BUILDING DOWNWARD.

The Difficult Engineering Problem Solved by Col. Casey.

HOW A NEW FOUNDATION WAS BUILT UNDERNEATH THE SHAFT—THE INGENIOUS PLAN ADOPTED—ALL DOUBTS OF THE STABILITY OF THE STRUCTURE REMOVED BY COL. CASEY'S SKILL.

When Congress, in 1876, under the influence of the pariotic inspiration of the centennial year, made an appropriation for carrying on the long delayed work upon the Washington national monument there appeared, to the ordinary observer at least, nothing remaining to be done but to quarry the stone and continue building skyward from the point where the masons had stopped work twenty years before. Doubts, however, existed, in the minds of engineers as to the stability of the structure, and provision was made for an examination to ascertain whether the foundation was sufficient to sustain the weight of the completed structure. At the request of the monument commission, the Secretary of War detailed Lieut. Cols. Kurtz, Duane and Gilmore as a board of engineer officers to make the necessary examination. These officers reported that the foundation was insufficient, and it would be inadvisable to proceed with the work of construction until it was properly strengthened. The suspension of the work, in 1856, may, in the light of the representations of these officers, be considered providential. If money had flowed into the treasury of the Monument society, and the work had been prosecuted steadily, it appears not only probable, but almost certain, from the calculations made by the engineers, that the structure would have crushed in its foundations and been wrecked. So instead of building skyward it was apparent to the engineers that the first step to be taken was to build downward.

THE OLD FOUNDATION

was 80 feet square at its base or bed, which was 7 feet 8 inches below the general level of the ground about the structure. This foundation was 23 feet 4 inches in thickness and was carried up from bottom to top in eight offsets or steps of about 3 feet rise each, the upper course being 58 feet 6 inches square. It was built of large pieces of bluestone gneiss, put in the masonry as they came from the quarry, the interstices between the masses being filled with spawls and a mortar composed largely of fat lime and sand. No cement was used in the construction of the foundation, and no attempt seems to have been made to give parallel beds and builds to the pieces of stone used. The stones were laid as compactly as possible with the shape they had as they came from the quarry, large and small being packed in indiscriminately. A well-hole 2 feet square passed down through the center of this foundation, but did not, when the work was resumed, extend below the bottom of the foundation, though it had at some time probably been deeper. The weight of the shaft was found by measurement to be 23,794 tons, the weight of the foundation 8,139 tons and the weight of earth on the foundation 243 tons, making a total weight of 32,176, distributed over a foundation bed 6,400 square feet in area, giving a pressure upon each square foot of soil under the foundation of 5.027 tons of 2,240 pounds.

COL. CASEY'S CALCULATIONS.

When Col. Casey took charge of the work at the monument the plan which was eventually adopted had not been decided upon. It was then expected that the obelisk would be carried only to the height of 525 feet. In his first report to the joint commission for the completion of the monument, he said:

"Should the obelisk be carried to the height of 525 feet and the earth filled upon the foundation to the level of the bottom of the shaft, the pressure upon the bed of the foundation would be as follows:

Weight of shaft	43,421 tons.
Weight of foundation	8,139 "
Weight of roof and stairs	250 "
Weight of earth on foundation	2,283 "
Total	54,093

or 8.452 tons per square foot of area of bed of foundation. Supposing the shaft to be acted upon by a wind-pressure of 55 pounds to the square foot the pressure along the outer edges of the bed of the foundation would be increased to 9.941 tons per square foot. There are far greater pressures per square foot than the kind of material pressed has been know to sustain, and it is not believed that the monument could be carried to the desired height upon a foundation of no greater spread than that possessed by the present one."

THE PROBLEM GIVEN TO COL. CASEY.

