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A CURIOUS illustration of the high-handed manner in which the New York trades-unions carry on their affairs at present is furnished by several occurrences which took place recently at new buildings in that city. A coalition of all the unions concerned with the building trades has recently been formed, under the name of the Allied Building-Trades Union, and the managers of this association have undertaken to put in practice for purposes of their own the tactics employed before them by the Plasterer's Union, by employing, like the plasterers, inspectors to visit all new structures, and enforce, by the summary process of calling off their men such demands as they see fit to lay upon the contractors. The first building subjected to this process seems to have been the new Produce Exchange, which was visited by a "walking delegation," and the men in it strictly questioned, to ascertain whether they were members of the Unions of their several trades. As it happened all those reached by the delegation were members in good standing, and were left unmolested, until a fresh arrival of a party sent to put up some fire-proof blocks required the attention of the delegates. On being asked whether they belonged to any Union, the men with the fire-proof blocks replied that they were not mechanics; but they were promptly informed that there was a laborers' union which they could join, and that they must do so if they wished to continue their work. They immediately enrolled themselves as members, and were allowed to proceed with their business.

AFTER this victory, the "walking delegates" visited many other buildings meeting with similar success everywhere. At a new store in process of construction on the corner of Fifth Avenue and Fifty-ninth Street two derrick-men were found who were not members of the union, and the contractor who employed them was requested to discharge them at once. He refused, and the delegates ordered all the Union men in the building, seventy-five in number, to drop their tools and quit work, which they did immediately. The next day the delegates visited the place again, and found the contractor more tractable. On the condition that his Union men should be allowed to come back to him, he promised to discharge the two derrick-men, unless they consented to join the Union. They were called up, and being, apparently, persons of some independence of character, they refused absolutely to join the Union under compulsion, and were accordingly discharged. The seventy-five Union men then came back to their work. What the contractor's conscience said to him for his cowardly desertion of his employés does not appear, but we hope that it will not cease to trouble him until he makes them reparation. At a large apartment-house now building opposite the Central Park the delegates came upon contractors of a different kind. One of these was Mr. Power, a well-known plasterer, and a man of mind besides. Among his workmen were found several who did not belong to the Union, and he was summoned to discharge them unless they joined it at once. To this he replied that he was satisfied with the work of these men, and saw no reason for discharging them. The men themselves declined to join the Union, and all the Union men were thereupon ordered to pack up their tools and seek employment elsewhere. This seems not to have been an easy task, for soon afterward a number of them returned quietly and resumed their work. Unfortunately for them, they were discovered, and disciplined without mercy. Enormous fines were extorted from them, and they were forced again into idleness, while Mr. Power, faithful to his Non-Union men, and they to him, went on quietly with the building. The delegates, finding their dictates resisted, applied to the owners of the estate, who were also constructing a large number of houses near by, but with the help of different contractors, and threatened to call out all the men on all the buildings belonging to the estate, unless the owners would assist them to revenge themselves on Mr. Power and his independent workmen. The reply to this extraordinary proposition had not been given at the last accounts and the Union men were amusing themselves in the meantime by defacing Mr. Power's finished work with lead-pencil marks. It is singular that no question of advance or reduction of wages has entered into the movement, which seems to be directed solely to driving the most intelligent workmen into joining associations whose character, judging from its manifestations, they have good reason for disliking and despising.

A CORRESPONDENT of the *Sanitary Engineer* describes a curious instance of the charring of wood by steam-pipes, which is worthy the attention of those steam-heaters who so strenuously deny the possibility of such a thing. In the case in question the steam-drum of a boiler projected up between the beams of a floor, about three inches from the nearest one, and for some purpose a wooden wedge, about eight inches long, was driven in between this beam and the drum. Steam was carried during the day-time only, at about sixty pounds pressure; and in less than five months after being placed in position the wedge was converted into charcoal through its entire thickness, and even the beam against which it rested, three inches from the steam-drum at the nearest point, was charred brown. As the temperature of steam under a pressure of sixty pounds to the square inch is far from being high enough to char wood under ordinary circumstances, the effect shown in this case must, apparently, have resulted from the slow, but long-continued action of the moderately heated steam, and as charcoal thus formed is said to be very liable to absorb oxygen suddenly, and break out into spontaneous combustion, it is not impossible that the alternate periods of heating and cooling may have developed a chemical action of this kind in addition to the usual effect of heat alone.

THE *Building News* gives some curious details of the provisions for health and comfort which are found by archæologists to have been customary among the better class of householders three or four hundred years ago. Until within a few years, we were accustomed to think of the fourteenth and fifteenth centuries as a period of semi-barbarism in Europe, and our very reading-books held up the habits of the age of Queen Elizabeth as a warning to the infant mind. The works of Sir Gilbert Scott and Viollet-le-Duc, however, presented the mediæval housekeeping in a very different light, and the latter, particularly, seems to have successfully shown that the castles of the fourteenth century were generally much more comfortable and healthful abodes than the Renaissance palaces of a later age. Even in the higher matters of sanitary administration our forefathers may not have been so ignorant as we suppose, and a proof that they were at least familiar with the weapon of internal quarantine which we use rather ineffectually against contagious diseases is found in the historical fact that Henry the Seventh's soldiers, in their triumphant march after the battle of Bosworth Field, were prevented by the inhabitants from entering the town of Atherstone on the ground that they were infected with the sweating sickness, which some of them, as it seems, had contracted in the prisons of the Continent.

IN the matter of domestic hygiene some, at least, of the mediævals were nearly as well off as ourselves. The monasteries, for example, with their admirable system of plan and their careful and thorough provision for warming, cleanliness and ventilation, would put to shame almost any of the great summer hotels of the present day, which closely resemble them in conditions to be fulfilled. In the religious establishments, it is hardly necessary to say, household wastes would generally be carefully collected for use upon the farm, but in the fortified castles the circumstances were very different, and the disposal of the refuse of a garrison might be a serious problem. In the wildest districts latrines could be, and generally were, built out over the steep escarpment, either natural or artificial, which guarded at least one side of the fortress, but among the rich pastures of England this disposition was neither pleasant nor convenient. In some cases a special tower, open at the top for ventilation, and situated at one corner of the enclosure, seems to have served as a general vault, something after the manner of the modern French *fosse*, but with the difference that the latrine tower was isolated from all the rest of the building, while the Parisians of to-day build the rest of their house directly over their vaults. In establishments not provided with such special towers a kind of earth-closet seems to have been used, provided with a movable receptacle, and in some instances the castle moat, where this was filled with water, was employed as the final outfall. The latter disposition, seems, however, to have been considered objectionable, and a fortified mansion of the fifteenth century, still standing in the middle of the Forest of Arden, has a well-built drain carried under the bed of the moat, and discharging in the meadows some distance away. In minor points of construction, also, our ancestors were not without intelligence. Many of the most ancient chimneys are provided with a vertical flagstone, set half-way up the flue in such a way as to divide the current, allowing the air to pass down on one side of the flue, and up on the other, which as some, but not all of the moderns know, effectually prevents the chimney from smoking.

A CORRESPONDENT asks us for information about an invention which has made some noise in the world of late, for utilizing the rays of the sun in the production of motive power. The points upon which he wishes to be enlightened relate particularly to the value of the invention, and the validity of the patent, which he has heard called in question. Our knowledge of the subject is extremely general, and we should be far from presuming to decide upon the validity of a patent, but we can at least say that many, if not all the points upon which Mr. Culver claims the protection of the law seem to us quite novel. In substance his apparatus consists of a boiler, standing in the middle of a small railway, which extends through a circular arc of about two hundred and fifty degrees. An engine is connected with the boiler, and a carriage carrying a set of reflectors moves upon the railway. The reflectors are pivoted, so that their inclination to the horizon can be changed, and a simple gearing operated by a belt from the engine, drives the carriage, with the reflectors, around the railway at the same time that it tilts the mirrors. In this way, by suitable adjustment, the mirrors can be made to reflect the beams of the sun constantly upon a given spot, the carriage and the mirrors following the solar movement in such a way as to keep the reflected rays always directed toward the intended place. The principle of all this is familiar enough in the common heliostat, which is operated by a spring or weight, and serves to maintain an unchanging sunbeam in a dark room for solar microscopy or investigations with the prism; but Mr. Culver's invention goes beyond the heliostat, in applying the rays themselves to producing the movement. This is done by concentrating the reflected rays, either by means of a lens, or by placing the small mirrors so as throw all their images on the same point upon the boiler, which they heat sufficiently to evaporate the water in it, and generate steam. The specification of Mr. Culver's patent contains twenty-two claims, and it would be strange indeed if he had been anticipated in all the details of so extraordinary a device.

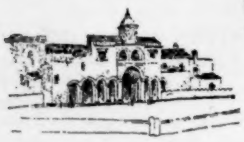
WHETHER the invention, although novel, is practically valuable, is another question in regard to which we should not wish to express an opinion. A great many attempts have been made to utilize the solar heat for the direct production of power, but none have yet made themselves available for general use, although some remarkable effects have been obtained by experimenters. If our recollection serves us, the venerable Captain John Ericsson once devised an apparatus by which the effect of the sun's rays in expanding long metal beams was made to accomplish a considerable amount of mechanical work. Any one who has observed the operation of an ordinary furnace governor, in which the expansion of a small brass rod by a difference of a few degrees in the temperature of the surrounding air serves to operate the dampers with perfect certainty, can easily understand the use which might be made of such means, but no important results followed from the experiments. Later it was discovered that water placed in an iron vessel could be strongly heated by covering it with a considerable number of sheets of glass, and exposing it to the rays of the sun. The multiplied surfaces of glass seemed to prevent the heat of the rays which passed through them from radiating back into space, and we believe that water was boiled, and meat cooked, in this way, but no successful attempt seems to have been made to generate steam under sufficient pressure to give motive power. The subject is an interesting one, and the discoverer of an easy means of absorbing the superfluous heat of our summers, to accomplish mechanical work, will deserve well of mankind.

THE late Baron Foerstel forms the subject of many expressions of respect and regret in the technical journals. A good architect is a person thoroughly appreciated in Germany, and the whole city of Vienna, which flocked a few days before to pay its compliments to Herr von Hansen, the designer of the Austrian Parliament House, on his seventieth birthday, now mourns for his friend and fellow artist. Although his whole professional life had been unusually successful, Baron Foerstel was happy in having chosen to rest his artistic reputation upon one or two buildings, in which he could put his whole heart, rather than on a variety of scattered, and perhaps imperfectly studied works of less importance, and the Votive Church, upon which he spent twenty-six years of fruitful labor, will perpetuate his name, perhaps, as long as that of its imperial founder. His latest important work, the group of buildings for the University of Vienna, is but just ready for occupancy, and the ceremony of opening has taken place without the presence of one whose energy did as much to secure an endowment for the University itself as his skill to provide it with a fitting shelter.

THE English merchants who were so much disappointed at not being allowed to cut an independent canal through the Isthmus of Suez have revived an old project for obtaining a passage between the Mediterranean and the Red Sea by way of the Jordan valley. In its upper course the river Jordan approaches within about twenty-five miles of the Mediterranean, and a canal could without much difficulty be cut to reach it from the harbor of Acre. From this point nearly the whole of the river valley is below the level of the Mediterranean, the Dead Sea, into which it flows, being more than thirteen hundred feet below tide-water, so that the whole would soon fill by gravitation, forming an estuary of the Mediterranean extending to a point within about one hundred miles of the Gulf of Akabah, an arm of the Red Sea. The time required to fill the valley of the Dead Sea and its tributary to the tops of the mountains which now enclose it is estimated at three years, after the completion of a feeder canal twenty feet wide and one-third of a mile long, so that even if the work should be actually undertaken, which is by no means probable, those who wish to visit the places in the neighborhood hallowed by their association with sacred history, as for instance the Sea of Galilee, which would be four hundred feet below the surface of the new canal, will have ample time to do so before their obliteration.

ACCORDING to the New York *Times*, a singular lawsuit is going on in San Francisco. It seems that certain workmen, in excavating for the foundation of a building in the city, came upon a vein of black sand, in which some of them, who were experienced miners, detected grains of gold. The vein was by no means rich, a trial with the ordinary gold-washing apparatus only yielding fifteen or twenty cents in gold to the panful of sand, but the men immediately laid claim to the entire lot, under the United States law regulating the rights of the discoverers of precious metals. As the land is valued for building purposes at sixty-five thousand dollars, a sum far greater than any probable profits from gold-mining operations upon it, the owners very naturally object to delaying their building, and regard the miners' claim as a mere scheme for annoying them. It must be confessed that it has something of that air, and if it is true, as is often said, that all parts of the soil of San Francisco are more or less auriferous, there seems to be no reason why all the most valuable portion of the city might not be staked out into claims by a few enterprising blackmailers.

ARTIFICIAL STONE AS A BUILDING MATERIAL.[1]—II.


San Domingo Cathedral.

THE high antiquity of prehistoric remains is frequently authenticated by the presence of the "sun-baked bricks" found amongst them. The *Encyclopædia Britannica*, in an article on St. Jean d'Acre (a town and seaport in Syria, and in ancient times a place of some celebrity), says: "Its great antiquity is proved by fragments of houses that have been found, consisting of that highly-sunburnt brick with a mixture of cement and sand, which was only used in erections of the remotest ages."

In Scotland, Ireland and Wales it has been found that the most durable material of those old "castles of the gallant clans" is concrete, in which small cobble-stones were imbedded to form a solid piece of masonry.

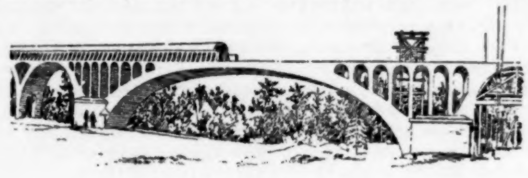
The Moors have left samples of their artificial stone inwrought upon the rock of Gibraltar, which have withstood successfully the storms of ten centuries. The Colosseum at Rome presents further examples which have nobly resisted the tests of time; the cisterns of Solomon, near the city of Tyre, which are of still higher antiquity, are almost complete in their preservation; and at Jerusalem there are to be seen five immense courses of Cyclopean masonry, the base of the wall of the city (now enclosing the Mosque of Omar), supposed to be a remnant of the wall of the Temple of Solomon, which, as the record tells us, was "set in its place *without the noise of the hammer and the axe*."

Scientists have suggested that the Pyramids were mainly built of artificial blocks, manufactured upon the spot, from the sands of the surrounding plain, by some cunning process which has perished with the builders; and travellers have claimed that the Diocletian or "Pompey's" Pillar, and the ruins of Baalbeck and Palmyra are mainly of artificial stone. Whatever may be said of these, we have in the actual measurements of the enigmatical "coffer" in the king's chamber of the Great Pyramid, indubitable evidence of its original plasticity. In the first place, we find it depressed upon all its sides, from the corners toward the centre, and *unequally* so. The illustration which we give of the coffer shows its east side, which has been sadly mutilated by tourists, the southern corner being chipped away about two-fifths its height. The mean depressions are at the north end 0.26 inch, at south end 0.19 inch, at west side 0.20 inch, and at east side 0.01 inch. They are observable vertically as well as horizontally. At the south end of the west side there is no depression perceptible; while at the north end of the same side the depression is 0.20 inch, and on the south end, at different distances from east to west, the depressions are 0.08, 0.12 and 0.14 inch. Upon all sides the coffer is highly polished over all these inequalities. Now no one acquainted with the simplest means of working natural stone would look for these inequalities, and for the corresponding *bulging out upon the inner surfaces* which we find to exist. The square, the plummet and the rule would have done their perfect work before the polishing, and if the depressions had been *intentional*, they would have been *regular*. Again, if we take the superficial outside measurements of the coffer, we find the same irregularity. On the east side near the bottom we have a length of 90.5; ten inches below the top, 90.15; on the top, 90.20. On the west side near the bottom, 89.2; near the top, 89.95; at the top, 90.05; mean length, 90.01. At the north end near the bottom, 39.05; near the top, 38.7; at top, 38.67. At south end near bottom, 38.8; near top, 38.6; at top, 38.5; mean width, 38.72. From all which we argue that the coffer was moulded in its present position from plastic material, and that it became thus slightly warped, or shrunken, as it dried — in short, that it is of artificial stone and not of "porphyry," of "black marble," or of "a darkish variety of red and possibly syenitic granite," as has been variously asserted.


Coffer in the Great Pyramid.

Coming down to a later period and a little nearer home, we have in the city of Santo Domingo some of the most interesting historical monuments of this material. This is the oldest existing settlement by white men in the New World, being founded by Bartolommeo Columbus in 1494. Although built on a solid limestone formation, the city is surrounded by a wall of artificial stone, eight feet thick, built (in 1506) of *mamposteria*, "a composition of earth, powdered stone and lime." Many of the more ancient houses and public buildings of the city, constructed of this material, are still standing and are remarkable for their solidity: the cathedral, especially, in which the remains of Columbus and his brother Bartolommeo reposed for two and a half centuries, which was begun in 1512, and finished in 1540; while on the opposite bank of the river the so-called "Castle of Columbus," a fortified stone house subsequently built by Diego Columbus, the son of the Great Admiral, is in ruins.

We also show an illustration of a section of the Vanne Aqueduct, in France, while under construction. Gen. Gillmore characterizes this as "the most important and costly work that has yet been undertaken in this material," being thirty-seven miles in length. This aqueduct, which supplies the city of Paris with water, traversing the forest of Fontainbleau its entire length, comprises two and a half to three miles of arches (some of them as much as fifty feet in height), eleven miles of tunnels, and eight or ten bridges (from seventy-five to one hundred and twenty-five feet span) for the bridging of rivers, canals and highways. The smaller arches are half-circles, and are generally of a uniform span of thirty-nine feet, four inches, with a thickness at the crown of fifteen and three-fourths inches. Their construction was carried on without interruption through the winter of 1868–69 and the following summer, and the character of the work was not affected by either extreme of temperature. The spandrels were carried up in open work to the level of the crown, and upon the arcade thus prepared the aqueduct pipe was moulded of the same material, the whole becoming firmly knit together into a perfect monolith. The construction of the arches was carried on about two weeks in advance of work on the pipe, and the centres struck about a week later.


The Vanne Aqueduct, France.

The light-house at Port Saïd, in Egypt, is another interesting structure of this material. It is one hundred and eighty feet high, without joints, and rests upon a monolithic block of the same material containing nearly four hundred cubic yards.

An entire Gothic church, with its foundation walls and steeple in a single piece, has been built of this material at Vesinet, near Paris. The steeple is one hundred and thirty feet high, and shows no cracks or other evidences of weakness. M. Pallu, the founder, says that "during the two years consumed by M. Coignét in the building of this church, the material in all its stages was exposed to rain and frost, and it has perfectly resisted all variations of temperature."


House of G. A. Ward, Esq., New Brighton, N. Y.

But we have upon our own shores a building ante-dating these structures nearly thirty years, an illustration of which is given above, and a description of which was given in the *American Architect* of April 7. This is the residence of the late George A. Ward, Esq., at New Brighton, Staten Island, familiarly known as "the cement house," built in 1837, and ten times more solid to-day than the day it was erected. There is no more exposed place to test the stability of this material than the north shore of Staten Island, where this building stands. We confess to some misgivings as we approached it last summer, not having seen it for about thirty years, but we left it more than satisfied, and to such of our readers as require the test of Thomas, the doubter, we commend a pleasant trip over the Bay of New York, and a personal inspection.

We are enabled, also, to give an illustration of another building referred to in the same article — the residence of Wm. E. Ward, Esq., at Port Chester, N. Y. This is beyond doubt the most expensive private residence of the kind yet erected in this country. It is a perfect monolith, from the lowest line of the cellar wall to the top course of its towers, and is a monument at once of the enterprise, taste and munificence of its proprietor, a monument, too, which


House of W. E. Ward, Esq., Port Chester, N. Y.

