-st'y brick tenements; cost, each $10,000; owner and builder, Jas. E. Ray, 222 East One Hundred and Twentieth St.

One Hundred and Thirtieth St., n s, 225' w Seventh Ave., 4 three-st'y brownstone dwells.; cost, each $9,000; owner, W. J. Reynolds, 209 West One Hundred and Twenty-eighth St.; architect, J. H. Valentine; mason, not selected; carpenter, J. R. Smith.

One Hundred and Thirty-second St., n s, 135' e Fifth Ave., four-st'y brownstone flat; cost, $10,000; owner and builder, Patrick Dunphy, 2293 Fourth Ave.; architect, J. H. Valentine.

Ninth Ave., e s, opposite One Hundred and Fifty-third St., three-st'y brick and stone dwell.; cost, $65,000; owner, F. W. Du Bois, 510 West Thirtieth St.; architect, Chas. Baxter.

Ninth Ave., e s, between One Hundred and Fifty-third and One Hundred and Fifty-fourth Sts., 8 three-st'y brick and stone dwells.; cost, each $17,000; owner, F. U. Du Bois, 510 West Thirtieth St.; architect, Chas. Baxter.

One Hundred and Twenty-eighth St., s s, 75' e Seventh Ave., 2 four-st'y brick apartment-houses; cost, each $30,000; owner, E. F. L. Baxter, Brooklyn; architect, Chas. Baxter.

One Hundred and Thirty-second St., s s, 125' w Sixth Ave., 2 three-st'y dwells.; cost, each $7,500; owner, E. F. L. Baxter; architect, Chas. Baxter.

Lexington Ave., s e cor. Thirty-seventh St., 4 four-st'y brick and brownstone dwells.; cost, $22,000, $28,000, and $24,000; owner, Chas. Buck, 63 East Forty-first St.; architects and builders, Chas. Buek & Co.

East One Hundred and Ninth St., No. 312, four-st'y brick tenement; cost, $8,000; owner and builder, Joseph Handwerker, 174 East One Hundred and Twelfth St.; architect, Bart Walther.

Forty-third St., n s, 90' e Lexington Ave., five-st'y brownstone dwell.; cost, $20,000; owner and builder, Francis Campbell, 709 Madison Ave.; architect, Fr. S. Barus.

ALTERATIONS. — *West Thirty-second St., No.* 104, new brick wall from front to rear, 98', interior altera-

(*Continued on next page.*)