After the board of engineers had made its report, Lieut. Col. Casey was on June 25, 1878, directed to report to the joint commission, and since that date has had charge of the work at the monument. The task before Col. Casey was one that might well have appalled the stoutest hearted engineer. Practically a new foundation had to be built under a huge stone structure 156 feet high and weighing 32,000 tons. The structure had to be undermined and the earth upon which it rested replaced to a considerable extent with substantial masonry. Members of the Senate committee on public buildings and grounds expressed doubts as to the possibility of accomplishing this feat, and some of them even apprehended that the whole structure would tumble over. Congress authorized the expenditure of $36,000 upon the work of strengthening the monument, as that was the sum asked to carry out a plan which some person had presented to Congress, contemplating the building of a series of horizontal arches. Col. Casey's first work was to make careful measurements and calculations, so as to determine what was needed. He experimented to see how much more weight could safely be added to the structure as it then existed, and came to the conclusion, on account of the nature of the foundation and the character of the soil, that not a stone more could be imposed upon it. The board of engineer officers who had previously examined the monument concluded that the structure had settled some. The first builders of the monument had used a bench mark, which the engineers assumed to be the stone near the monument, known as the Meridian stone. Measurements made from that showed that the structure had settled. Members of the Monument society, however, contended that that was not the right stone. As the old records were lost, the point could not be definitely decided. When Col. Casey assumed charge of the work all the plans for strengthening the foundation were referred to him. The several methods suggested for securing the foundation are comprised under two general classes, one proposing to hoop in the earth beneath the foundation, so as to prevent the lateral displacement under the additional load to be brought upon the bed of the foundation; the other to underpin and extend the surface of the base of the foundation so as to distribute the load over a greater area within the limits of resistance of the soil to be pressed.

THE PLAN ADOPTED.

Col. Casey after carefully examining all the plans proposed rejected all. He began work at once upon a new plan, and in less than a month had worked out all the details. His plan fell in the second of the two classes named, contemplating the extension of the foundation so as to widen the area of pressure or the bearings of the structure. The work upon the foundation, commenced in 1878, was pushed to a successful completion in May, 1880, at a net cost of $99,973. Though Congress had at first authorized the expenditue of $36,000 upon this work, Col. Casey's plans, involving a larger expenditure, were subsequently approved.

HOW THE WORK WAS DONE.

Briefly, it may be said, that the foundation was deepened 13 feet 6 inches, and extended in all directions 23 feet 3 inches. Seventy per centum of the earth under the old foundation was dug away and replaced with a mass of concrete extending 18 feet within and 23 feet 3 inches without the line of the outer edges of the old foundation. This mass of concrete extended 5 feet under the outer face of the shaft at its lowest joint, where it rests upon the foundation. This gave a new foundation 126 feet 6 inches square, and enlarged the area of the foundation from 6,400 square feet to 16,000 square feet. To distribute the pressure of the shaft over the new foundation, the old rubble-stone base was torn from under the walls of the shaft and replaced by a concrete underpinning extending out upon the new concrete slab. In doing this 51 per cent of the cubical contents of the old stone foundation was removed and 48 per cent of the area of the shaft undermined. The foundation as completed extends 36 feet 10 inches below the shaft and 6 inches below the permanent level of water at the site of the monument. The weight of the completed structure is as follows:

Weight of foundation and earth upon it	36,912 tons.
Weight of 150 feet of old portion of the shaft	22,373 tons.
Weight of new portion of shaft	21,260 tons.
Weight of pyramidion	300 tons.
Weight of iron frame	275 tons.
Total weight	81,120 tons.

It is calculated that the pressure upon the bed of the foundation nowhere exceeds nine tons per square foot, and is less than three tons per square foot near the outer edges of the foundation. The shaft, as proportioned, both in dimensions and weight, is entirely stable, as against winds that would exert a pressure of one hundred pounds or more per square foot upon any face of the structure.

THE HOLE THROUGH THE MILLSTONE.

The work accomplished in securing the foundation seems entirely practicable now, but at the time it was commenced many people regarded it as a foolhardy undertaking. No one doubted but that if such a foundation as was proposed could be sunk under the shaft that the structure would be rendered stable. The problem was how to get it under the shaft. The plan adopted by Col. Casey, and successfully carried out, was to introduce the masonry in three vertical layers about four feet in width, having first tunneled under the structure with drifts of the same width and of the required height and length. These layers were connected with each other by dowel stones set in their faces as the work progressed, and with panel depressions in the alternate layers, into which the intermediate layers were molded. The material used in these layers was strong Portland cement concrete, except for a short distance just under the old foundation, where rubble masonry was forced in and wedged up under the stones of the old structure. The tunnels described were excavated in pairs on opposite sides of the monument, in such a way that the strain was equalized. During the course of the work the monument sunk a little, but owing to the precautions taken, it practically settled squarely or evenly all around, so as not to displace the axis or disturb the equilibrium of the structure. Each of these pairs of tunnels was filled with cement before the next pair was excavated, and thus the work was continued until all the earth within the dimensions given had been tunneled out and replaced with concrete. To lock the old foundation in with the new, and distribute the pressure more uniformly over the new mass, three large buttressss on each side of the structure—twelve in all—were carried from the upper surface of the new foundation up to and under the outer portions of the shaft; while to sustain the central portion of the old foundation a leg of concrete was projected under the middle of it, the well in the center being used as a means of access to the portion to be excavated and filled.