[1] Continued from page 159, Vol. XIII., No. 380.

is likely to endure when some other monuments have crumbled in decay. A full description of this building was given in the *American Architect* of August 17, 1877, and a further description was read before the American Society of Mechanical Engineers, at their recent meeting in the city of Cleveland. Our illustration presents the rear view of the house, although far less beautiful than the front, as the tower here given is employed as a distributing reservoir for the premises, containing two tanks, of five thousand and three thousand gallons' capacity, one above the other, with twenty and forty feet head of water. Other views of this interesting building may be found at the office of Robert Mook, Esq., architect, New York, and to those of our readers who can make it convenient, an actual visit to the premises will well repay the trouble.

Perhaps the severest tests to which the material has ever been subjected were in the great Chicago fire of 1871. While granite was chipped and splintered into fragments, while limestone was reduced to powder, while sandstone was disintegrated, and iron twisted into fantastic shapes, artificial stone alone remained intact, and was in shape to be immediately re-laid. Several instances could be given, conspicuous among which, however, is the front of the store 114 Monroe Street, which, although thrown down by the failure of its iron supports, was taken up, stone by stone, and re-laid. Many of the stones were placed in their original positions; some few were fractured by the fall, and had to be replaced by fresh ones, but none were disintegrated or fractured by the fire, and all were utilized. The front stands to-day exactly as it did before the fire.

The architect is often required to manage a sea-wall or a cellar-wall where the action of water is to be considered in connection with the safety of his superstructure. And here we claim the vast superiority of this material. In basements it will be found not only water-proof, but *rat-proof.* The United States Government has recently employed it as the base of a light-house in the Chesapeake, where heavy masonry had proved inadequate, and they would have done better if they had followed the example of the French Government in the construction of the light-house at Port Saïd, and constructed the whole building of the same material. As a sea-wall, the jetties of the Mississippi are perhaps the best example we have in this country. The illustration we give shows the outlet of the jetties passing into the Gulf, and from it the reader may form a tolerably correct idea of the work. When we consider that this great river is the outlet of twenty of our States and Territories, covering an area of 750,000,000 acres — the granary and the principal cotton-producing region of the world, the importance of these jetties cannot be over-estimated. And hand-in-hand with their far-reaching commercial value is the triumph they have so signally achieved for artificial stone; for it must be conceded that without this element of success, the jetties would have been a failure. Indeed, they had already proved so, and in less energetic hands they might have been abandoned. The jetties themselves, primarily jets or projections of wicker-work, anchored in place and secured in position by rubble and heavy stone, proved inadequate to resist the easterly storms that sometimes prevail, and it became evident that some further protection of the work was required. Heavier stones, some of them weighing three thousand pounds, were accordingly and with great difficulty anchored upon the jetties; but these proved also insufficient. Resort was now had to monolithic masses of artificial stone, and they have proved successful where nothing else could; some of the blocks being thirteen feet in width, five feet thick, and fifty-five feet long, and weighing more than two hundred and sixty tons. One mile of the east jetty and half a mile of the west were thus effectually protected, and so complete were the appliances employed upon the work that it required only the hands of two men to mould them and place them in position.

The Mississippi Jetties.

The jetties at the mouth of the Suez Canal are of a cheaper quality of béton, and are not monolithic, the blocks weighing only about twenty tons; but they are sufficient for the purpose, eighteen thousand of them being employed in the work.

From the scope covered by the illustrations we have given, the far-reaching utility of this material is quite palpable. Its durability is established beyond cavil, and it has the approval of the most eminent architects and engineers of both hemispheres. While other material is constantly undergoing disintegration and decay, this as constantly improves by age. In the air, in the water, in the fire, and in fact under all imaginable circumstances, the certainty of using it with success is one of the greatest of its recommendations. H.

Correction. — In our extract from the report of the chief engineer of Cincinnati, page 82, No. 399, the name of that gentleman was incorrectly given: it should have been printed H. J. Stanley.

BUILDERS' SCAFFOLDING.[1] — XIV.

MECHANICS. — III.

THE intuitive ability to mentally analyze the directions taken by the component strains, tension and compression, due to given loads on certain combinations of elementary members, should be the first aim of the student to attain. It will naturally lead to the modes adopted in practice, of determining the proportional distribution of loads amongst the various parts of any generic system of structural combination, and these in turn must be preliminary to the rules of proportioning a framework structure to sustain given loads or pressures. Thus there are three distinct leading processes involved in arriving at the proportioning of the parts in the design of a structure, and it is advisable to have this clearly before the mind of the student, as it will direct him to avoid confusing his mind with matters relevant to other processes than those on which he is engaged for the time being.

45. *The resolution of forces* is the reverse of the process of *composition*, and consists in finding two or more forces, of definite directions and magnitudes, the combined effect of which shall be equivalent to a single given force in direction and magnitude. No force can produce any effect in a direction at right angles to its own line of action, because the components are independent of each other, each representing the whole effect of the resultant. The lines of action of components must intersect lines of action of the given force, the three lines of action being in one plane.

46. In mechanics, forces, pressures, thrusts, tensions and velocities can be geometrically represented in magnitude and direction, by straight lines of definite length in required positions, drawn to a scale of equal parts, whereby an inch shall represent a convenient number of pounds' weight, equivalent to the intensity of the given force.

47. If two adjacent sides of a parallelogram represent, in magnitude and lines of action, two diverging forces conjointly applied to a point, then the diagonal of such parallelogram, drawn from the point of divergence to the opposite angle, will represent the equivalent single force, in magnitude and direction, called the "resultant." This constitutes the important principle in mechanics known as the "parallelogram of forces," and from it is derived the "triangle of forces" and the "polygon of forces."

48. To those working mechanics unaccustomed to consider forces represented geometrically on paper as above indicated, it may be a help to a clearer comprehension to treat it as if the velocity of motion imparted by the respective forces would in the same time carry the body along the adjacent sides which we assume to be part of a parallelogram; then, by drawing the two remaining sides parallel to these representative sides, we complete the parallelogram, and can now draw the diagonal as above; then these laws become the measure of the forces in their relative directions, and by comparison of their lengths with any convenient recognized unit-scale which shall represent a unit of magnitude, we derive an easy means of estimating the intensities or magnitudes of these forces.

49. Scaling forces on a diagram may seem incongruous to the uninitiated, and therefore perplexing; but there is really no more perplexity in scaling eight pounds, or eight hundred pounds, or eight tons to an inch, than in scaling the dimensions of a house on a drawing of eight feet, or any other number of feet, to an inch. As forces are thus represented by straight lines, there is no difficulty in conceiving that forces may have any ratio to each other in respect of magnitude. Forces whose lines of direction coincide can be added or subtracted, just as any other magnitudes, as feet, etc., can be added or subtracted.

50. When a force acts upon a rigid body, which is not susceptible of change of form, it is transmitted by the rigid body along its line of direction, and may be supposed to act at any point of that line; and this takes place whether the line of action of the force is contained within the body, or is not.

51. If we take Figure 37 to illustrate a case of the parallelogram of forces, in which the two converging forces are f^1 and f^2, whose lines of action intersect, and which are applied to a material point O, they being represented in given magnitude and lines of action by the adjacent sides $o\,b$ and $o\,a$ of the parallelogram, the arrow-heads indicating the directions in which the given forces act, the same mechanical effect would be produced on the point O to propel it in the direction of the diagonal by the resultant 3, as by the two given forces f^1, f^2, if substituted therefor. If the resultant force is exerted in the direction of the arrow-head, motion of the body O along diagonal 3 will ensue; but if exerted in the direction opposite to the resultant the body at O will be stationary, for equilibrium or equality of opposing forces thus establishes a balanced counteraction between these opposing forces, *i e.*, between the resultant and its components.

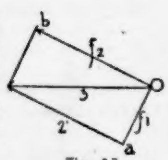


Fig. 37.

[1] Continued from page 52, No. 397.

52. Let Figure 38 illustrate a practical example of rectangular components of a force, in which the directions of the components lie at right angles to each other; suppose that the parallelogram of forces is drawn to a scale of 100 pounds to one inch; then the side O A will represent 100 pounds, and the side O B 50 pounds, which forces are applied to the material point O in directions perpendicular to each other; then their resultant will be represented in direction and magnitude by the diagonal of the parallelogram, which will scale 111.8 pounds. We can prove the correctness of the scale by aid of the 47th proposition, Euclid, Bk. I, as the opposite sides of a rectangle are equal, the side opposite to O B is equal to it, and as all the angles in a rectangle are right angles, we may take either two sides, above or below the diagonal. $\sqrt{50^2 + 100^2} = 111.8$.

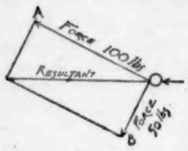


Fig. 38.

53. What has been said may serve to guide the student to the process of finding the resultant of component forces and *vice versa*, but it is unnecessary in practice to draw the whole of the parallelogram, because we have recourse to the principle known as the *triangle of force*, whereby three lines representing the two components and their resultant acting on a point in equilibrium form a triangle by taking the sides in order. Thus in Figure 37: if from end *a* or *o a* a line 2′ equal and parallel to *o b* be drawn, assuming only the two force lines $f^1 f^2$ to have been drawn, the farther end of $a2'$ will fix the farther extremity of resultant $O3$, which can be drawn in, without completing the parallelogram, the three lines f^1, 2′ and 3 taken in succession forming the required triangle; hence the three forces represented by f^1, 2′ and 3 if applied directly at point O would be in equilibrium.

54. The converse of this proposition is true: thus, if the three forces are in equilibrium, and the triangle be constructed having its sides parallel to the directions of the forces, its sides will be proportional to the magnitudes of the forces. The following rule for compounding the triangle of forces will extend to compounding any number of forces by following the same principle: —

RULE.—*Draw from extremity of one of the component forces a line equal and parallel to the other component, and join its farther end to the point of application, which gives the resultant, and completes the third side of the triangle.*

In Figure 39 if three forces, A B W, acting at their point of intersection upon a rigid body, are in equilibrium, keeping the body at rest, then three lines drawn consecutively parallel to their respective directions will form the required triangle; hence the direction of the third force returns through the point of application of the other two forces. Thus, lay off to any convenient scale, as 200 pounds or 2,000 pounds, whether of weight or static pressure, to an inch on the vertical line W W, any length, which call W, to represent by scales the weight 100 pounds suspended by it, and from the lower extremity of this portion draw a line, which call B, parallel to force B, and produce force A to intersect it; then the three lines of the triangle, W B A, parallel to the directions of the three forces in equilibrium will be proportional to these forces, and may be scaled off by the scales, by which the weight was laid.

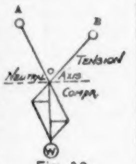


Fig. 39.

55. (*a*) Any force acting at a definite angle can be determined if we know either component and the angle of the inclination of its other action from the geometrical relations of the parts of a triangle. (*b*) If two of three forces which balance meet, the third force will pass through the point of intersection of the other two forces. (*c*) By knowing the magnitude and direction of two intersecting forces, the magnitude and direction of their resultant can thereby be found. (*d*) If the directions of any two forces into which a single force is resolved be given, the amount of these components can be found by the above process. (*e*) A small force may counterbalance two larger forces the more nearly opposite are the directions of the larger forces, in order that the latter may counteract each other the more.

56. (*f*). If three members of a structural frame meet, as at Figure 40, C, the strains to which all are subject are all either tension or compression, as indicated by the double arrow-heads, *i. e.*, in both directions on each line representing the forces B C D.[1]

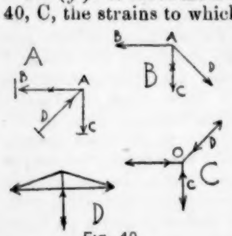


Fig. 40.

57. If two of three members of a truss, meeting at a point, are on the same side of the line of the third member, as for instance below a horizontal third member, they are affected by *different* strains; the members which have the greater angle between them have the same kind of strain, the intermediate member having an opposite strain. Thus, in Figure 40, Diagrams A and B, if the line B is in tension in both diagrams, then in Diagram A, C is also in tension, and D in compression. But if D is in tension, then both B and C are in compression. Then in Diagram B, if line B is in tension, D is also in tension and C in compression; but if C is in tension, both lines B and D are in compression.[2]

58. In Figure 41, if the vertical mechanical effect of a given force be represented by the side 3 of a triangle (right-angled at 3–4), drawn to a scale of twenty tons to one inch, and the geometrical relations of the sides of the triangle are known, the longitudinal strain in the oblique side, 5, will exceed the vertical strain in 3, by the number of times 3 is contained in 5. Thus, if we use for illustration the well-known numerical proportions of the sides of a right angled triangle, 6 feet, 8 feet, and 10 feet, *i. e.*, the double of the figures distinguishing the sides of the diagram employed by masons, carpenters, etc., to lay off on the ground a right angle for the walls of a building, etc., the right angle being formed between the adjacent sides 6, 8 (represented by 3, 4, in the diagram), and the hypothenuse 10 (5 in diagram), according to Euclid, Prop. 47, Bk. 1; *i. e.*, $\sqrt{6^2 + 8^2} = 10$, we find that the strain in 5, being 10 tons, and that in $3 = 6$ tons, then the strain in 5 is equal to $\frac{10}{6}$, or $1\frac{2}{3}$ times the vertical strain, by the principle explained in paragraph 42 (page 52, No. 397), and similarly that the strain in $4 = \frac{8}{6}$, or $1\frac{1}{3}$ times the vertical strain. This is a graphical representation of three forces in equilibrium in the same plane. Now to reproduce the parallelogram of these three forces, draw the two remaining sides of it parallel to the two shorter sides, 3, 4; then side 5 will be the diagonal of the parallelogram, and the resultant of the two component forces 3 and the opposite of side 4, or of 4 and the opposite of side 3, acting at either end of the diagonal, and in either case there will be equilibrium.

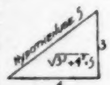


Fig. 41.

59. The lines representing forces may be inclined at any angle, equally or unequally, as for instance with respect to the line of gravitation (vertical), and may all be of equal or unequal length; in fact, this useful principle of the geometrical representation of the direction and magnitude of forces of any kind is applicable to their composition and resolution wherever the sides of any triangle, right-angled or oblique, are parallel respectively to the direction of three separate forces, acting in the same plane, which are in equilibrium against a material point; then the three sidesof the triangle will be relatively in proportion to the respective forces which they represent, in direction and static magnitude; and if one of the forces be known, the others can be measured by the scale of the known force.

KEIM'S PROCESS OF MINERAL PAINTING.

A NEW process of mineral painting, invented by Herr Adolph Keim, of Munich, was exhibited in operation and by executed specimens at the Art Training School, South Kensington, on Saturday afternoon. Mr. T. Armstrong, the art director, explained that when he visited the Art Exhibition at Nuremberg some months since, he saw numerous specimens of this new form of decoration. It was to some extent analogous to distemper painting, and offered facilities resembling those possessed by the antique decorators for the rapid execution of ornamental paintings, scrolls, and arabesques on a surface of gesso or plaster without reflecting the light. The Science and Art Department purchased two large pieces illustrating the process, which were now hung at a proper level in the Architectural Court at South Kensington, and Herr Schraudolph, a Munich artist, had been engaged during the present term to execute work by this process before the students of the National Art Training School. Some specimens of that work, life-sized studies of female figures and floral decoration executed on canvas, and smaller sketches on tile, glass, slate, and marble surfaces, were exhibited in the room. At the conclusion of Mr. Armstrong's explanation, Herr Schraudolph showed to the audience how the work was done, the outlines being traced on a ground kept moist by a spray, and then filled in with moist colors and fixed by repeated sprays of potash water-glass, after which carbonate of ammonia and benzine were applied to the surface. Skill and judgment are needed to insure that the process of fixing is not carried too far, or a troublesome and unsightly efflorescence is formed on the surface similar to that

[1] It should not be difficult, even for those unaccustomed to reason mathematically on the relations of strains to the directions of the action of the forces which produce them, to perceive the truth of this and the next two propositions; nevertheless, any such can easily re-affirm their conviction of it by very simple experiment, the exercise of which will no doubt inspire clear and certain ideas of the action in these, as well as in other arrangements of the forces, around a single point, and to advance from this to a transfer of the resultant force to another point connected therewith in a system, as in trusses supported at one or both ends: If strings be arranged in the relative positions of this figure, now by pulling on one of them, the strains will all be in tension. But if small rods be similarly arranged, and a *push* be exerted against one of them, they will all be in compression; now if a string be substituted for either of the rods, when the push is exerted the string will collapse, as it cannot resist compression.

[2] If similar experiments be made with strings and rods arranged as in the two diagrams of this figure, and also in a reverse arrangement, *i. e.*, by placing the *two* lines *above* the third line, B, which is assumed as the normal, and also by making the normal line vertical, and placing the two lines to the *right* and also to the *left* of it, and alternately applying the contrary forces *push* and *pull*, as required by the proposition, and by thus experimentally attaining a familiarity with the action of three forces around a point in various positions with regard to the *normal* line, and also in various other relative positions amongst the lines of each, it will be a much more valuable exercise to most minds than mere book demonstrations alone, and prepare the mind to readily realize and formulate the composition and resolution of any complexity of combination of forces. It will be noted that in all these cases the lines of action of the three forces are in the *same plane*; otherwise, the forces represented by the strings and rods would not be in equilibrium.

which disfigures the frescoes in the House of Lords. As to the permanency of the process Herr Schraudolph stated that some work which had been done on marble ten years ago, and other specimens on canvas two years ago, showed no signs of deterioration at present, but the process was quite a modern one. Mr. Armstrong added that there was no attempt to simulate tapestries, and any development in that direction resembling the dyed fabrics now to be seen in the Bond-Street and Regent-Street show-rooms was to be deprecated. It was equally as effective as tapestry, and as could be seen from the exhibits, allowed a wide range of color.

The following description of the process has been prepared by Professor Church: —

Herr Adolph Keim's process of "Mineral Painting," although identical in principle with the stereochromy of Fuchs, differs from that process in several important particulars. For the simple mortar, or plaster, of lime and sand generally used in stereochromy as the painting-ground, Herr Keim substitutes a composition made by the careful admixture of 4 parts quartz sand, 3½ parts marble sand artificially prepared and free from dust, ½ part infusorial earth, and 1 part quick-lime slaked with distilled water. The pigments are admixed with various substances before use, so as to render the action of the fixative solution upon them, when the painting is complete, more uniform. The pigments are also treated with alkaline solutions (of potash or ammonia), so that any change of hue which might ensue from the use of alkaline liquids in fixing the paintings may be anticipated by treating the paints themselves before use with the same solutions. But not only do the pigments and the materials of the painting-ground offer novel features in this process of Herr Keim, but the fixing of the painting with a hot solution of potash water-glass and its subsequent treatment with a solution of carbonate of ammonia differ from the process adopted in stereochrome painting. It should be stated that paintings may be executed not only upon external and internal walls coated with the specially-prepared plaster, but also upon tiles, slate, glass, etc., similarly coated, and even upon canvas, which has been washed with baryta water, and is kept moist with a fine spray of distilled water. The operations of "mineral painting" may be thus summarized: upon an ordinary but perfectly dry mortared surface a coat of the painting-ground material is laid without "floating;" a thin coat, but rough and porous, being secured. Then the dry painting-ground is soaked with a solution of hydro-fluo-silicic acid. When the ground is sufficiently dry to be again absorbent, it is treated with a solution of potash water-glass. The outlines having been traced upon the ground, kept moist with a fine water spray (distilled or rain water), the painting is carried out with the prepared colors, which are kept in glass bottles, in a moist, pasty condition. These colors, it has been before stated, contain certain admixtures, as the hydrates of alumina, magnesia or silica, oxide of zinc, carbonate of baryta, felspar, powdered glass. The colors used are those which have been found available for the stereochromic process. The fixing of the picture is accomplished by means of a hot solution of potash water-glass, thrown against the surface by means of a spray-producing machine, in the form of a very fine spray. This fixing done, by several repetitions of the process, a solution of carbonate of ammonia is finally applied to the surface. The carbonate of potash, which is thus quickly formed, is removed with repeated washings with distilled water. Then the picture is dried by a moderate artificial heat. Finally a solution of paraffine in benzine may be used to enrich the colors, and further preserve the painting from adverse influences. — *The Building News.*

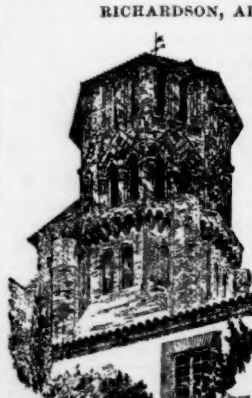
A NEW WAY OF REMOVING A BLUFF.

From Church of Notre Dame. Paris

THE hydraulic machinery which has been brought to this city to be used in washing away the threatening bluffs which hang over the track of the Milwaukee road, two miles west, was put to a test yesterday. The best possible arrangements for undertaking the difficult work have been made. From the Worthington pump, which is considered the more powerful of the two on the boat, an eight-inch pipe extends up the bank to a height of about sixty feet, where it reaches the road-bed of the track. It then runs under the track nearly to the base of the bluff and terminates in a movable iron nozzle, with a two-inch end. From the point where the nozzle is directed toward the bluff begins a sluiceway constructed of boards and about two feet deep. This sluiceway leads under the track, downward in a diagonal course to the river. The pipe through which the water rushes to the nozzle is well secured. The sluiceway is constructed on timbers, and is strongly braced. As the nozzle points toward the bluff, without the water rushing from its mouth and the sluiceway is dry, there is nothing particularly curious or interesting in the machinery's appearance; but when the big boiler at the water below begins to puff, the powerful pump commences action, and the glittering stream shoots from the mouth of the nozzle with lightning speed, and, hardly spraying, strikes the bluff with terrific force, boring deep into the earth and causing the dust to rise in clouds, some appreciation of the force of the water can be gained. Then, too, the practical result of the aqueous battering-ram's power is seen in the mass of mud which rushes through the sluice. Hundreds of tons of earth, made soluble, melt away in an hour and are swiftly carried off through the apparently small board runway to the river below. When the pumps started yesterday afternoon it was just half-past two o'clock. General Superintendent Clark, General Master-Mechanic Lowrey, Assistant Master-Mechanic Campbell and Division Superintendent Jackson were present, directing the movements of about thirty men who assisted the machinery in its work. As spectators, fully fifty gentlemen from this city were also on hand, watching with great interest the action of the water on the bluff. At the boat below J. M. Finch, of Milwaukee, who superintended the putting together of the hydraulic machinery, and Engineer Joseph Powell, of Yankton, waited for the signal to "set her going." The boiler showed one hundred and twenty pounds of steam — a full head. The sluiceway was inspected and strengthened. S. Coleman, of this city, stood at the nozzle, clad in a rubber suit, while four assistants were near the nozzle similarly protected from the water and ready with shovels and hoes to clear the sluice at its mouth from obstructing masses of turf or dirt. When all was ready the signal was given and the water began to rush through the pipe and pound away at the bank. In five minutes immense quantities of the dirt were melting and rushing through the sluice. The cutting was done in a scientific manner. First, the water was sent against the bluff sixty feet up, and holes bored to weaken its dry solidity. Then the boring began underneath, and the foundation of a mass of earth sixty feet high and ten feet thick by about fifty feet in width was dug away. All at once the big chunk gave way and with vast clouds of dust and much noise fell downward and toward the track. The plucky pipe-man and his assistants were the least disturbed by the slide and advance of the earth, but they had cause for alarm, as for an instant it looked as if a large part of the bluff would be affected by the movement of that detached and would break loose to sweep everything before it to the river. During the hour, while the crowd of visitors remained, a much larger quantity of earth was washed away than was expected when the work commenced, and the officials generally seemed to be satisfied that at last an effective way of conquering the dangerous bluff had been found. It being understood that General Superintendent, J. T. Clark, was the proposer of the hydraulic method of cutting away the bluff, and that principally through his efforts it has been brought to a practical test, he was briefly interviewed. He expressed himself much pleased with the result of the experiment as far as it had gone. He added that it was only an experiment, but that it looked to him as being much more effective than blasting or shovelling, while the ultimate expense would not be half so great. Just at that moment, as if to furnish him an example to illustrate by, a blast of giant powder was fired about three hundred feet down the track by two men who had been working two hours to put it in and get it ready to fire. The quantity of dirt which came down was inconsiderable, and it did not need explanation to show that the blast only displaced the dirt, but did not move it. The advantage of the hydraulic over every other system is that the dirt is carried away as fast as washed down. The only difficulty in the way of carrying the work to a successful conclusion all along the line of the bluffs may be found in the places where the bluffs are very near the track and precipitous. The obstacle in that event is to carry away the earth as fast as it caves down. Some means of overcoming this may be found. At any rate, for the point of attack chosen at present, the hydraulic engine and the shooting stream of water seem to be about what is needed. — *Sioux City Journal.*

THE ILLUSTRATIONS.

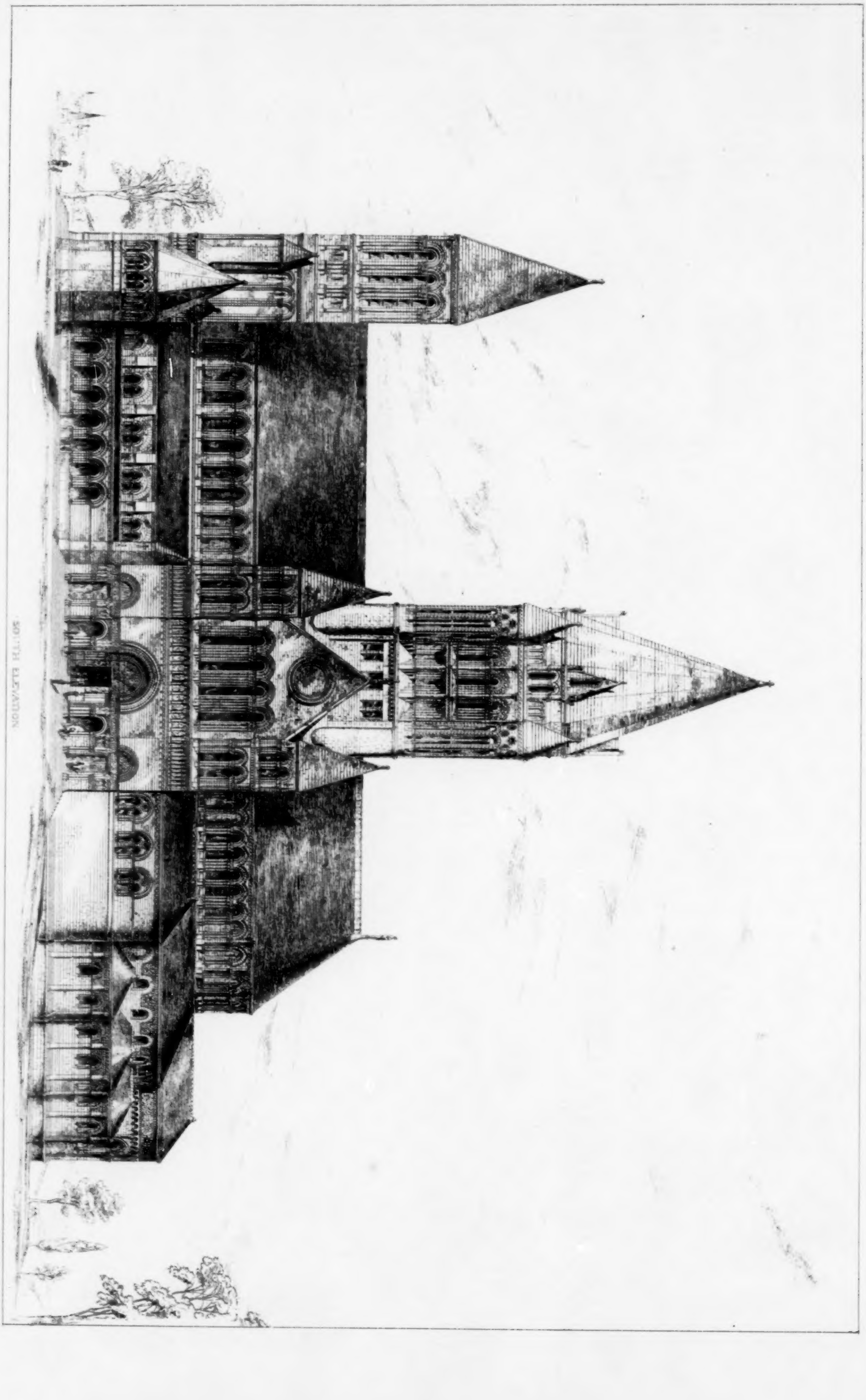
DESIGN FOR ALL SAINTS' CATHEDRAL, ALBANY, N. Y. MR. H. H. RICHARDSON, ARCHITECT, BROOKLINE, MASS.



Tower of the Augustins Toulouse France

THE drawings we publish in this number were prepared in the early part of this year in competition for the proposed Episcopal Cathedral of All Saints. For this design, both in interior and exterior, effect has been sought by simplicity of form and strength of mass, for which reason the main features have been kept very simple in outline however rich the detail might be, and the window reveals have been made very deep. To obtain unity one consistent treatment has been used throughout the structure, and while its different parts have received such distinctive handling as they seemed to demand, certain strong features have been carried round the whole building, binding it together. The main entrances are by porches at the western end of the nave and at either end of the transept. These entrances are connected by vaulted cloisters, their arcades supported on clustered columns, which gives a sheltered passage from one door to another.

In view of the size of the church, and the necessity of providing free and speedy exit for large congregations, the vestibules are



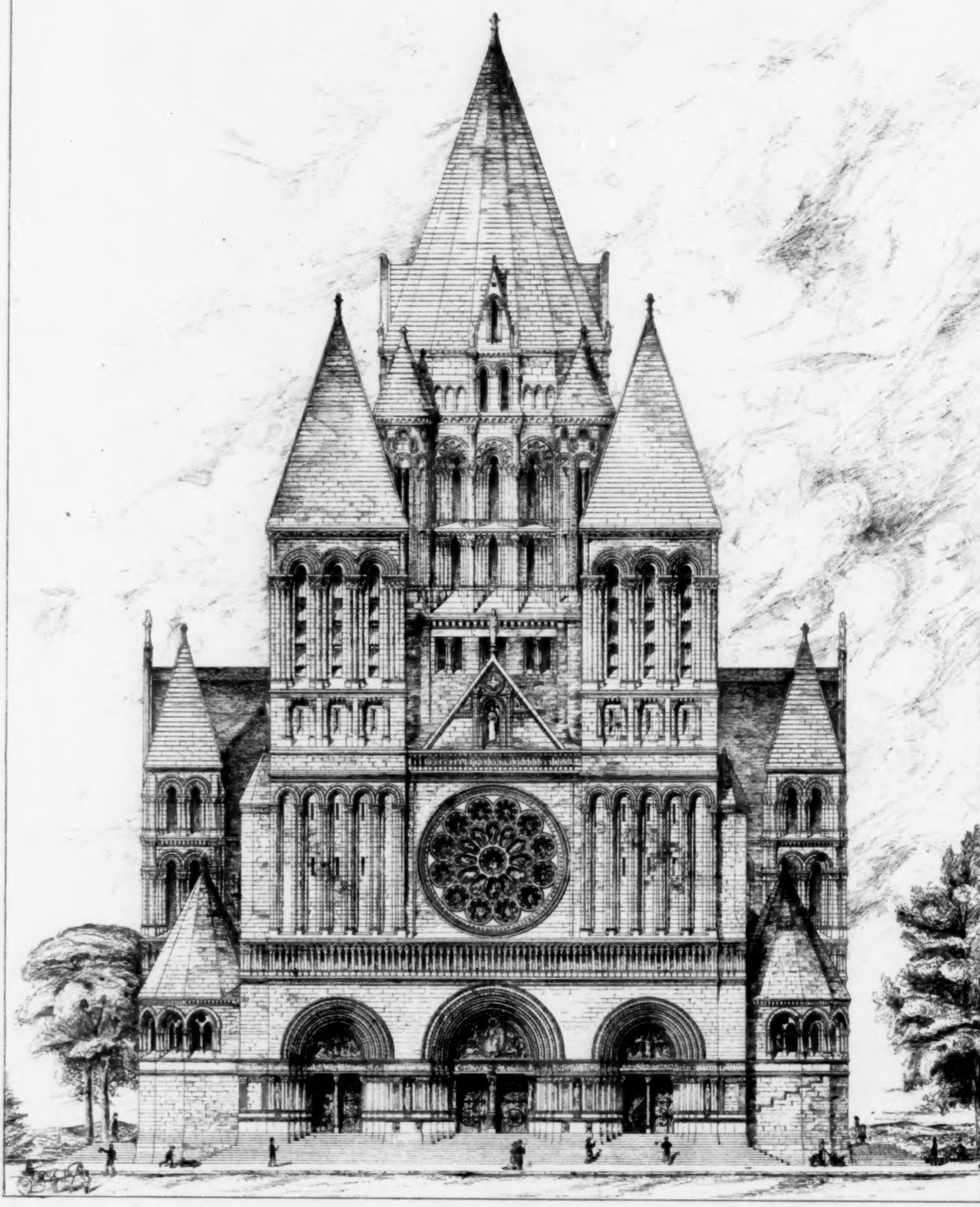
+ DESIGN FOR THE CATHEDRAL OF ALL SAINTS, ALBANY, N.Y. +

H. H. RICHARDSON, ARCHITECT. *

Heliotype Printing Co. 211 Tremont St. Boston.

Design for All Saints' Cathedral Albany · N · Y ·

H · H · Richardson, Architect.

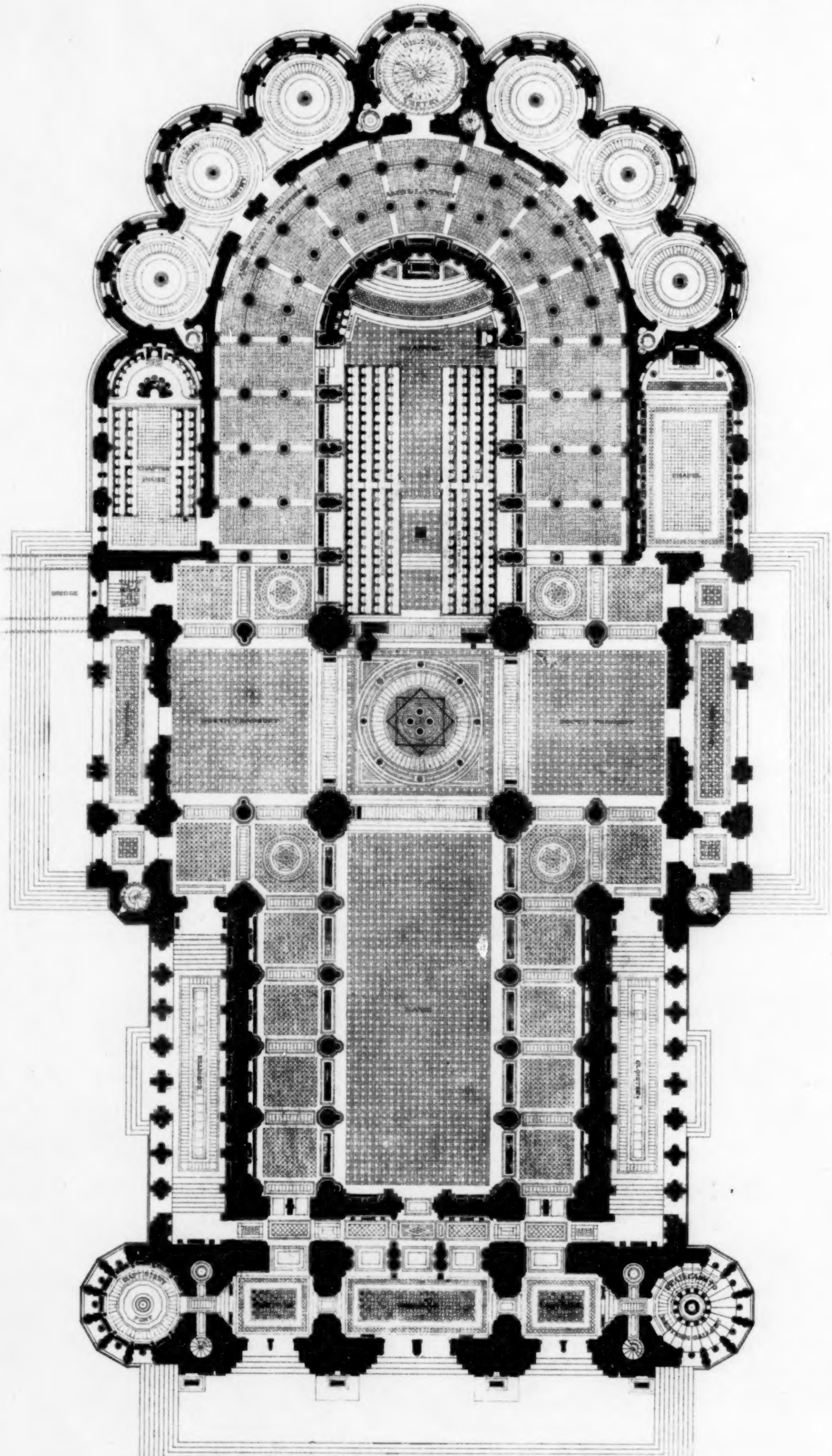


· West Elevation ·

Heliotype Printing Co. 211 Tremont St. Boston

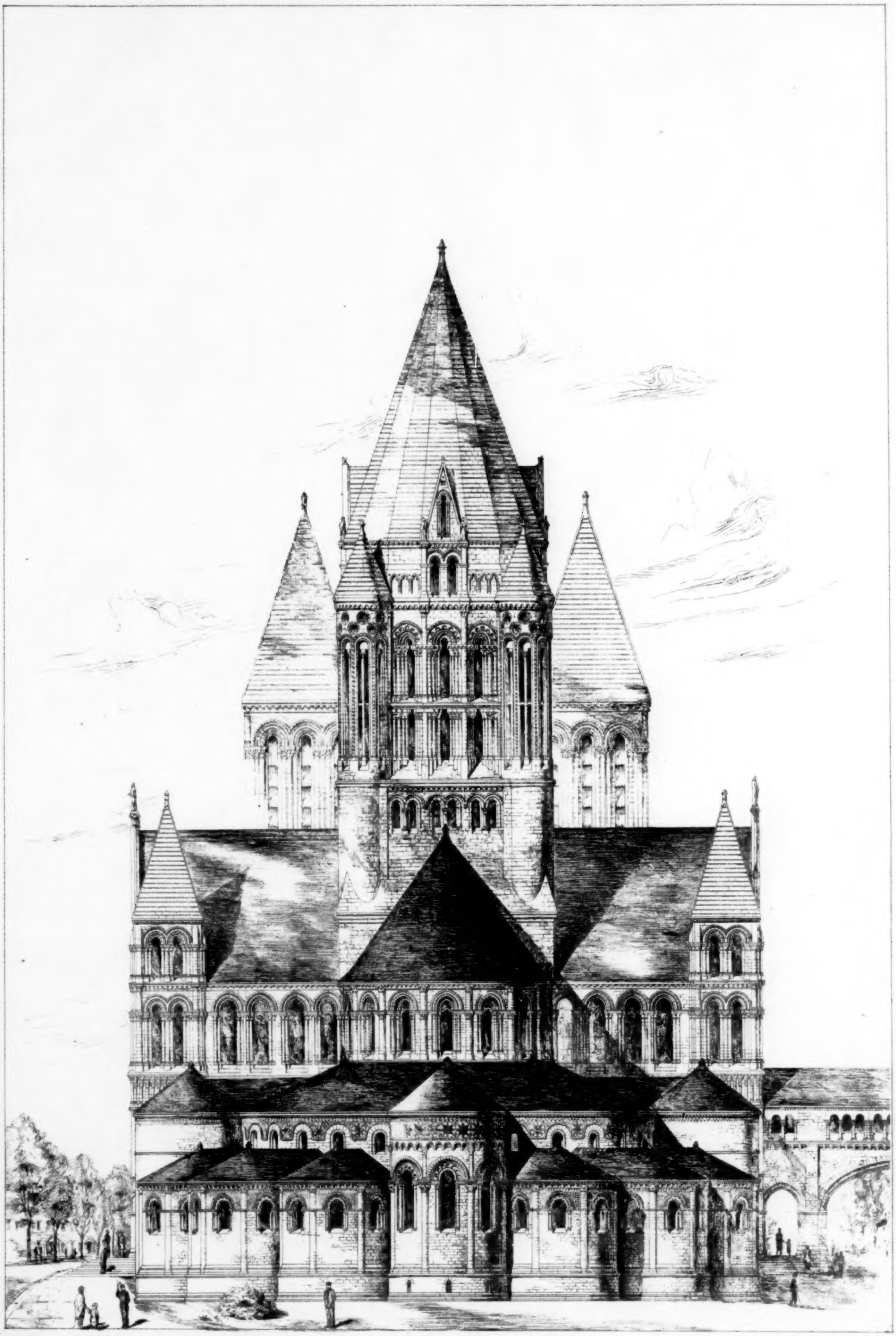
DESIGN FOR ALL SAINTS' CATHEDRAL ALBANY · N · Y ·

H · H · RICHARDSON, ARCHITECT.