ALL DOUBTS REMOVED.

When the work was nearly completed in April, 1880, a committee of the National Monument Association in a memorial to Congress upon the subject, enclosing a succinct statement by Col. Casey of the condition of the work, said:

"That statement warrants the assertion that all reasonable or unreasonable doubts as to the security of the foundation have now been removed; and there is abundant testimony from the highest scientific sources that by a most ingenious and skillful process, which has been carried on by authority of Congress, the base of the monument has been rendered capable of sustaining as great a weight as it has ever been proposed to place upon it, and that the shaft, when carried up to its contemplated height, will be able to withstand the force of a wind of double the velocity of any which could reasonably be the subject of calculation or conjecture." On the 29th of May following the enlarged foundation was pronounced to be finished. The entire work had been accomplished without causing the slightest crack or the least opening in any joint of the structure. The joint commission in a communication to Congress formally complimented Col. Casey and Capt. Davis, his assistant, and said: "The manner in which the work has been conducted gives evidence of their high scientific knowledge and faithful performance of duty."

THE SETTLEMENT OF THE SHAFT.

During the progress of the work of introducing the new foundation the several corners of the shaft settled as follows: Southwest, 2 inches; southeast, 2.34 inches; northeast, 2.23 inches; northwest, 1.90 inches. The total settlement of each corner since the work was resumed to the present date is for the southwest, 4.02 inches; southeast, 4.36 inches; northeast, 4.26 inches, and northwest, 3.98 inches. The greatest difference, nearly half an inch, occurred during the introduction of the foundation. When Col. Casey made his first measurements before beginning work it was found that the shaft was slightly "out of plumb." Its axis leaned 1⅜ inches to the northward. The difference noted in the settlement of the four corners aided materially in correcting this slight deviation of the shaft from the perpendicular. The top of the uncompleted shaft, when the work of laying stone was begun, was found to be not exactly square, there being a difference of nearly two inches between the length of the south side and that of the north side. After the work was commenced this difference was gradually corrected from course to course until within the first fifty feet of new work it had entirely disappeared. This makes a slight departure from straight lines in the form of the shaft, which, it is claimed, can be detected by the eye when the atmosphere is very clear.

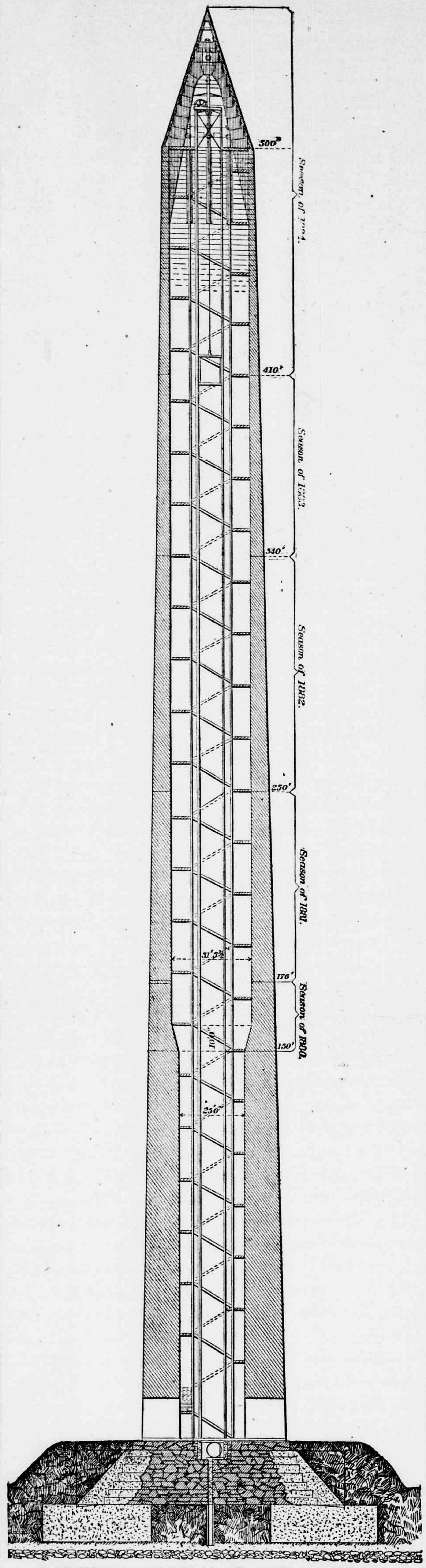
THE MONUMENT AND THE LAKE.