Heliotype Printing Co.

· PLAN ·



East Elevation

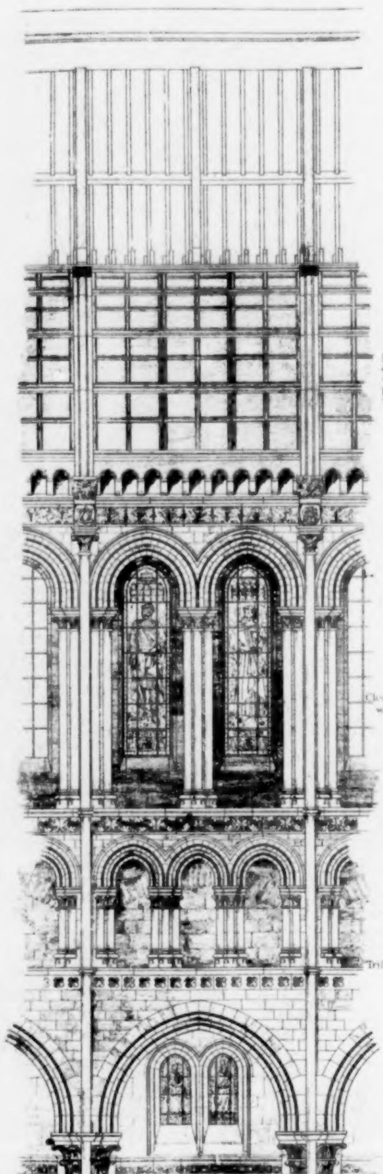
+ Design for the Cathedral of All Saints, Albany, N.Y. +

H. H. Richardson, Architect.

DESIGN FOR THE CATHEDRAL OF ALL SAINTS · ALBANY · N.Y.

DETAIL DRAWING

H·H·RICHARDSON, ARCHITECT.

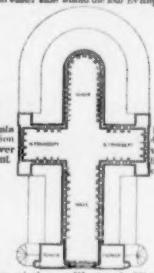


It is intended that the Clerestory windows in Nave Transepts and Choir shall be filled with Stained Glass to illustrate the whole Bible by the representation of the principal characters of Scripture. Thus in the Nave windows will be illustrated the Old Testament, in the Transepts the Prophets and the builders of the Tabernacle and the Temple, and in the Choir the New Testament. The scheme is given below.

CHOIR.

The disposition of the 25 windows of the Choir Clerestory is as follows, commencing with left hand side on entering.

1. Simon Peter.
2. Andrew.
3. Thomas.
4. James, son of Alphæus.
5. Judas, brother of James.
6. Simon the Canaanite.
7. Philip.
8. Bartholomew.
9. James, brother of John.
10. St. Matthew.
11. St. Luke.
12. Angel adoring.
13. Angel adoring.
14. Christ, throned in Glory, comes in the centre window, and on either side are angels adoring; beyond them on either side stand the four Evangelists.
15. Angel adoring.
16. Angel adoring.
17. St. Mark.
18. St. John.
19. Matthias.
20. Mary, Mother of Jesus.
21. Lazarus.
22. Paul.
23. Silas.
24. Stephen.
25. John the Baptist.
26. Nicodemus.
27. Joseph of Arimathea.



NORTH TRANSEPT.

1. Jonah.
2. Micah.
3. Nahum.
4. Habakkuk.
9. Zephaniah.
10. Haggai.
11. Zechariah.
12. Malachi.

5, 6, 7 & 8 represent in upper compartments 4 principal names mentioned in connection with the building of the Temple; the lower panels four scenes representing that work.

5. Hurum.
6. Solomon.
7. Hiram.
8. Adoniram.

SOUTH TRANSEPT.

1. Isaiah.
2. Jeremiah.
3. Ezekiel.
4. Daniel.
9. Hosea.
10. Joel.
11. Amos.
12. Obadiah.

5, 6, 7 & 8 represent in upper compartments 4 principal names mentioned in connection with the construction of the Tabernacle; the lower panels four scenes illustrative of that work.

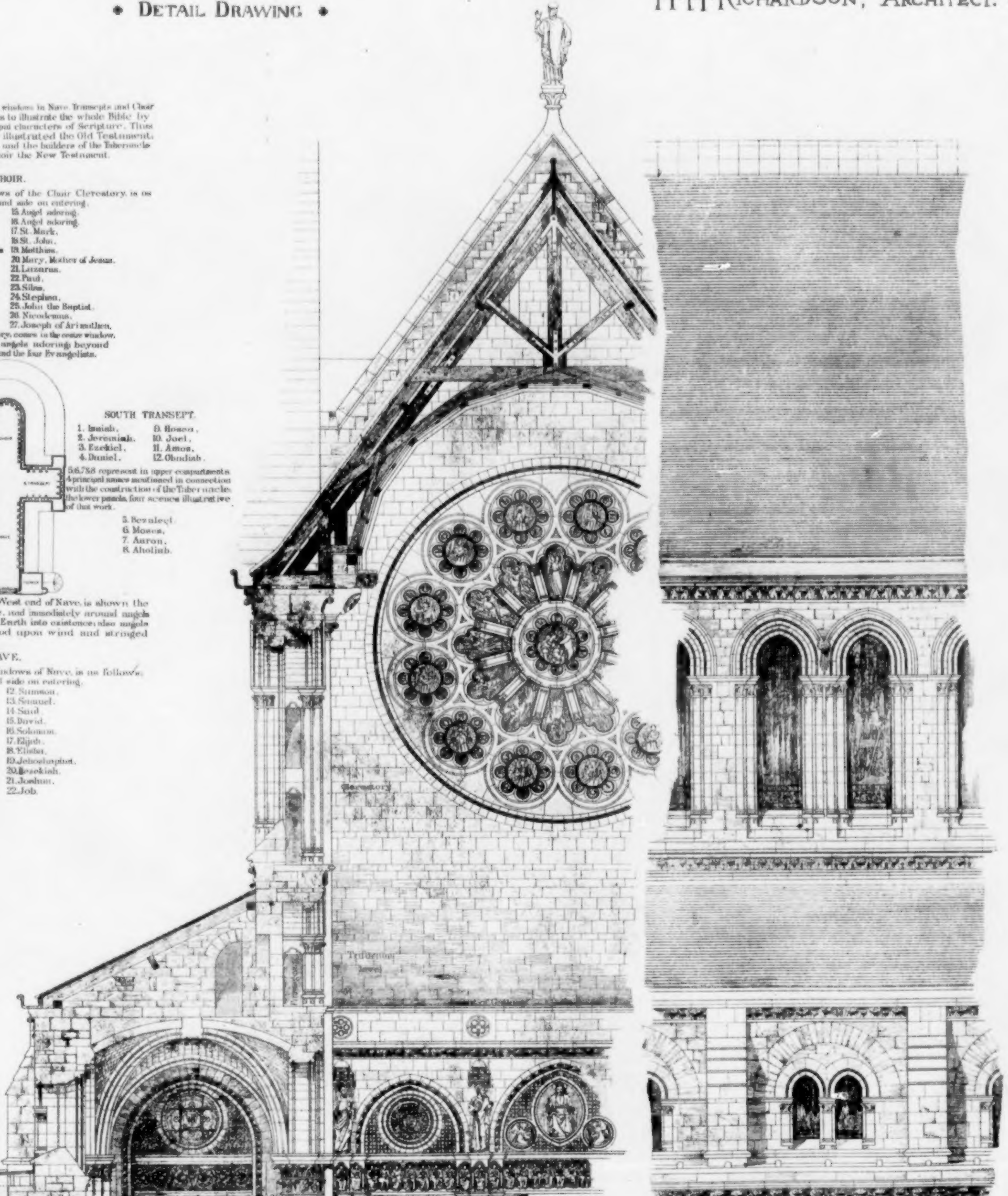
5. Bezaleel.
6. Moses.
7. Aaron.
8. Aholiab.

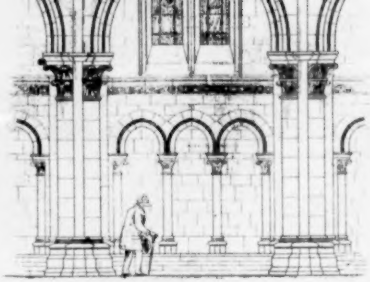
In the large Rose window at West end of Nave, is shown the Word of God throned in centre, and immediately around angels hastening away to awaken the Earth into existence; also angels in the outer circles praising God upon wind and stringed instruments.

NAVE.

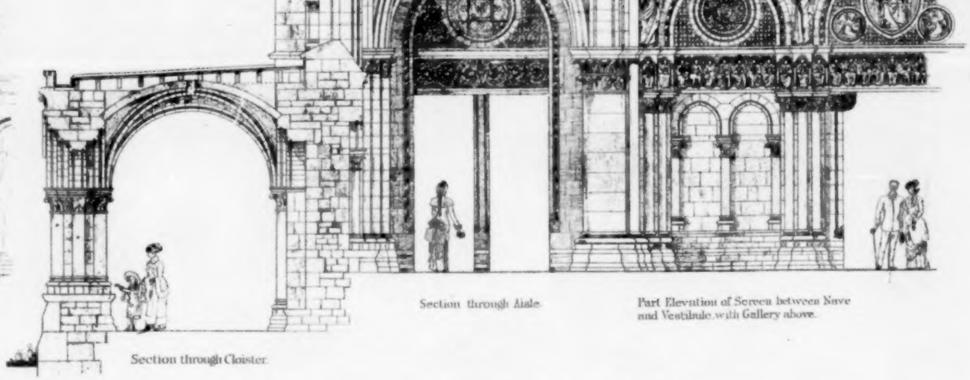
The arrangement of the 22 windows of Nave, is as follows, commencing with the left hand side on entering.

1. Adam.
2. Noah.
3. Abraham.
4. Isaac.
5. Jacob.
6. Joseph.
7. Moses.
8. Aaron.
9. Joshua.
10. Deborah.
11. Gideon.
12. Samson.
13. Samuel.
14. Saul.
15. David.
16. Solomon.
17. Elijah.
18. Elisha.
19. Jehoshaphat.
20. Hezekiah.
21. Joshua.
22. Job.

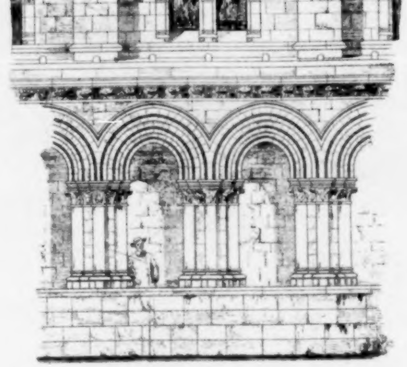




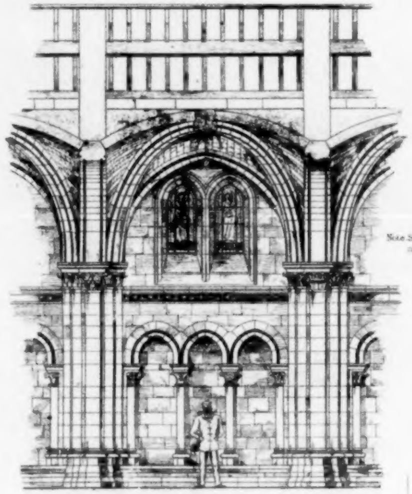
INTERIOR ELEVATION OF ONE BAY OF NAVE.



SECTION THROUGH ONE BAY OF NAVE, AISLE AND CLOISTER.

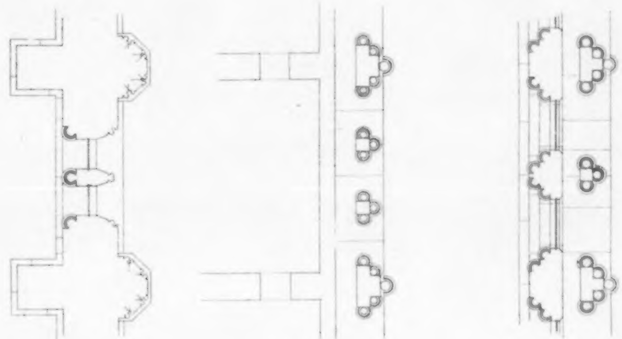


EXTERIOR ELEVATION OF ONE BAY OF NAVE.



Note Subjects for Stained Glass in Aisles are the Emblems of the Church of Christ &c.

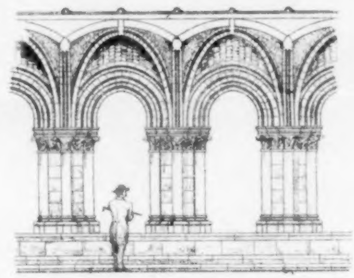
Longitudinal Section through one Bay of South Aisle.



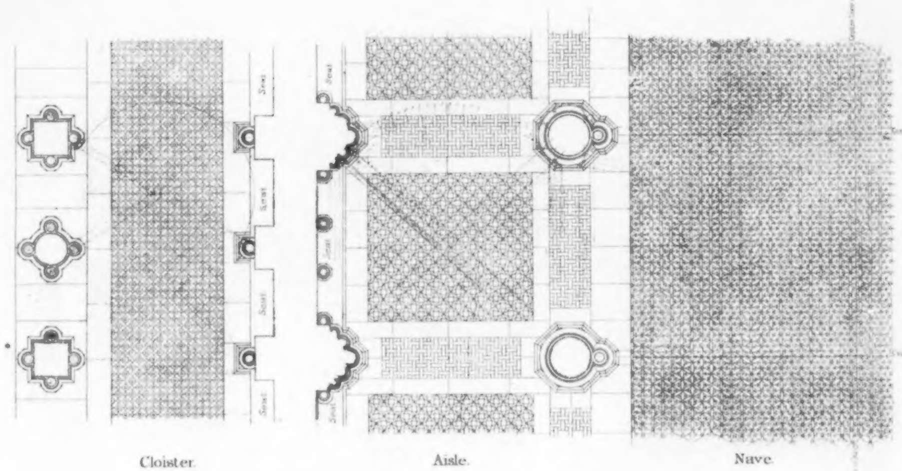
Plan through Aisles to Windows.

Plan at Triforium level.

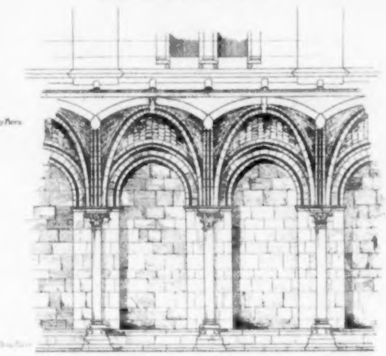
Plan of Clerestory Windows.



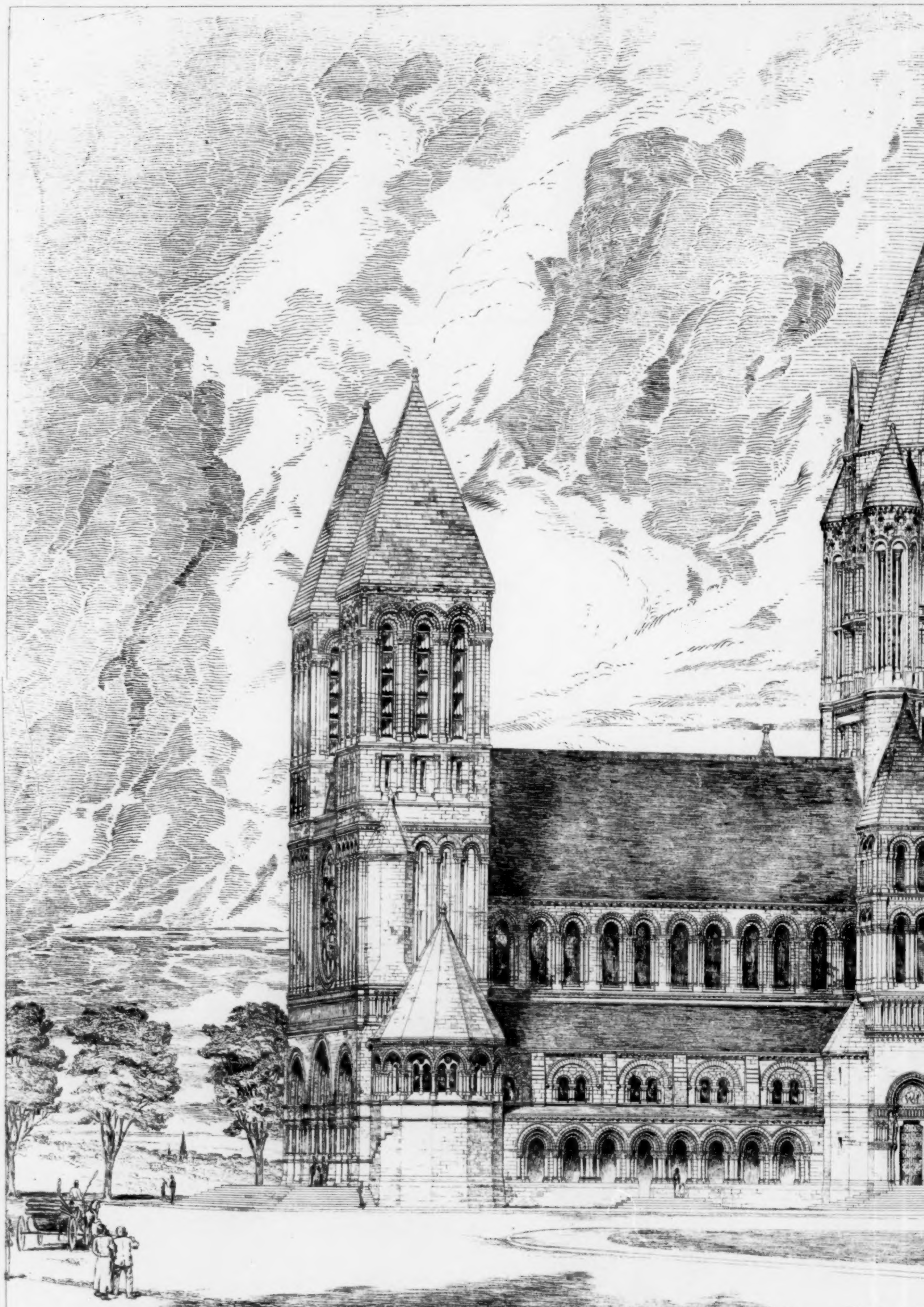
Longitudinal Section through two Bays, South Cloister, looking South.



GENERAL PLAN OF ONE BAY OF NAVE.



Longitudinal Section through two Bays, South Cloister, looking North.



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made especially ample and spacious; for the same reason, as many doors as possible have been provided throughout the building.

On the left side of the western vestibule is the baptistery, a vaulted polygonal chamber somewhat more than eighteen feet in diameter, lighted by a range of pointed and traceried windows in the upper part of the wall. Corresponding with the baptistery, on the right of the western vestibule, is a wide staircase leading to the gallery over the vestibule and to the organ loft. The vestibule with the baptistery opening on the north and the staircase on the south, forms a long, continuous vista.

Besides the large gallery over the western vestibule, there are smaller galleries over the transept entrances, reached by spiral staircases; smaller but similar staircases at the western end lead to the towers, and to galleries in the triforium, which give access to the windows and add to the effect of the interior by their open arcades through which the windows in the main wall are seen.

The altar, standing as it does against the main wall of the apse, is practically at the end of the church. Surrounding the apse are the vestries, that of the bishop in the centre, and those for the clergy and the choir on either side in chambers, the circular form of which was suggested by the apsidal chapels of the Auvergnat churches. These chambers are entered from an ambulatory which is lighted from windows above the roofs of the vestries; the ambulatory runs around the apse inside of the vestries, and is separated from the apse by a wrought-iron screen, which gives a retired communication between the vestries, but at the same time leaves the arcades entirely open.

The chapter-house is placed near the entrance of the northern transept, and corresponding to it, near the entrance of the southern transept is a chapel.

The walls both of the clerestory and of the aisles are not very high, and the western towers are kept low to give greater value and interest to the main feature of the composition, — the great polygonal central tower which crowns and governs the whole mass.

DIMENSIONS OF ROD-ENDS, HEADS, NUTS AND WASHERS.

It is believed by the writer that the following formulæ and tables will be found to be of considerable value to architects, engineers and draughtsmen, by saving labor in computation, especially for roof and bridge trusses.

A washer, pressing against the side of a timber and serving to transmit to it the tensile strain in a wrought-iron rod, is usually made too small, especially when the rod is of large diameter, or is severely strained. If such a washer is too small, the fibres of the wood beneath it are apt to become badly crushed and injured, so that the form of the truss or other construction is changed, often increasing the original strains in the members, if not inducing new ones. The writer is not aware that the question of the proper diameter of washers has ever been fully investigated previously.

There are two general kinds or forms of bolt rod-ends.

1. Those not upset or enlarged, which are commonly found in the case of ordinary bolts or short rods.

2. Those with enlarged ends, as in the long rods of bridge and roof trusses. The object of enlarging the end before cutting the screw, is to make the end of equal strength with the part of the rod between the ends, causing a considerable saving of material and cost, if the end be enlarged in a way which injures the tensile strength of the fibres as little as possible.

I. — ENDS OF RODS NOT ENLARGED.

The screw thread is cut on the end of the rod, materially reducing the tensile strength of the rod, because this will be no greater than that of the solid core of metal left between the roots of the threads, where fracture would first occur. Consequently, that portion of the metal of the rod lying outside this core is practically lost, increasing both the weight and cost of the truss or construction. Therefore a due regard to economy indicates that these ends should be enlarged if possible, whenever the length of the rod exceeds a certain maximum.

1. *Proportions of Screw Threads.*

The standard proportions of threads recommended by the Franklin Institute have been generally adopted throughout the United States, and will therefore be employed in this article.

The number of threads per inch in length of the rod will be found in a line with the diameter of any given rod, in the tables to be given hereafter.

These threads are of V-section, the cross-section being an equilateral triangle, with a flat left on the edge and also between the roots of two adjacent threads, of one-eighth the pitch or distance between centres of two adjacent threads.

It has been thought desirable to avoid introducing any number of threads per inch not included in the original table of the Franklin Institute, consequently, the nearest and most appropriate pitch has been selected for such diameters as it has been found necessary to add to those given in the original table.

Let $n =$ number of threads per inch for the given rod. (See Tables.)

Then $\frac{1}{n} =$ pitch of threads or distance between threads.

2. *Safe Tensile Strength of Rod.*

This will be that of the core between the threads only.

Let $d =$ original diameter of rod in inches, before cutting threads.

Then $\frac{3}{8}\, n$ tan. $60° = \frac{.65}{n} =$ depth of one thread.

And $d - \frac{1.3}{n} =$ diameter of solid core between threads.

Let $W =$ maximum safe tensile strength of rod in net tons.

Let $T =$ ultimate tenacity of metal of rod, in net tons per square inch of section, $=$ 25 tons for wrought-iron of good quality.

Let $f =$ a factor of safety, usually $= 5$.

Then $.7854\, (d - \frac{1.3}{n})^2 =$ sectional area of the solid core.

And $W = .7854\, \frac{T}{f}\, (d - \frac{1.3}{n})^2 = 3.927\, (d - \frac{1.3}{n})^2 =$ maximum safe tensile strength of any rod, and which is the required general formula.

3. *Proportions of Heads and Nuts.*

Several different systems of proportions are in use by different manufacturers, but that of the Franklin Institute being probably the one most widely adopted, it will alone be here given.

1. *For Rough or Unpolished work.*

$1.5\, d + \frac{1}{8}$ inch $=$ width of head or nut between two parallel sides, for square or hexagonal heads or nuts.

One-half this width $=$ thickness of the head.

Thickness of nut $=$ diameter of rod.

2. *For Polished work.*

$1.5\, d\ 1\frac{1}{16}$ inch $=$ width of head or nut between two parallel sides.

$d - \frac{1}{16}$ inch $=$ thickness of nut and usually of head also.

Note. — The Franklin Institute standard nuts would frequently require to be made from bars of odd sizes, not found in stock. Therefore, the dimensions of nuts given in the following tables might be considered as the minimum safe dimensions, and in practice the next larger available stock size of bar could be substituted therefor, if desired. Nuts are now largely made by special manufacturers, each of whom has his own special proportions, usually larger than those of the Franklin Institute standard.

4. *Proportions of Washers.*

1. *Washers pressed against metallic surfaces or beams.*

In this case the ordinary wrought-iron punched washers are usually sufficient, where any washer is required. They are sold at any hardware store, and are usually a little smaller than the nut, and are from one-sixteenth to one-eighth of an inch in thickness.

2. *Washers pressed against the side of a timber.*

a. Thickness of such washers.

If made of cast-iron, as is usually the case, their thickness should be the same as the diameter of the rod.

If made of wrought-iron, half this thickness will suffice.

b. Diameter or side of washer.

Let $C' =$ ultimate resistance to crushing at right angles to the fibres of the wood, in net tons per square inch.

Let $k =$ the factor of safety for this crushing.

Let $k = 1.25$, when the maximum safe tensile strength of the rod is very seldom exerted, as in the case of the rods of roof trusses.

Let $k = 2.5$, when this maximum safe strength is frequently or permanently exerted, as in the case of bridge trusses.

The first case is embodied in the tables, in the columns headed "Temporary:" the latter, in those marked "Permanent."

Note. — The values assumed for C' are those corresponding to the pressures which would materially injure the structure of the surface of the wood, much less than those required to crush it into a shapeless form.

It is doubtless true that the safe resistance of the wood to being crushed by the washer would be somewhat increased by the resistance to shearing, which acts along the periphery of the washer, but this must be much smaller than the direct resistance of the wood to crushing, and is therefore not here considered, because the experimental data for determining its amount does not yet exist.

It is evident that the maximum tensile strain on the rod causes an equal pressure of the washer against the timber, and that this pressure must be distributed over a sufficient area, so that the wood may be in no danger of material injury.

Hence, Total area of washer $=$ Effective or bearing area required $+$ Area of hole in its center.

Let $d' =$ diameter of circular washer required.

Let $s' =$ side of a square washer required.

We have then, $.7854\, d = 3.927(d - \frac{1.3}{n})^2\ \frac{K}{C'} + .7854\, d^2$.

Reducing, $d' = \sqrt{d^2 + 5\, \frac{K}{C'}\, (d - \frac{1.3}{n})^2}$, and $s' = .885\, d'$.

Which are the required general formulæ.

Let $C' = 1.16$ tons for white-oak, an average value for hard woods.

Let $C' = .40$ ton for white-pine, an average value for soft woods.

Let $k = 1.25$ for temporary, and 2.5 for permanent strains, as already explained.

Substituting these values in the general formulæ, the four following special formulæ are obtained, by means of which the values given in the tables were calculated.

1. For washers against white-oak timbers.

Temporary strain, $d' = \sqrt{d^2 + 5.39\left(d - \frac{1.3}{n}\right)^2}$.

Permanent strain, $d' = \sqrt{d^2 + 10.78\left(d - \frac{1.3}{n}\right)^2}$.

2. For washers against white-pine.

Temporary strain, $d' = \sqrt{d^2 + 15.63\left(d - \frac{1.3}{n}\right)^2}$.

Permanent strain, $d' = \sqrt{d^2 + 31.25\left(d - \frac{1.3}{n}\right)^2}$.

For all these cases, $s' = .885\ d'$.

II.—ENDS OF RODS ENLARGED.

The ends of the rod are heated and enlarged or upset, either by forging, by pressure in dies of the proper form or by welding on a piece of larger diameter. As this process evidently destroys the parallelism of the fibres, it appears that the diameter of the solid core between the screw threads must be made somewhat greater than that of the original rod, in order to possess equal strength.

Therefore, the diameters of the enlarged ends given in the tables have been so arranged, that the diameters of the solid cores may be as nearly as possible one-sixteenth inch greater than the original diameters of the rods, for all sizes, which is probably a sufficient allowance, if the work be properly performed.

But the given diameters are to be considered as minima, and might be increased if desired, though this might require the use of a thread of a different pitch, which would make a small change in the dimensions of nuts and washers.

The length of the upset end depends on the form and nature of the parts with which it is connected; it must pass through the nut and the washer and enter the timber sufficiently to prevent any danger of sliding out of place sidewise.

1. *Proportions of Screw Threads.*

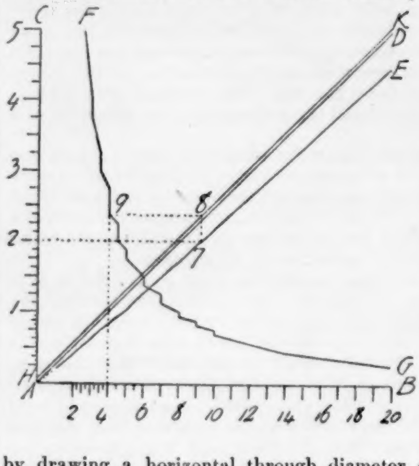
The pitch of the thread is proportioned to the total diameter of the enlarged end, using the most appropriate standard pitch for a rod of equal diameter, with end not enlarged.

This pitch may be most conveniently found by the following graphical method.

Draw the lines A B, A C, at right angles, and lay off on A C a scale of diameters of rods, at full size; and on A A, a scale of threads to the inch, up to 20, at any convenient scale of equal parts.

Bisect the angle C A B by A D; make A H = one-sixteenth inch, and draw H K parallel to A D.

Points in the broken line F G are found by drawing a horizontal through diameter of any rod taken on A C, and a vertical through the corresponding number of threads per inch, on A B, as given for rods with ends not enlarged. The intersection of these will be a point of the line which is drawn by connecting these points as in the figure.



The broken line A E is a line giving actual diameters of solid cores between threads, for ends not enlarged. Points in A E are found by drawing a horizontal through diameter of rod on A C, and intersecting A D; then on a vertical through this intersection the solid diameter of the core is laid off from A B, giving the required point in A E. These points are then connected as shown, producing a broken and approximately curved line.

To determine the proper number of threads per inch for a rod with enlarged end:

Draw a horizontal 2-7 through diameter of the given rod, taken on A C, intersecting A E in 7; draw a vertical through 7 intersecting H K in 8, and through 8 a horizontal cutting the broken line F G in 9; lastly, a vertical through 9, which will give the required number of threads on the line A B. If this should not coincide with any standard number, the nearest standard number should be taken, to avoid introducing any irregular pitch of thread.

By means of such a diagram, the numbers of threads per inch for rods with upset ends were determined, as given in the following table for enlarged ends.

TABLE FOR RODS, ETC., WITH ENDS ENLARGED.

Diameter of Rod.	No. of Threads.	Max. safe Strain, W.	Diam. Enlarged End.	Dimensions of Nuts. Rough. Width.	Rough. Thick.	Finished. Width.	Finished. Thick.	Dimensions of Washers. For Temporary Strains. Against Oak. Side.	Temp. Against Oak. Diam.	Temp. Against Pine. Side.	Temp. Against Pine. Diam.	For Permanent Strains. Against Oak. Side.	Perm. Against Oak. Diam.	Perm. Against Pine. Side.	Perm. Against Pine. Diam.	Thickness of washer. Cast-Iron.	Wr't-Iron.
1-4	16	.25	.39	.72	.39	.66	.33	.62	.70	.95	1.07	.81	.91	1.29	1.46	.39	.20
5-16	14	.38	.47	.83	.47	.77	.41	.77	.87	1.17	1.32	1.00	1.13	1.61	1.81	.47	.24
3-8	12	.55	.55	.95	.55	.89	.49	.91	1.03	1.40	1.58	1.29	1.35	1.92	2.17	.55	.28
7-16	11	.75	.62	1.06	.62	1.00	.56	1.05	1.19	1.63	1.84	1.39	1.56	2.23	2.52	.62	.31
1-2	11	.98	.68	1.16	.68	1.10	.62	1.19	1.35	1.85	2.09	1.58	1.78	2.55	2.88	.68	.34
9-16	10	1.24	.76	1.25	.76	1.19	.70	1.36	1.51	2.08	2.34	1.76	1.99	2.86	3.23	.76	.38
5-8	9	1.54	.83	1.38	.83	1.32	.77	1.48	1.67	2.31	2.61	1.96	2.22	3.19	3.59	.83	.42
11-16	9	1.86	.89	1.47	.89	1.41	.83	1.62	1.83	2.55	2.86	2.15	2.43	3.50	3.95	.89	.45
3-4	8	2.21	.98	1.61	.98	1.55	.92	1.77	2.00	2.78	3.12	2.36	2.65	3.82	4.31	.98	.49
13-16	8	2.59	1.04	1.66	1.04	1.60	.98	1.91	2.15	2.99	3.38	2.55	2.86	4.13	4.66	1.04	.52
7-8	7	2.97	1.12	1.81	1.12	1.75	1.06	2.05	2.31	3.21	3.62	2.72	3.07	4.42	4.99	1.12	.56
15-16	7	3.45	1.19	1.91	1.19	1.85	1.13	2.20	2.48	3.45	3.89	2.92	3.30	4.76	5.38	1.19	.60
1	7	3.93	1.25	2.00	1.25	1.94	1.19	2.34	2.64	3.67	4.15	3.03	3.51	5.08	5.73	1.25	.63
1 1-8	6	4.97	1.41	2.23	1.41	2.17	1.35	2.63	2.97	4.13	4.67	3.50	3.95	5.71	6.45	1.41	.71
1 1-4	6	6.14	1.53	2.42	1.53	2.36	1.47	2.91	3.28	4.59	5.18	3.88	4.38	6.34	7.16	1.53	.77
1 3-8	5	7.43	1.70	2.69	1.70	2.63	1.64	3.20	3.62	5.05	5.70	4.27	4.82	6.98	7.88	1.70	.85
1 1-2	5	8.84	1.82	2.88	1.82	2.82	1.76	3.48	3.93	5.56	6.27	4.65	5.25	7.69	8.68	1.82	.91
1 5-8	4 1-2	10.37	1.98	3.11	1.98	3.05	1.92	3.78	4.26	5.96	6.72	5.04	5.69	8.24	9.30	1.98	.99
1 3-4	4 1-2	12.02	2.10	3.30	2.10	3.24	2.04	4.05	4.57	6.47	7.23	5.42	6.12	8.86	10.00	2.10	1.05
1 7-8	4 1-2	13.81	2.23	3.48	2.23	3.42	2.17	4.33	4.89	6.86	7.74	5.80	6.55	9.59	10.71	2.23	1.12
2	4	15.71	2.39	3.72	2.39	3.66	2.32	4.63	5.22	7.33	8.26	6.15	6.92	10.13	11.44	2.39	1.20
2 1-8	4	17.74	2.51	3.91	2.51	3.85	2.45	4.91	5.54	7.77	8.77	6.57	7.42	10.77	12.15	2.51	1.26
2 1-4	4	19.89	2.64	4.09	2.64	4.03	2.58	5.19	5.86	8.22	9.28	6.96	7.86	11.39	12.86	2.64	1.32
2 3-8	4	22.16	2.76	4.28	2.76	4.22	2.70	5.47	6.17	8.67	9.79	7.33	8.27	12.02	13.56	2.76	1.38
2 1-2	3 1-2	24.54	2.94	4.53	2.94	4.47	2.88	5.76	6.50	9.14	10.31	7.73	8.72	13.74	15.50	2.94	1.47
2 3-4	3 1-2	29.70	3.19	4.91	3.19	4.85	3.13	6.32	7.14	10.04	11.33	8.49	9.58	13.92	15.71	3.19	1.60
3	3 1-4	35.34	3.46	5.33	3.46	5.27	3.46	6.89	7.78	10.95	12.36	9.25	10.44	15.18	17.13	3.46	1.73
3 1-4	3	41.49	3.75	5.75	3.75	5.69	3.69	7.47	8.42	11.87	13.39	10.02	11.31	16.44	18.55	3.75	1.88
3 1-2	3	48.11	4.00	6.13	4.00	6.07	3.94	8.02	9.06	12.76	14.41	10.78	12.17	17.70	19.98	4.00	2.00
3 3-4	2 7-8	55.24	4.27	6.53	4.27	6.47	4.21	8.59	9.70	13.79	15.43	11.56	13.03	18.96	21.40	4.27	2.14
4	2 3-4	62.83	4.54	6.81	4.54	6.75	4.48	9.16	10.34	14.58	16.45	12.32	13.89	20.22	22.82	4.54	2.27
4 1-4	2 5-8	70.95	4.81	7.34	4.81	7.28	4.75	9.73	10.98	15.49	17.48	13.08	14.76	21.49	24.25	4.81	2.41
4 1-2	2 1-2	79.53	5.08	7.75	5.08	7.69	5.02	10.40	11.62	16.41	18.52	13.85	15.63	22.75	25.67	5.08	2.54
4 3-4	2 1-2	88.62	5.33	8.13	5.33	8.07	5.27	10.85	12.24	17.47	19.72	14.59	16.47	24.25	27.37	5.33	2.67
5	2 3-8	98.18	5.61	8.55	5.61	8.49	5.55	11.43	12.90	18.20	20.54	15.37	17.35	25.25	28.50	5.61	2.81

If the horizontal 8-9 be produced to intersect A C, it will give the external diameter of the enlarged end before cutting threads, or this can be easily found by computation, as soon as the number of threads is determined.

2. *Safe Strength of Rod.*

Since the strength of the screw end is assumed to be equal to that of the rod, $W = .7854\ \frac{T}{f}\ d^2 = 3.927\ d^2 =$ Maximum safe tensile strength of the rod, a general formula.

3. *Proportions of Nuts.*

Heads are seldom or never used for rods of this kind, nuts at each end being much more convenient, as well as being less liable to defects in welding, etc.

The standard proportions of the Franklin Institute are employed, applying them to the external diameters of the enlarged ends.

4. *Proportions of Washers.*

1. Washers against metal.

No washers are required, if care be taken to ensure that the under surface of the nut has a good bearing on a true surface at right angles to the rod.

2. Washers pressed against timbers.

Let C' and k have the same values as for rods with ends not enlarged.

As before, Tensile strain in rod = Pressure of washer against side of the timber.

Also, Total area of washer = Its effective bearing area + Area of hole in its center.

Then the extreme diameter of enlarged end = Diameter d of the rod + $\frac{1.3}{n}$ + one-sixteenth inch.

And diameter of hole in washer = Diameter of enlarged end.

Let d'' = diameter of round washer required.