In his recent report to the monument commission, Col. Casey says: "It has been observed during the construction of this work that when any motion took place in the structure due to addition of weight, the two north corners of the monument were the first to settle. This is believed to be due to the falling away of the earth on the north side of the structure, thus reducing the conjugate pressures on that side, and to the proximity of the pond just north of the terrace, in the south margin of which are numerous springs. As the bottom of the foundation of the monument is only some two feet above mean high water in the Potomac, and the bed upon which the foundation rests is below the level of water in the ground at the site, there may be some connection between these waters and those of the pond and springs referred to. In the interest of increased stability of the monument, and for the better arrangement of the terrace slopes and grades, it is recommended that the pond just north of the obelisk be filled to the level of its banks, requiring for the purpose about 83,000 cubic yards of earth."

BUILDING SKYWARD.

How the Huge Stones were Set in the Shaft—The Ingenious Method of Constructing the Marble Roof—Some of the Details of the Work.

The shaft of the monument is 500 feet 5⅛ inches high, slightly over nine times the base, which is 55 feet 1½ inches square. The top is 34 feet 5⅛ inches square, being ⅝ of the width of the base. The shaft, if continued in this proportion, would come to a point at 2⅔ times its present height. The construction of this immense shaft was naturally slow, as the greatest care and precision were necessary in the cutting and setting of the stones. The shaft, after the resumption of the work in 1880, grew at the rate of twenty feet at a jump. That is, the iron framework for the building was built twenty feet above the completed portion of the shaft and around this the stones were set until they reached its top. Work was then suspended until the framework could be erected again above the completed portion, and the same operation was repeated. This change was called a shift, and each course of stones, which was two feet high, could be set in a day if everything was favorable. Procuring the material in sufficient quantities and cutting it properly after its receipt formed the great part of the work. The setting of the stones could be accomplished rapidly when everything was in readiness. The thickness of the walls at the bottom is fifteen feet, and at the top only eighteen inches. The facing of the walls is pure white marble, while the interior backing, up to a height of 150 feet, the old portion, is rubble masonry. Above that point, to a height of 452 feet, it is of dressed granite from New England quarries, and from there to the top the walls consist of white marble entirely, the interior backing being dispensed with. The blocks are two feet high, and the headers and stretchers alternate. The interior well of the shaft is 25 feet square at the bottom, but enlarges 31 feet 6 inches square at the top. In the walls of the lower part of this well are many of the memorial stones which were inserted in the earlier days of the work. The memorial stones which are on hand will be properly cut down in very thin slabs and also inserted in or attached to these walls. Around this well runs a strong iron stairway, and in the center runs a powerful steam elevator of ten tons capacity, supported by a construction of eight vertical iron columns. At a height of 470 feet the twelve marble ribs which form the support of the roof spring from the walls of the well. They are carried upward until those nearest the angles of the shaft meet in the hips of the pyramidion, while those in the center of each face are connected still higher, forming two arches, intersecting each other at right angles. The keystone of the center ribs is at a height of 529 feet. The pyramidion or roof which is thus firmly supported is composed of marble slabs only seven inches in thickness, resting upon spurs or projections upon the marble ribs. The vertical height of the roof is 55 feet, making the height of the monument 555 feet 5⅛ inches, and the weight of the roof is 300 tons. The capstone in which it terminates weighs 3,300 pounds, and is crowned by a tip or pyramid of pure aluminium. The character of this roof and the method of constructing it exhibit much ingenuity. There is nothing similar in any buildiug ever constructed. A roof of some other material than marble could have been built with much less designing, labor and expense, but it was particularly desirable to have the face of the monument of the same material from bottom to top. In this way any change of the weather will have the same effect on all parts of it. The eight windows which look out upon the surrounding country just above the 500-foot level can be closed when not in use by very thin marble shutters, which fit with wonderful exactness, and when closed make the entire face of the monument one unbroken harmony of white marble. To prevent the outer face of these white shutters from being soiled when they are swung back, a very clever device in the shape of a guiding arm causes each one to revolve as it swings back so that when not in place on the monument the outer face lies against a rib, and can never be soiled by the vandal visitor who delights in writing his name in public places!



SECTIONAL DIAGRAM OF THE MONUMENT,
SHOWING METHOD OF CONSTRUCTING THE NEW FOUNDATION.