Let s'' = side of square washer required.

We have, $.7854\, d''^2 = 3.927\, \frac{k}{C'}\, d^2 + .7854\, (d + \frac{1.3}{n} + \frac{1''}{16})^2$.

Reducing, $d'' = \sqrt{5d^2 \frac{k}{C'} + (d + \frac{1.3}{n} + \frac{1}{16})^2}$.

And $s'' = .885\, d''$.

These are the required general formulæ.

Make as before;

$C' = 1.16$ for white-oak, and $= .40$ for white-pine:

$k = 1.25$ for temporary, and $= 2.5$ for permanent strains.

We obtain the four following special formulæ, employed in the calculation of the corresponding table.

1. For washers against white-oak,

Temporary strain, $d'' = \sqrt{5.39\, d^2 + (d + \frac{1.3}{n} + \frac{1}{16})^2}$.

Permanent strain, $d'' = \sqrt{10.78\, d^2 + (d + \frac{1.3}{n} + \frac{1}{16})^2}$.

2. For washers against white-pine.

Temporary strain, $d'' = \sqrt{15.63\, d^2 + (d + \frac{1.3}{n} + \frac{1}{16})^2}$.

Permanent strain, $d'' = \sqrt{31.25\, d^2 + (d + \frac{1.3}{n} + \frac{1}{16})^2}$.

For all these cases, $s'' = .885\, d''$.

The thickness of a cast-iron washer should be equal to the diameter of the enlarged end of the rod; of a wrought-iron one, half this amount.

MODE OF USING THE TABLES.

Case 1. — *Given*, maximum working tensile strain on the rod in net tons; *required*, least safe diameter of rod, number of threads per inch, dimensions of head, nut, and washers.

Note whether the ends of the rod are to be enlarged or not, also the character of the working strain, whether "temporary" as in a roof truss, or "permanent" as in a bridge truss.

Then look in the proper table in the column headed "Maximum safe strain *W*," for the given strain, or if this be not found, for that next larger. The required diameter of the rod and dimensions of parts will be found in the same horizontal line as this strain, in the proper columns of the table.

Example 1. — Let this maximum strain = 8 net tons; "temporary," as in a roof struss; washer to bear against the side of a white-pine timber.

TABLE FOR RODS, ETC., ENDS NOT ENLARGED.

Diameter of Rod.	No. of Threads.	Max. safe strain, W.	Rough. Width of Head or Nut.	Rough. Thickness of Head.	Rough. Thickness of Nut.	Finished. Width of Head or Nut.	Finished. Thickness of Head of Nut.	Dimensions of Washers. For Temporary Strains. Against Oak. Side.	Temp. Oak. Diam.	Temp. Against Pine. Side.	Temp. Pine. Diam.	For Permanent Strains. Against Oak. Side.	Perm. Oak. Diam.	Perm. Against Pine. Side.	Perm. Pine. Diam.	Thickness of Washer. Cast-Iron.	Thickness of Washer. Wr't-Iron.
1-4	20	.13	.50	.25	.25	.44	.19	.44	.50	.69	.77	.58	.66	.94	1.06	.25	.13
5-16	18	.23	.59	.30	.31	.53	.25	.57	.64	.89	1.00	.75	.85	1.23	1.38	.31	.16
3-8	16	.34	.69	.34	.38	.63	.32	.69	.78	1.08	1.22	.92	1.04	1.50	1.69	.38	.19
7-16	14	.47	.78	.39	.44	.72	.38	.81	.91	1.27	1.43	1.08	1.21	1.75	1.98	.44	.22
1-2	13	.63	.88	.44	.50	.82	.42	.93	1.06	1.47	1.66	1.25	1.41	2.03	2.29	.50	.25
9-16	12	.81	.97	.48	.56	.91	.50	1.06	1.20	1.67	1.89	1.42	1.60	2.31	2.61	.56	.28
5-8	11	1.01	1.06	.53	.63	1.00	.57	1.18	1.33	1.86	2.10	1.58	1.78	2.57	2.90	.63	.32
11-16	10	1.23	1.16	.58	.69	1.10	.63	1.30	1.47	2.05	2.31	1.74	1.96	2.83	3.20	.69	.75
3-4	10	1.51	1.25	.63	.75	1.19	.69	1.44	1.62	2.27	2.56	1.92	2.17	3.14	3.55	.75	.38
13-16	9	1.77	1.34	.67	.81	1.28	.75	1.56	1.76	2.46	2.78	2.08	2.35	3.40	3.84	.81	.41
7-8	9	2.12	1.44	.72	.88	1.38	.82	1.70	1.91	2.69	3.03	2.27	2.56	3.71	4.19	.88	.44
15-16	8	2.36	1.53	.77	.94	1.47	.88	1.80	2.03	2.84	3.21	2.40	2.71	3.92	4.43	.94	.47
1	8	2.75	1.63	.81	1.00	1.57	.94	1.94	2.19	3.06	3.46	2.59	2.93	4.24	4.79	1.00	.50
1 1-8	7	3.46	1.81	.91	1.13	1.75	1.07	2.18	2.46	3.44	3.88	2.91	3.29	4.76	5.37	1.13	.57
1 1-4	7	4.45	2.00	1.00	1.25	1.94	1.19	2.45	2.77	3.89	4.39	3.29	3.71	5.39	6.08	1.25	.63
1 3-8	6	5.27	2.19	1.09	1.38	2.13	1.32	2.68	3.02	4.24	4.78	3.58	4.04	5.87	6.62	1.38	.69
1 1-2	6	6.46	2.38	1.19	1.50	2.32	1.44	2.96	3.34	4.69	5.29	3.96	4.47	6.50	7.33	1.50	.75
1 5-8	5 1-2	7.58	2.56	1.28	1.63	2.50	1.57	3.20	3.61	5.07	5.73	4.29	4.84	7.03	7.93	1.63	.82
1 3-4	5	8.72	2.75	1.38	1.75	2.69	1.69	3.40	3.88	5.45	6.15	4.61	5.20	7.54	8.51	1.75	.88
1 7-8	5	10.24	2.94	1.47	1.88	2.88	1.82	3.71	4.19	5.90	6.66	4.98	5.62	8.17	9.22	1.88	.94
2	4 1-2	11.49	3.13	1.56	2.00	3.07	1.94	3.94	4.45	6.25	7.05	5.28	5.96	8.66	9.77	2.00	1.00
2 1-8	4 1-2	13.24	3.31	1.66	2.13	3.25	2.07	4.22	4.76	6.70	7.56	5.66	6.39	9.30	10.49	2.13	1.07
2 1-4	4 1-2	15.10	3.50	1.75	2.25	3.41	2.19	4.50	5.08	7.17	8.07	6.04	6.82	9.92	11.20	2.25	1.13
2 3-8	4	16.51	3.69	1.84	2.38	3.63	2.32	4.71	5.32	7.48	8.45	6.32	7.14	10.37	11.71	2.38	1.19
2 1-2	4	18.58	3.88	1.94	2.50	3.82	2.44	5.03	5.67	7.93	8.95	6.75	7.62	11.00	12.41	2.50	1.25
2 3-4	4	23.09	4.25	2.13	2.75	4.19	2.69	5.55	6.27	8.84	9.98	7.47	8.42	12.26	13.84	2.75	1.38
3	3 1-2	27.12	4.63	2.31	3.00	4.57	2.94	6.02	6.80	9.59	10.82	8.10	9.14	13.19	15.00	3.00	1.50
3 1-4	3 1-2	32.53	5.00	2.50	3.25	4.94	3.19	6.58	7.42	10.47	11.82	8.85	9.98	14.54	16.41	3.25	1.63
3 1-2	3 1-4	37.75	5.38	2.69	3.50	5.32	3.44	7.09	8.00	11.29	12.75	9.54	10.77	15.67	17.68	3.50	1.75
3 3-4	3	43.20	5.75	2.88	3.75	5.69	3.69	7.59	8.57	12.09	13.64	10.21	11.52	16.72	18.87	3.75	1.88
4	3	49.97	6.13	3.06	4.00	6.07	3.94	8.15	9.20	12.99	14.66	10.97	12.38	18.02	20.34	4.00	2.00
4 1-4	2 7-8	56.61	6.50	3.25	4.25	6.44	4.19	8.68	9.79	13.82	15.60	11.67	13.17	19.18	21.65	4.25	2.13
4 1-2	2 3-4	63.70	6.88	3.44	4.50	6.82	4.44	9.20	10.38	14.68	16.55	12.38	13.97	20.35	22.97	4.50	2.25
4 3-4	2 5-8	71.07	7.25	3.63	4.75	7.19	4.69	9.71	10.96	15.49	17.48	13.08	14.76	21.50	24.26	4.75	2.38
5	2 1-2	78.83	7.63	3.81	5.00	7.57	4.94	10.23	11.54	16.31	18.40	13.76	15.54	22.52	25.53	5.00	2.50

1. Ends of rod not enlarged.

By Table I. we find diameter of rod = $1\frac{3}{4}$ inches; 5 threads per inch; head, $1\frac{3}{8}$ x $2\frac{3}{4}$; nut, $1\frac{3}{4}$ x $2\frac{3}{4}$; washer, $1\frac{3}{4}$ thick and $6\frac{9}{64}$ diameter.

2. Ends of rod enlarged.

By Table II. we find diameter of rod = $1\frac{1}{2}$ inches, with ends enlarged to $1\frac{53}{64}$ in diameter; 5 threads per inch; nuts at each end, $1\frac{53}{64}$ x $2\frac{3}{4}$; washer, $1\frac{53}{64}$ x $6\frac{17}{64}$ diameter.

Example 2. — Let maximum tensile strain on rod = 6 tons; "permanent," as in case of a bridge truss.

1. Ends not enlarged. Rod, $1\frac{1}{2}$ diameter; 6 threads per inch; head, $1\frac{3}{16}$ x $2\frac{3}{8}$; nut, $1\frac{1}{2}$ x $2\frac{3}{8}$; washer, $1\frac{1}{2}$ x $7\frac{21}{64}$ diameter.

2. Ends of rod enlarged. Rod, $1\frac{1}{4}$ diameter, ends enlarged to $1\frac{17}{32}$; 6 threads per inch; nuts, $1\frac{17}{32}$ x $2\frac{27}{64}$; washer, $1\frac{17}{32}$ x $7\frac{5}{32}$ diameter.

Case 2. — *Given*, diameter of the rod; *required*, its maximum safe tensile strength.

Look for the given diameter in the proper table; in the same horizontal line and in the column headed *W* will be found the required safe tensile strength in net tons.

Example 3. — A rod is $2\frac{3}{8}$ inches diameter: required its maximum safe tensile strength.

1. If ends are not enlarged, $W = 16.51$ tons.

2. If ends are enlarged, $W = 22.16$ tons.

Case 3. — *Given*, total working tensile strain on a group of similar and equal rods; *required*, diameter of each rod, dimensions of head, nut, washer, etc.

Divide the total strain by the number of rods to be used; the quotient = strain on each rod, if all are screwed up equally tight. Then proceed as for a single rod.

Example 4. — A group of rods of equal diameter is subject to a maximum tensile "permanent" strain of 50 tons; washer pressed against a white-pine timber; required the dimensions of one rod, etc.

Strain on one rod = 50 ÷ 3 = 16.67 tons.

1. Ends not enlarged. Diameter of rod, $2\frac{1}{2}$ inches; 4 threads per inch; heads, $1\frac{15}{16}$ x $3\frac{7}{8}$; washers, $2\frac{1}{2}$ x $12\frac{13}{32}$ diameter.

2. Ends enlarged. Diameter of rod, $2\frac{1}{8}$ inches; ends enlarged to $2\frac{23}{64}$ inches; 4 threads per inch; nuts, $2\frac{23}{64}$ x $3\frac{23}{32}$; washers, $2\frac{23}{64}$ x $12\frac{5}{32}$ diameter.

Case 4. — *Given*, diameter of rod and maximum tensile strain actually acting on it; *required*, the factor of safety used in this case.

The factor of safety for resistance to tensile strain employed in the given tables = 5.

Let W = maximum safe strength of the rod, as given by the proper table.

Let W' = maximum tensile strain acting on the rod.

We have $W' : W :: 5$: required factor of safety.

Or $5\, W \div W'$ = factor required.

Example 5. — A rod has a diameter of $1\frac{5}{8}$ inches and is subject to a maximum tensile strain of 15 tons; required the factor of safety used.

1. Ends not enlarged. Tabular safe strength of rod = 7.58 tons.

Therefore, $5 \times \frac{7.58}{15} = 2.53$, nearly, = factor of safety.

2. Ends enlarged. Tabular safe strength of rod = 10.37 tons.

Hence, $\frac{5 \times 10.37}{15} = 3.46$ nearly, the factor of safety used.

Case 5. — *Given*, diameter of rod; *required*, dimensions of a rectangular washer or bearing area transmitting strain in rod against the side of timber.

Find side of square washer suitable for the given case; compute its area in square inches; dividing this by given or assumed side of rectangular area, the quotient will be its required other dimension.

Example 6. — Let the diameter of the rod = 2 inches; ends enlarged; permanent strain; pine timber. One side of rectangular area = 6 inches.

By table, 10.13 inches = side of suitable square washer; its total area $= 10.13^2 = 102.6$ square inches; $102.6 \div 6 = 17.1$ inches.

The rectangular washer or area therefore is 6 x 17.1 inches.

Note. — It may sometimes be found more convenient to find the diameter of a suitable circular washer, determine its area by means of a table of circles, then computing dimensions of rectangular area as before, obtaining identical results.

Case 6. — *Given*, number and diameters of a group of equal rods; *required*, the dimensions of a single bearing piece, serving to transmit the strains in the group of rods to the sides of the timbers. This case frequently occurs at the joints of heavy trusses.

Find as before, the bearing area for one rod; multiply this by the number of rods to obtain total bearing area; the quotient of this area divided by one side of rectangular area will be its other side.

Example 7. — A group of 3 equal rods, each being 2 inches in diameter, passes through a bearing piece of 4-inch oak plank, lying across the chord, which is composed of 4 timbers, each being 6 inches thick. Required the least safe width of this bearing piece, dimensions of washers for rods, etc. Permanent strain; ends enlarged; pine timbers.

Bearing area for one rod = 102.6 square inches; for the 3 rods $= 102.6 \times 3 = 307.8$ square inches.

Total bearing length of piece against top or bottom of chord $= 4 \times 6 = 24$ inches.

Hence $307.8 \div 24 = 12.83$ = least width of the oak bearing piece.

By table, each rod would also have a washer 6.15 inches square or 6.92 inches in diameter, pressing against the other surface of the oak bearing piece.

If this bearing piece were made of cast or wrought iron and of sufficient thickness, no washers would be required.

Note. — In bridge trusses it is now usual to transmit the strains from diagonals to verticals directly, and *vice versa*, without causing pressure against the chords, by means of joints of peculiar form, or by cast-iron pipes, which pass through the chord and abut against the joint block and the inside of the washer. Since the pressure of the washer against the timber is greatly reduced, its dimensions may be correspondingly diminished.

A series of tables, nearly similar to the two now given, have been used in my classes for several years, and have been found to save a great deal of time in determining the dimensions of rods, and in making detail drawings for roof and bridge trusses.

APPROXIMATE FORMULÆ FOR DIMENSIONS OF WASHERS.

In case the preceding correct formulæ for the side or diameter of washers, or the tables, are not at hand, the following approximate formulæ may be of service, since they can be readily transferred into a note-book and are easily applied. The values are averaged for the range of the tables.

1. *Ends of rod not enlarged.*

Temporary strain; oak timber; side of washer = 2 diameters of rod.

Temporary strain; oak timber; diameter of washer = $2\frac{1}{4}$ diameters of rod.

Temporary strain; pine timber; side of washer = $3\frac{3}{8}$ diameters of rod.

Temporary strain; pine timber; diameter of washer = $3\frac{5}{8}$ diameters of rod.

Permanent strain; oak timber; side of washer = $2\frac{3}{4}$ diameters of rod.

Permanent strain; oak timber; diameter of washer = 3 diameters of rod.

Permanent strain; pine timber; side of washer = $4\frac{1}{3}$ diameters of rod.

Permanent strain; pine timber; diameter of washer = 5 diameters of rod.

2. *Ends of rod enlarged.*

Temporary strain; oak timber; side of washer = 2.3 diameters of rod.

Temporary strain; oak timber; diameter of washer = 2.6 diameters of rod.

Temporary strain; pine timber; side of washer = $3\frac{2}{3}$ diameters of rod.

Temporary strain; pine timber; diameter of washer = 4.1 diameters of rod.

Permanent strain; oak timber; side of washer = 3.1 diameters of rod.

Permanent strain; oak timber; diameter of washer = $3\frac{1}{2}$ diameters of rod.

Permanent strain; pine timber; side of washer = 5.1 diameters of rod.

Permanent strain; pine timber; diameter of washer = $5\frac{3}{4}$ diameters of rod.

N. CLIFFORD RICKER.

THE PROPORTIONS OF CHURCHES.

EDINBURGH, IND., August 23, 1883.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Gentlemen, — Can you give the proper proportions for the heights of church ceilings, or do you know of any works that can be got that would give the proper proportions of churches and other public buildings?

SUBSCRIBER.

[GWILT's *Encyclopædia of Architecture*. — EDS. AMERICAN ARCHITECT.]

THE PUBLICATION OF PLANS.

DENVER, COLO.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — We notice very frequently some of the prettiest designs appearing in the *American Architect* fail to have the first and second floor-plans shown; this is a mistake, we think, as the floor-plans are of as much interest as the elevation, and should have the sizes of rooms marked in figures. We think the many readers of your valuable paper would appreciate this change.

Yours respectfully, A. L. WELCH.

[WE entirely agree with our correspondent. — EDS. AMERICAN ARCHITECT.]

BOOKS FOR BEGINNERS.

RICHMOND, VA., August 6, 1883.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Some time ago (I think it was May 26,) I wrote asking about books for beginners. For the study of the orders you recommended Vignola or Sir William Chambers (*American Architect*, June 2, 1883). Since that time I have written to several architectural book dealers, but they told me that they had neither. Now I would like to ask (if it is not too much trouble to you) where I can obtain them, and what are the prices.

By letting me know you will greatly oblige,

Yours respectfully, WM. G. NOTTING.

[WRITE directly to Garnier Frères, No. 6, Rue des Saints-Pères, Paris, France, for a copy of Leveil's Vignola, enclosing an international money order for ten francs, which will cost you about $2.15, and you will receive the book by mail in about four weeks. On its arrival at the post-office you will be notified to come and pay the duty, amounting to about fifty cents, and on doing so the book will be delivered to you. The books of Sir William Chambers are much more expensive than this, and are, so far as we know, out of print, but you can get second-hand copies, at various prices, from B. T. Batsford, 52 High Holborn, London, England. You should write him first asking prices, and then remit international money order for the amount, with postage, which he will tell you the cost of. Duty, if any is charged, will be payable at the post-office on delivery. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS.

A DOUBLE ARTESIAN WELL. — Selma has the most wonderful artesian well in the world. Two separate streams of water of entirely different properties flow from this well. This effect is produced by the insertion of a two-inch pipe within a four-inch tube. The larger pipe descends four hundred feet; the water has no mineral qualities, and is very cold. The inner pipe descends seven hundred feet; the water is strongly impregnated with sulphur and iron, and, compared with the temperature of the twin stream, is quite warm. — *Selma* (*Ala.*) *Times*.

INDURATION OF SOFT LIMESTONE WITH FLUOSILICATES. — The use hitherto made of alkaline silicates to harden limestones is far from satisfactory; it leaves the stone impregnated with soluble salts which are only expelled after long exposure to rain. These salts of potassa and soda rapidly nitrify, and assist the growth of fungous bodies for which the potassa salt is a manure. Another mischievous consequence, resulting from this process, is the formation of an enamel impermeable to water upon the surface of the stones which have reached a point of saturation with the alkaline wash, and this enamel upon the arrival of frost imprisons the water, which freezing underneath this obstinate varnish forcibly detaches the glassy coating and breaks and injures the underlying surface. M. L. Kessler has apparently succeeded in replacing this induration bath by a solution of fluosilicates of bases whose oxides and carbonates are insoluble in a free state. When soft limestone is saturated with a concentrated solution of a fluosilicate of magnesium, aluminum, zinc, or lead, a degree of induration is soon reached which is very considerable. In fact, except the liberated carbonic anhydride there is formed only fluorspar, silica, aluminic oxide, and carbonates of zinc and lead, or fluoride of magnesium, all of which are less soluble than the limestone itself. No varnish is formed and therefore no danger threatened from the expansion of frost underneath it. The process has perfectly resisted the severe tests of winter, and this method of silification is only slightly more expensive than the old process it is intended to replace. It possesses unexpected advantages. It is frequently valuable to give to the surfaces of soft limestones the appearance and the polish of the hard marbles, if only to avoid the settlement of dust and soot upon their rough surfaces. In order to smooth and polish the coarsest limestone it answers to coat it with a paste made of the pulverized stone and water, and after drying to impregnate it with fluosilicate chosen for its lapidification. It forms a homogeneous body finely granular in texture, and as hard and refractory as the stone itself. It is only necessary to take some very simple precautions to avert the carrying away of fine dust in the beginning of the operation, caused by the rapid disengagement of carbonic anhydride. The skill in its application consists in flowing the solution in a thin film over a surface sufficiently dried. When a coloring substance insoluble in water is mixed with the paste, a very variable and interesting series of decorative effects are secured. Finally, by employing colored fluosilicates, as those of copper, chromium, iron, etc., the limestone is colored even in its interior by the formation of insoluble compounds. These colors follow the intimate construction of the stone and afford designs of considerable beauty. — *Les Mondes*.

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.]

283,105. FLUSHING-TANK FOR WATER-CLOSETS, URINALS, ETC. — Thos. Henderson, Nashville, Tenn.
283,110. ELEVATOR SAFETY-CATCH. — Alexander C. Hope, Cartersville, Ind.
283,125. LOCK. — Chas. A. Ludlow, Bridgeport, Conn.
283,126. ROOFING-TILE. — Wilhelm Ludowici, Ludwigshafen-on-the-Rhine, Germany.
283,128. LOCK-HINGE. — Egbert E. Masters, Woodland, Cal.
283,133. FIRE-PROOF LINING FOR BOXES, SAFES, DOORS, SHUTTERS, VAULTS, ETC. — Luke H. Miller, Baltimore, Md.
283,134. KNOB-ATTACHMENT. — William N. Mills, Truro, Nova Scotia, Canada.
283,148. VENTILATING AND APPARATUS THEREFOR. — Thomas Rowan, London, England.
283,149. WARMING AND VENTILATING AND APPARATUS THEREFOR. — Thomas Rowan, London, Eng.
283,158. FIRE-ESCAPE. — Peter Smith, Cato, Kans.
283,159. FIRE-ESCAPE. — Chas. F. Spencer, Rochester, N. Y.
283,163. FIRE-ESCAPE. — Jeremiah Stever, Bridgeport, Conn.
283,163. PIPE-TONGS. — Daniel E. Stewart, Guyandotte, W. Va.
283,166. INSULATED METALLIC ROOF. — Henry C. Thomas, Rock View, N. Y.
283,172. WATER-CLOSET. — Richard Walsh, Detroit, Mich.
283,184. BRICK-MACHINE. — William Woodward and Abel B. Woodward, Nashville, Tenn.
283,196. FIRE-EXTINGUISHER. — John W. Bishop, New Haven, Conn.
283,203. CANT-HOOK. — Jesse Carpenter, Wyman, Mich.
283,208. DOOR-HANGER. — William Brown Cogger and Henry A. Hamlin, Minneapolis, Minn.
283,214. BUILDERS' SCAFFOLD OR MORTAR-BOARD. — Samuel Dale, Boonesborough, Iowa.
283,223. NAIL-PULLER. — Marvin D. Edgerton, Bristol, Conn.
283,268. LATCH. — Eugene M. Mix and James E. Mix, Buffalo, N. Y.
283,277. HINGE. — Alonzo L. Porter, Chicago, Ill.
283,279. DOOR-HANGER. — Edwin Prescott, Arlington, Mass.
283,291. ROOFING-MACHINE. — Robert C. Snowden, Elizabeth, Pa.
283,300. HYDRAULIC PILE-DRIVER. — Joseph W. Surprenant and James E. Ferguson, Astoria, Oreg.
283,319. BEVEL ATTACHMENT FOR HAND-SAWS. — Emanuel Andrews, Williamsport, Pa.
283,332. SKYLIGHT. — John Ehrhardt, St. Louis, Mo.
283,345. FIRE-PROOF BUILDING. — Philipp G. Hubert, New York, N. Y.
283,357. RATCHET-WRENCH. — John Williams Pruitt, Russellville, Ark.
283,358. MANUFACTURE OF ARTIFICIAL STONE. — Harriott H. Ravenel, Charleston, S. C.
283,365. SASH-FASTENER. — Frederick Dudley, Eugene City, Oreg.
283,366. BRICK-MACHINE. — James C. Anderson, Highland Park, Ill.
283,372. MACHINE FOR MAKING BLIND-SLATS. — Joseph W. Brainard, Kent, O.
283,375. FLOORING. — Amand J. B. A. Chatain, New York, N. Y.
283,378. PIPE-WRENCH. — Geo. W. Cook, Chicago, Ill.
283,379. HAMMER. — Geo. W. Cook, Chicago, Ill.
283,380. KNOB. — Geo. Cooper, Greenwood Iron Works, N. Y.
283,384. SASH-FOLLOWER. — John J. Dwyer, New York, N. Y.
283,391. FIRE-ESCAPE. — Joseph Hart, New York, N. Y.
283,393. SAW-FILING MACHINE. — Charles F. Hill, Phelps, N. Y.
283,404. WEATHER-BOARD GAUGE. — Jesse M. Keith, Maiden Rock, and Simeon R. Bolton, Trim Belle, Wis.
283,431. ELEVATOR. — Wilson R. Smith, Beloit, Wis.
283,439. FIRE-ESCAPE. — William Torst, Bingham Cañon, Utah.
283,449. HEATING-APPARATUS. — Robert Tungfer, Görlitz, Prussia, Germany.
283,460. PORTABLE SASH-SECURER. — Reinhold Bettermann, Cambria, Pa.
283,473. DRILL-STOCK. — Louis Eicke, New York, N. Y.
283,502. FASTENER FOR THE MEETING-RAILS OF SASHES. — Philip Mathes, Idlewood, Pa.
283,517. VAULT-COVER FASTENING. — Christian Hansen Ross, Chicago, Ill.
283,530. FIRE-ESCAPE LADDER. — Geo. A. Swartz, Orangeville, Ill.
283,564. RIGHT-ANGLED LEVEL. — Bozwell B. Butt, Richmond, Va.
283,565. BRICK-PRESSING MACHINE. — George Carnell, Philadelphia, Pa.
283,575. SOLDERING-IRON. — Jas. C. Covert, West Troy, N. Y.
283,58[illegible]. MECHANISM FOR RAISING LINES TO THE UPPER PARTS OF BUILDINGS. — Geo. O. Daw, New York, N. Y.
283,595. ORNAMENTING SURFACES OF WALLS, CEILINGS, PAPER-HANGINGS, ETC. — Gustave Giersberg and Richard Wirth, New York, N. Y.
283,601. DOOR-HINGE. — Heinrich Haltaufderheide, Cassel, Prussia, Germany.
283,603. MANUFACTURE OF ARTIFICIAL STONE AND ARTIFICIAL EMERY. — Bernhard Hess, Baireuth, Bavaria, Germany.
283,617. FIRE-ESCAPE. — Handley B. Kimball and Cornelius S. Barrett, Charlotte, Mich.
283,620. FIRE-ESCAPE. — Henry A. Lee, New York, N. Y.
283,637. HEATING, COOLING AND VENTILATING APPARATUS. — Isaac N. Mills, Dover, Del.
283,649. BLIND AND DOOR SPRING. — Patrick K. O'Laily, Boston, Mass.
283,650. FIRE-ESCAPE. — Madison M. Ormsby, David City, Neb.
283,654. FIRE-ESCAPE LADDER. — Alois Peteler, New Dorp, N. Y.
283,655. HOD-ELEVATOR. — Franklin Pierce, New York, N. Y.
283,658. DOOR-CHECK. — Stephen Porter, Boston, Mass.
283,660. COMPRESSION-COCK. — Charles C. Reed, Worcester, Mass.
283,666. FIRE-ESCAPE. — Edward T. Rowe, Boston, Mass.
283,675. WRENCH. — William J. Sherman, St. Augustine, Fla.
283,685. LATHE FOR DRESSING STONE. — Frank Trier, London, Eng.
283,696. WRENCH. — John J. Brandt, De Witt Centre, N. Y.
283,699. STATIONARY WASH-STAND. — Patrick Connolly, Brooklyn, N. Y.
283,702. FIRE-ESCAPE. — Horace D'B. Cutler, Glenwood, Mo.
283,705. BORING-BIT. — Hiram E. Fuller, New York, N. Y.
283,718. KNOB-ATTACHMENT. — John B. Morris, Cincinnati, O.

SUMMARY OF THE WEEK.

Baltimore.

HOUSES. — Thomas Dixon, architect, has prepared drawings for Lewis H. Robinson, builder, for nine houses, six of which will front on Park Ave., each 18′ 3″ x 50′; two on Park Pl., 28′ x 51′ and 31′ x 56′ 2″ respectively, and one on North Ave., 21′ 10″ x 58′ 3″ (a store and dwell). They will be built of brick, with marble and terra-cotta finish, and cost about $32,000.

BUILDING PERMITS. — Since our last report twenty-seven permits have been granted, the more important of which are the following: —

W. F. Stubs, 7 two-st'y brick buildings, n s Pratt St., commencing n e cor. Pulaski St.

Henry Westphal, 3 two-st'y brick buildings, w s Fulton St., n of Eagle St.

Dr. G. Reuling, three-st'y brick building, in rear of 79 Monument St., s s, between Cathedral St. and Park Ave.

J. D. Mason, four-st'y brick back building, rear 141 Pratt St., s s, between Charles and Light Sts.

John Kearn, Jr., & Co., one-st'y brick foundry, 77′ x 81′, in rear of s w cor. Cross and Wicomico Sts.

L. W. Counselman, three-st'y brick building, w s Broadway, between McElderry and Jefferson Sts.

Calvary Baptist Church, stone church and two-st'y brick parsonage, n w cor. Howard St. and Park Ave.

D. D. Mallory, 2 two-st'y and mansard roof brick buildings, n w cor. Eutaw and Robert Sts.

Baltimore Sheep Butchers' Association, two-st'y brick stable, e s Pennsylvania Ave., between Robert and Laurens Sts.

James A. Wilson, four-st'y brick building, w s Eutaw St., between Lexington and Saratoga Sts.

The labor market report for the month of September remains the same as for August.

Boston.

STORES. — The old buildings at 18 and 20 Beacon St., formerly occupied by the Boston University, have been torn down and the foundation for a new building started. It will have a freestone front, six stories high, measures on the ground 41′ x 84′, and will be occupied as stores and offices; Mr. Wm. G. Preston, of Boston, is the architect; Leander Greely & J. P. Lovering are the contractors; cost, about $50,000.

BUILDING PERMITS. — *Brick.* — *Tremont St., No.* 1037, Ward 19, V. W. Rivinius, dwell. and store, 14′ x 20′, two-st'y flat.

Shawmut Ave., cor. Madison St., Ward 19, Nathan Cushing, trustee, tenement, 40′ x 74′, four-st'y flat; Robert R. Mayers.

Westland Ave., cor. Falmouth St., Ward 22, Albert D. Kilham, family hotel, 44′ x 91′ x 145′, five-st'y flat; C. P. Soule.

Wood. — *Shirley St.*, n w s, near George St., Ward 20, William Donaldson, dwell., 14′ x 16′ and 20′ x 28′, two-st'y pitch; Wm. Donaldson.

Mansfield St., Ward 25, Moses A. Rice, dwell., 14′ x 18′ and 26′ x 30′, two-st'y pitch; John McNamara.

Union Ave., near Green St., Ward 23, Maria Roan, dwell., 28′ x 34′ 9″, two-st'y pitch.

Chelsea St., No. 129, Ward 3, Patrick C. Neary, dwell. and store, 25′ 6″ x 30′, four-st'y flat; John Hayes.

Chelsea St., No. 127, cor. Tremont St., No. 911, Ward 3, Patrick C. Neary, dwell. and store, 25′ 6″ x 30′, four-st'y flat; John Hayes.

East First St., Nos. 384–390, Ward 14, H. A. Lewis, protection to kiln, 44′ x 44′, one-st'y pitch; H. A. Lewis.

Washington St., near Walk Hill St., Ward 23, John J. Murray, stable, 40′ x 50′, two-st'y pitch; Thomas Congley.

Dorchester Ave., cor. Jackson St., Ward 15, C. H. Daloh, dwell. and storage, 20′ and 47′ x 80′, two-st'y flat; Ira A. Medbury.

Centre St., near Lamartine St., Ward 23, George Pecker, dwell., 24′ x 30′, three-st'y flat; J. L. Dakin.

A St., near New Congress St., Ward 13, Boston Wharf Corporation, manufactory, 40′ x 100′, two-st'y flat; G. G. Older.

Fuller St., near Milton Ave., Ward 24, Horace W. French, dwell., 16′ x 14′ and 24′ x 29′, two-st'y pitch; Sam. Rantin.

Dudley Ave., cor. Washington St., Ward 23, James H. Atwood, dwell., 18′ x 19′, and 20′ and 23′ x 32′, two st'y pitch.

Grigg St., junction Allston St., Ward 25, Chas. H. Brown, dwell., 14′ x 23′ and 20′ x 32′, two-st'y pitch; H. M. Peavy.

Grigg St., junction Allston St., Ward 25, Chas. H. Brown, 20′ x 30′ and 14′ x 23′, two-st'y pitch; H. M. Peavy.

Allston St., junction Grigg St., Ward 25, C. H. Brown, dwell., 20′ x 30′ and 14′ x 23′, two-st'y pitch; H. M. Peavy.

Allston St., junction Grigg St., Ward 25, Chas. H. Brown, dwell., 20′ x 22′ and 14′ x 23′; H. M. Peavy.

Water St., No. 77, opposite Foss St., Ward 5, Hoosac Tunnel Dock & Elevator Company, storage freight, 72′ x 84′ and 80′ 6″ x 84′, one-st'y flat; H. W. Ball.

Brooklyn.

BUILDING PERMITS. — *Park Pl., Nos.* 22 *to* 32, s s, 100′ w Beaver St., 5 two-st'y frame flats, tin roofs; cost, each, $3,200; owner, Henry Minck, 43 Beaver St.; architect, T. Engelhardt.

Myrtle St., n e cor. Charles Pl., three-st'y brick store and tenement, tin roof; cost, $4,200; owner, John S. Hays; architect, T. Engelhardt.

Maujer St., n s, 275′ w Morgan Ave., two-st'y brick storehouse, gravel roof; cost, $8,000; owner and architect, Wm. Brookfield, 516 Madison Ave., New York City; builder, J. Bisom.

Clifton Pl., No. 227, three-st'y brick tenement, tin roof; cost, $5,000; owner and builder, D. Boyl, 225 Clinton Pl.; architect, M. J. Morrill; mason, not selected.

Broadway, No. 692, w s, 50′ n Lewis Ave., three-st'y frame store and dwell., tin roof; cost, $4,000; owner, Chas. Scholl, 28 Sumner Ave.; architect, T. Engelhardt; builder, J. Rueger.

Park Ave., Nos. 663 *to* 669, 100′ e Marcy Ave., 4 three-st'y frame double tenements, tin roofs; cost, each, $4,200; owner, Fred. Miller; architect, T. Engelhardt; builders, G. Lehrian & Sons.

Ninth Ave., e s, 213′ s Braxton St., three-st'y and attic brick dwell., mansard and tin roof; cost, $6,000; owner, Thomas L. O'Reilly, 5[illegible]5 Prospect Ave.; architect, C. Byrne; builders, M. Ryan and P. Murphy.

Rutledge St., s s, 100′ w Bedford Ave., 6 two-st'y brownstone front dwells., tin roofs; cost, each, $4,000; owner and builder, Richard Healey; architect, I. D. Reynolds.

Floyd St., n s, 236′ e Marcy Ave., two-st'y frame tenement, tin roof; cost, $3,500; owner, — Bayer, 195 Floyd St.; architect and builder, H. Loeffler.

Hopkins St., s e cor. Delmonico Pl., three-st'y frame double tenement, tin roof; cost, $4,000; owner, architect and builder, Henry Loeffler, 189 a, Stockton St.

Madison St., s s, 300′ e Tompkins Ave., 5 two-st'y brownstone front dwells., tin roofs; cost, each, $5,000; owner, architect and builder, Jas. A. Thompson, 300 Lexington Ave.

Leonard St., No. 43, w s, 180′ s Nassau Ave., three-st'y tenement, tin roof; cost, $3,200; owner, Evangelical Association, Greenpoint; architects, R. Van Lehn; builders, Bryden & Shiler.

Central Ave., No. 64, n s, 75′ n Melrose St., three-st'y frame store and tenement, tin roof; cost, $4,200; owner, Michael Rausch, 45½ Wilson St.; architect, T. Engelhardt; builders, W. Bayer and D. Kreuder.

Atlantic Ave., s s, 200′ e Rockaway Ave., 2 three-st'y frame dwells., gravel roofs; cost, $6,700; owner and builder, D. C. Davidson, 125 Sumner Ave.

Marcy Ave., Nos. 132 *to* 136, w s, 76′ n Heyward St., 4 two-st'y and basement brick dwells., tin roofs; cost, each, $5,000; owner and builder, Henry Grassman, 807 Willoughby Ave.; architect, T. Engelhardt.

Marcy Ave., n w cor. Hayward St., three-st'y brick store and dwell. tin roof; cost, $6,000; owner, etc., same as last.

Hancock St., n s, 475′ e Reid Ave., 5 two-st'y brownstone front gravel roofs; cost, each, $4,500; owner, D. B. Algie, 881 Tenth Ave., New York City; architect, J. E. Styles; builders, Algie & Son.

Third Pl., n s, 2[illegible]′ e Henry St., 4 two-st'y and basement brownstone front dwells., tin roofs; cost, each, $4,000; owner and builder, Alfred Williams, 39 Fourth Pl.; architect, W. H. Wirth; mason, W. Rountree.

Third Pl., n e cor. Henry St., three-st'y and basement brownstone front dwell., mansard roof slated, deck roof tinned; cost, $5,000; owner, etc., same as last.

John St., n s, 115′ e Jay St., six-st'y brick warehouse, gravel roof; cost, $40,000; owners, Chas. and John Arbuckle, foot of Adams St.; architect and builder, F. D. Norris.

Calyer St., s e cor. West St., three-st'y brick office-building, gravel roof; cost, $21,000; owner, T. F. Rowland, on premises; architect, R. B. Eastman; builder, T. Rutan.

Park Ave., No. 685, n s, 400′ e Marcy Ave., three-st'y frame store and double tenement, tin roof; cost, $4,000; owners and builders, Eich Bros., 762 Park Ave.; architect, T. Engelhardt; mason, J. Fuchs.

Court St., w s, 200′ n Degraw St., four-st'y brick tenement, tin roof; cost, $7,000; owner, H. W. Stearns, 292 Court St.; architect, T. H. Houghton.

ALTERATIONS. — *Harrison St.*, n w cor. Clinton St., two-st'y brick extension, tin roof; cost, $5,755; owner, John Byrne, on premises; architects and builders, M. Freeman's Sons; masons, Burnes & McCann.

Albany Ave., s e cor. Herkimer St., four-st'y and basement brick extension, tin and slate roof; cost, $13,000; owner, Church Charity Foundation, of Long Island, Albany Ave., cor. Atlantic Ave.; architect, M. J. Morrill; builders, J. Ashfield & Son and Martin & Lee.

Buffalo, N. Y.

Building Permits.—Five-st'y brick fire-proof building, brownstone and terra-cotta ornament, for Commercial and Advertiser, cor. Washington and North Division Sts.; cost, $75,000; architect, R. A. Waite.

Brick fire-proof building, for Board of Trade, cor. of Seneca and Pearl Sts.; cost, $120,000; architect, M. E. Beebe.

Five-st'y brick addition to the factory of Lielney, Shepard & Co., Clinton St.

Brick and stone house, for Mrs. E. F. Metcalfe, North St.; cost, $22,000; architects, McKim, Mead & White, New York, N. Y.

House for H. W. Gorton, Seventh St., brick, with brownstone; cost, $13,500; architect, James G. Cutler.

Repairs to the building of Messrs. Miller & Greener, cor. of North Division and Washington Sts.; cost, $28,000; M. E. Beebe, architect.

Chicago.

Houses. — Architect J. C. Lane has plans completed for 6 three-st'y dwells., with stores below, for Mr. A. S. Wood, on West Madison St., at cost of $35,000.

Furst & Rudolph are architects for the three-st'y dwell. and store on Desplanes St., for C. F. Bland, to cost $10,000.

Wm. Ruehl is the architect for the four-st'y dwell. and store to be built on Twelfth St., for Wm. Cahill, to cost $8,000.

W. L. Carl is architect for 2 two-st'y dwells., to be built on Oak Street for B. F. Norris, to cost $11,000.

Plans have been completed for William Strippleman, for two-st'y dwell. on South Robey St., for C. W. Spronk, to cost $7,000.

Flats. — Plans are ready by H. Gierks, architect, for 2 three-st'y flats and stores below, to be built cor. Wood St. and Chicago Ave., for C. Kiergel, to cost $15,000.

Stores. — Plans are completed by Furst & Rudolph for 2 four-st'y stores on Waldo St., for J. & H. Beidler; cost, $20,000.

Building Permits. — N. Dubach, two-st'y dwell., 2807 Fifth Ave.; cost, $4,000.

Samuel F. Hunt, two-st'y dwell., 925 West Polk St.; cost, $3,000.

Peter Klein, two-st'y dwell., 554 Larrabee St.; cost, $3,500.

C. Kiergel, 2 three-st'y and basement store and flats, Wood St., cor. Chicago Ave.; cost, $15,000; architect, H. Gierks; builder, Fred Hanson.

S. P. Parmly, 4 two-st'y and basement stores and dwells., 129-135 West Van Buren St.; cost, $10,000; architect, F. L. Charnly.

L. G. Fisher, 2 stores, Third Ave., cor. Van Buren St.; cost, $10,000; architect, F. L. Charnly.

Christ Reformed Episcopal Church, addition and tower, Twenty-fourth St., cor. Michigan Ave.; cost, $2[illegible],000.

J. H. Schnoor, two-st'y flats, 378 Dayton St.; cost, $3,500.

Wm. Cahill, four-st'y and basement store and dwell., 217 Twelfth St.; cost, $8,000; architect, Wm. Ruehl; builders, Krug & Demuth.

W. J. Anderson, 3 cottages, 17-21 Courtland St.; cost, $3,000.

N. M. Freer, 3 stores, 50-58 West Adams St.; cost, $6,000.

Grace Lutheran Church, church, Chicago Ave., cor. Franklin St.; cost, $12,000.

S. E. Gross, 10 cottages, cor. Honora and Thirty-ninth Sts.; cost, $11,000.

P. Humiston, 3 three-st'y and basement stores and dwells., 665 and 667 West Lake St.; cost, $12,000; architect, O. H. Placey.

M. G. Collson, three-st'y and basement store and dwell., 235 Western Ave.; cost, $6,000; architect, O. H. Placey; builders, Oliver & Hill.

C. F. Bland, three-st'y and basement dwell. and store, 245 South Desplanes St.; cost, $10,000; architects, Furst & Rudolph; builders, Mueller & Schul.

J. & H. Beidler, 2 four-st'y stores, 52-64 Waldo St.; cost, $20,000; architects, Furst & Rudolph; builders, Mueller & Schul.

Brunswick & Balke Co., lumber-dryer, 89 and 91 Huron St.; cost, $3,500; architects, Adler & Sullivan.

R. Slater, two-st'y dwell., 12 Eagle St.; cost, $3,500; architect, Wm. H. Drake; builders, N. P. Loberg & Co.

A. S. Wood, 6 three-st'y stores and dwells., 837-847 Madison St.; cost, $35,000; architect, J. C. Lane; builder, A. R. Shannon.

C. Gisecke, two-st'y and basement dwell., 519 and 521 West Erie St.; cost, $4,500.

James Krisek, two-st'y and basement dwell., 830 Allport Ave.; cost, $3,000; architect, Joseph Wittner; builder, Matt Holek.

James Hodan, two-st'y and basement dwell., 535 West Twentieth St.; cost, $4,000; architect, J. Widner; builder, Matt Holek.

Buchan & Gill, 2 two-st'y dwells., 702 West Chicago St.; cost, $10,000.

Albert Crane, 6 cottages, Emerald Ave., near Twenty-eighth St.; cost, $6,000.

L. S. Dobbins, 4 cottages, Low Ave., near Twenty-ninth St.; cost, $4,000.

Ferd. Wistardl, brick basement, 44 Hobbin St.; cost, $3,000.

J. Kauttoff, two-st'y store and dwell., 299 Lincoln St.; cost, $3,000.

Chicago Steel Works, foundry and machine-shop, Noble St., cor. North Ave.; cost, $6,500.

B. F. Morris, 2 two-st'y and attic dwells., 417 and 419 Oak St.; cost, $11,000; architect, W. L. Carl; builder, B. G. Robinson.

Turney & Bond, 6 cottages, Butler St.; cost, $6,000.

N. S. Davis, three-st'y addition, 291 Huron St.; cost, $4,000.

E. J. Loveland, two-st'y and basement dwell., 2835 Calumet Ave.; cost, $4,500; architects, Dixon & Townsend; builder, E. J. Loveland.

Jno. Mittel, two-st'y and basement dwell., 284 North Ave.; cost, $4,000.

C. W. Spronk, two-st'y and cellar dwell., 238 South Robey St.; cost, $7,000; architect, Wm. Strippleman; builders, Wilkie & Halman.

Reunion Presbyterian Church, two-st'y church, 615 and 617 South Ashland Ave.; cost, $10,000.

A. T. Ewing, 4 cottages, 614-624 Thirteenth St.; cost, $4,000.

Cincinnati.

Building Permits. — Henry Kister, brick chapel, s s Baum St., near Lock St.; cost, $15,000.

A. D. Bullock & Co., four-st'y brick building, Lick St., near Pike St.; cost, $4,500.

John Ryan, three-st'y brick building, Gilbert Ave.; cost, $4,500.

Posey & Hartman, two-st'y brick building, n e cor. Eighth St. and Depot St.; cost, $3,500.

S. Haffel, two-st'y brick building, Summit Ave.; cost, $3,500.

Wiltstach & Dalton, four-st'y brick building; cost, $10,000.

Chas. Boltzen, 2 two-st'y brick buildings, s w cor. Lingo and Langland Sts.

Jno. Lackman, three-st'y brick building, Colerain Pike; cost, $8,000.

Repairs; cost, $10,975.

New York.

Labor. — There continues to be trouble with the unions of the building trades. The "bosses" are beginning to get restive under the continued interference with their business, and it is probable that an amalgamated effort will soon be made by them to stop the annoyance.

Apartment-Houses. — For the Cary Estate, a five-st'y apartment-house, 40′ x 40′, brick, stone and iron, is to be built from designs of Mr. Hugo Kafka, at Nos. 63 and 65 Vesey St.

For Mr. George Miller, a five-st'y brownstone apartment-house, 25′ x 85′, is to be built on the north side of Eighty-eighth St., between Friend and Third Aves., from designs of Mr. John Brandt, at a cost of about $20,000.

Building Permits. — *Greenwich St., Nos.* 430, 432, 434 *and* 436, seven-st'y brick factory, tin roof; cost, $50,000; owner, James Pyle, 215 West Forty-fifth St.; architect, Thos. R. Jackson.

One Hundred and Forty-seventh St., s w cor. Willis Ave., 2 three-st'y frame tenements, tin roofs; cost, $3,000 and $6,000; owner, Gepke Shulte, 11 First Ave.; architect, Adolph Pfeiffer; builder, not selected.

Seventy-first St., n s, 20′ w Ninth Ave., 5 three-st'y brownstone front dwells., tin roofs; cost, $12,600; owner, John M. Ruck, 910 Ninth Ave.; architects, Thom & Wilson.

Seventy-second St., s s, 100′ e Tenth Ave., 5 four-st'y brownstone front dwells.; cost, total, $130,000; owner, Geo. J. Hamilton, 2078 Fifth Ave.; architects, Thom & Wilson.

Suburban St., s s, 80′ w Decatur Ave., 5 two-st'y frame dwells., shingle roofs; cost, $2,700; owner, Chas. R. Hadden.

West Broadway, s w cor. York St., four-st'y brick store, fire-proof roof; owner, M. B. Baer, 72 West Thirty-fourth St.; architect, Jos. M. Dunn; builders, F. & W. E. Bloodgood and Wm. Arnold.

Ogden Ave., w s, 175′ s Union St., three-st'y frame tenement, tin roof, cost, $5,000; owner, E. Ketchum, Jerome Ave., near One Hundred and Sixty-fifth St.; architect, J. B. Jennings; builders, W. J. Hargrave and A. McNally.

Courtland Ave., w s, 27′ n One Hundred and Forty-ninth St., three-st'y dwell., tin roof; cost, $4,500; owner, Adam Janson, 635 One Hundred and Fifty-third St.; builders, Handwerker & Wagner and Janson & Jaeger.

West St., No. 494, four-st'y brick tenement and store, metal roof; cost, $8,000; lessee, P. Malone, 368 West Twenty-third St.; architect, And. Craig; builders, Drummond & Jones.

Ninth Ave., n w cor. Seventy-first St., four-st'y brownstone front flat and store, tin roof; cost, $20,000; owner, John M. Ruck, 910 Ninth Ave.; architects, Thom & Wilson.

Ninth Ave., w s, 60′ 2″ n Seventy-first St., 2 four-st'y brownstone front dwells., tin roofs; cost, $10,000; owner and architects, same as last.

West One Hundred and Nineteenth St., No. 454, four-st'y brick tenement, tin roof; cost, $12,250; owner, Mary Martin, 126 West Fiftieth St.; architects, Bettinger & Lange; builders, Dawson & Archer and W. H. Glover.

Fifty-first St., n s, 100′ w First Ave., 2 five-st'y brownstone front tenements, tin roofs; cost, $18,000; owner, John S. Johnston, 14 East One Hundred and Twenty-ninth St.; architect, John Brandt.

One Hundred and Twenty-ninth St., n s, 110′ e Madison Ave., five-st'y brownstone front tenement, tin roof; cost, $18,000; owner, Wm. Hughes, 52 East One Hundred and Thirtieth St.; architect, John McIntyre; masons, Shannon & Stewart.

East One Hundred and Fourteenth St., No. 124, four-st'y brick tenement, tin roof; cost, $15,000; owner, John Lalor, East One Hundred and Twelfth St.; architect, A. Spence.

Third Ave., n w cor. One Hundred and Fifty-fourth St., three-st'y frame tenement and store, on n s, and s s, tin roof; cost, $4,500; owner, Henry Gerken, Third Ave. and One Hundred and Fifty-third St.; architect, S. Baker; builders, Eheman and Wm. Kusche.

Alterations. — *West Thirty-seventh St., No.* 407, two-st'y brick extension; cost, $5,000; owner, Westing & Hofers, 403 West Thirty-seventh St.; architects, Lederle & Co.; builders, Fepler & Wolforth.

Grand St., No. 263, two-st'y brick extension, tin roof; cost, $3,000; owner, J. T. Maguire, on premises; architect, Jos. M. Dunn; builder, not selected.

Fifth Ave., Nos. 220 *and* 222, internal alterations; cost, $4,000; lessee, Wood Gibson, 1 West Forty-fifth St.; builders, N. & H. Andrews and A. C. Hoe & Co.

Clinton Pl., No. 44, rear, two-st'y brick extension; cost, $3,000; owner, Edward N. Tailor, 11 North Washington St.; architect, Richard Berger; builders, E. D. Connolly & Son and Henry D. Powers.

West Fifty-seventh St., Nos. 518 *and* 520, internal alterations; cost, $3,000; owner, Conrad Stein, 521 West Fifty-seventh St.; architect, J. Kastner.

East Fifty-seventh St., No. 441, one-st'y brick extension and bay window on rear; cost, $4,000; owner, Peter Doelger, 405 East Fifty-fifth St.; architect, J. Kastner.

Courtlandt St., No. 16, change dormer windows on top story; cost, $6,000; owner, Delaware & Hudson Canal Company, on premises; architect, E. Raht; builders, David Campbell and Cheney & Hewlett.

Fifth Ave., No. 133, new store fronts on Fifth Ave. and on Twentieth St.; cost, $4,000; lessee, Alex J. Roux, 39 West Twelfth St.; architect, E. Raht; builders, Cheney & Hewlett.

East Seventieth St., No. 207, three-st'y brick extension, tin roof; cost, $6,000; owners, Little Sisters of the Poor, S. Blanche de St. Maria, President, 207 East Seventieth St.; architect, John McIntyre; builder, Terence Kiernan.

Philadelphia.

Building Permits. — *Germantown Ave.*, opposite Rex Ave., two-st'y dwell., 28′ x 40′; Geo. S. Roth, contractor.

Little Medina St., No. 726, two-st'y dwell., 14′ x 28′; W. K. Hallowell, Jr.

Tacony Road, s Fraley St., three-st'y dwell., 17′ x 46′; Chas. Bosser, contractor.

Twenty-first St., n e cor. Johnson St., three-st'y dwell., 17′ x 47′; S. P. Johnson, contractor.

Nineteenth St., n Willow St., three-st'y foundry, 20′ x 74′; W. C. McPherson, contractor.

Christian St., Nos. 2629 *and* 2631, 3 two-st'y dwells., 16′ x 43′; Pat. Riley, owner.

Thirteenth St., cor. Lombard St., four-st'y brick building, 18′ x 27′; W. P. Fogg, contractor.

North Front St., No. 9, storehouse, 16′ x 30′; and on *Venango St.*, e Third St., freezing and press house, 17′ x 61′; Quaker City Oil Co., Limited.

Fifteenth St., cor. Cathedral Ave., 2 two-st'y dwells., 16′ x 45′; Geo. Matlack, contractor.

Germantown Ave., w Southampton Ave., two-st'y dwell., 20′ x 44′; and on *Orthodox St.*, w Mulberry St., three-st'y dwell., 18′ x 32′; Poucher & Shoch, contractors.

L St., n w cor. Venango St., two-st'y store and dwell., 20′ x 33′; Daniel Regester.

Lattimer St., No. 1527, two-st'y coach-house, 30′ x 32′; Jas. Howard & Co., contractors.

Moyamensing Ave., n e cor. Moore St., three-st'y dwell., 18′ x 58′; O. H. Hoffman, owner.

Rear of Bowman St., w Queen St., 4 two-st'y dwells., 16′ x 46′; Alfred Taylor, contractor.

Drinker's Alley, e Second St., addition to foundry, 44′ x 47′; Keister & Orem, contractors.

Germantown Ave., cor. Montgomery Ave., three-st'y hotel, 20′ x 83′; E. Schmidt, contractor.

Parker's Ave., e Ridge Ave., three-st'y dwell., 14′ x 28′; E. C. Parker, owner.

Forty-eighth St., cor. Chester Ave., three-st'y dwell., 27′ x 49′; Jas. D. Arthur, contractor.

Spruce St., No. 1823, four-st'y brick building, 14′ x 56′; Geo. McNichol, contractor.

Westwood St., bet. Thirty-second and Keifer Sts., 2 three-st'y dwells., 15′ x 44′; Wendell Smith.

Amber St., cor. Somerset St., three-st'y dwell., 18′ x 56′; Jas. McCartney, contractor.

Hancock St., Nos. 5051 *and* 5053, 2 three-st'y dwells., 18′ x 42′; T. W. Wright & Son.

South Fifteenth St., No. 1211, three-st'y dwell., 17′ x 56′; Jno. O'Donnell, contractor.

Midvale Ave., bet. Reading Railroad and Hunting Park Ave., Nicetown, 16 two-st'y dwells., 14′ x 30′; G. W. Blabon, owner.

Mount Pleasant St., w Germantown Ave., two-st'y dwell., 16′ x 32′; Octavia Gavett, owner.

Charlotta St., No. 829, three-st'y dwell., 16′ x 24′; L. Schwab, contractor.

Sixteenth St., s w cor. Market St., two-st'y dwell., 30′ x 40′; Harry Pettit, contractor.

Alder St., n Norris St., three-st'y foundry, 50′ x 75′; Michael Smith, contractor.

Queen St., e Thirty-sixth St. (Falls Schuylkill), 9 three-st'y dwells., 14′ x 42′; Keeley & Brownback, owners.

Seventh St., n e cor. Callowhill St., two-st'y chemical building, 80′ x 81′; R. C. Ballenger, contractor.

Twenty-eighth St., cor. Ingram St., 2 two-st'y dwells., 17′ x 30′; John Gregan, owner.

Mount Pleasant Ave., bet. Gresham St. and Germantown Ave., three-st'y dwell., 18′ x 42′; Martin Hetzel, contractor.

Washington Ave., above Eleventh St., two-st'y addition to factory, 41′ x 54′; Hall & Garrison, owners.

Richmond St., No. 1932, three-st'y store and dwell., 17′ x 52′; A. McClay, contractor.

Tioga St., e Richmond St., two-st'y factory, 40′ x 100′; F. W. Stapler, President.

Spruce St., No. 2411, three-st'y dwell., 17′ x 40′; Townsend Yearsley, owner.

Church St., w Webster St., two-st'y dwell., 16′ x 32′; Henry Rowley, owner.

Fifth St., s Somerset St., 3 two-st'y dwells., 16′ x 41′; H. Brocklehurst.

Pharo St., No. 759, two-st'y dwell., 16′ x 28′; Elenor McCauley, owner.

Madison St., s s, bet. the state road and Wissanoming St., 2 three-st'y dwells., 16′ x 42′; Frank Miller, contractor.

South Seventh St., Nos. 520, 522 *and* 524, 2 three-st'y stores and dwells., and two-st'y shop, 16′ x 32′; F. J. Ward, contractor.

Turner St., n s, and w s of Twenty-fifth St., 12 three-st'y dwells., 14′ x 44′; J. L. Carre, owner.

Garnet St., e s, s Somerset St., 3 two-st'y dwells., 12′ x 44′; J. Cairns, contractor.

Emerald St., cor. Willard St., 10 two-st'y dwells., 16′ x 43′ and 14′ x 41′; J. R. Pyle, owner.

Butler St., s s, bet. Fifth and Sixth Sts., 10 two-st'y dwells., 16′ x 38′; Thos. F. Middleton.

Mervine St., e s, n Oxford St., two-st'y brewery building; Chas. Wolters.

St. Louis.

Building Permits. — Sixty-eight permits have been issued since our last report, twenty-two of which are for unimportant frame houses. Of the rest, those worth $2,500 and over are as follows: —

A. M. McChesney, two-st'y brick dwell.; cost, $5,000; T. Renick, architect; Chas. Gerhardt, contractor.

Klausman Brewery Co., three-st'y brick malt-house; cost, $20,000; E. Janssen, architect; contract sub-let.

W. N. Graves, two-st'y brick dwell.; cost, $7,00 ; E. Mortimer, architect; Chas. Wehking, contractor.