THE DANGER FROM THE LAKE.

Why Col. Casey Wants the Carp Pond Filled Up.

THE SLIGHT MOVEMENTS OF THE STRUCTURE ALWAYS NOTICEABLE ON THE NORTH SIDE—THE ENGINEER'S VIEWS AS TO THE IMPROVEMENT OF THE BASE, &C.

"Is it necessary to fill up Babcock lake immediately to insure the stability of the Washington monument?" asked a STAR reporter of Col. Casey the other day.

"I disposed of that subject in my last report," said the colonel, with a weary air, as if he had said and heard enough about the monument.

"I want to tell the readers of THE STAR a little more about it," urged the reporter. "All of them are interested in both the lake and the monument."

"Well," said the colonel, resignedly, "in my opinion the lake should be filled as a precautionary measure, but it makes no difference to me whether it is filled or not. My work is finished, and I have expressed my opinion. If it were filled, however, not a thing would be left undone for the monument's protection. Then we could trust in Providence to protect it from earthquakes, for nothing else could topple it over. I don't mean to say that the existence of the lake endangers the stability of the monument, for both might remain for ages; at the same time it undoubtedly should be done away with for precautionary reasons. The monument belongs to the government, and it can do as it pleases, of course. The pond is valuable for carp breeding and for a skating ground, and if these reasons outweigh the others, well and good."

THE DANGER FROM THE LAKE.

"Now, I'll tell you," continued the colonel, "why I think the existence of the lake may endanger the stability of the monument. All along during the construction of the latter it was observed that when any motion in the structure took place, due to the addition of weight, the two north corners were the first to settle. Why should they settle first invariably and then the others follow? Simply because the congregate pressures on that side were reduced by the falling away of the earth. The foundation of the monument has been strengthened and well strengthened, and is now able to support the weight of the monument, and that is all. The foundation is built right in a marsh. The water stands several inches above the bottom of that foundation, and the earth upon which it stands is the finest sand imaginable—as fine as any ever used on writing paper. Imagine the pressure upon the stratum of earth on which the foundation rests with the same dimensions as that foundation. It is something enormous. Now, what prevents that section or stratum from spreading out under this weight and allowing the structure to settle? Simply the weight of the earth which is contained above a line drawn from that stratum to the surface at the angle at which the earth naturally falls, the angel depending upon the character of the earth. If it were rock it would stand perpendicular. You can catch the idea by recalling the formation of a railroad cut. The earth on the sides of the cut will roll down until it reaches the natural angle. Very well, then. If the weight of this earth is unequal the stratum is liable to be squashed out, as it were, in the direction of the least weight. That is exactly the case if the lake is allowed to remain. It has the effect of lessening the pressure on that side. The angle which I referred to would bring the line, if drawn to the surface, through part of the lake, showing an unequality of pressure, because the earth would be removed to form that part of the lake. Besides, I have always noticed when the water is drawn off that there are a number of springs bubbling forth from the monument side. What is to prevent these springs, which have their origin in the vicinity of the monument, from gradually drawing away, as they find an outlet in the lake, the fine sand from beneath the monument and allowing the structure to settle. These two closely allied reasons led me to recommend that the lake be filled. I haven't an idea that the monument will fall. If it does fall, and from natural causes, it will not take a sudden tumble, but will be

YEARS IN TOPPLING OVER.

There will have to be some gradual undermining, similar to the possibilities I suggested. If these possibilities are done away with there is no reason for alarm."

"How much has the monument settted?" asked the reporter.

"Only about four inches," was the reply, "and the settlement has been equal all round. We have kept a record of the daily movement or settlement of each corner since the foundation was strengthened. As I said, the north corners have always started first, and the others followed. The measurements are inconceivably small. The standard is one-thousandth of a foot—less than the width of a horse hair. By this measurement we have watched the movement of the monument. The standard is inconceivably small and the movement imperceptible. The greatest settlement recorded is about seven-thousandths of a foot, in 1879. It sounds much larger than it is. Of late years the settlement has been much less. For the past sixteen or seventeen days the monument has not moved, although we have watched it to the thousandth part of a foot. The weight is over 80,000 tons, and the structure contains enough stones to cover the whole of the White lot, if spread upon the ground. It stands firm, and all that I care about is to see everything possible done to keep it firm."

THE BASE OF THE SHAFT.

"How about the improvement of the base?" asked the reporter.

"I don't know anything about it," was the reply. "The whole matter is in the hands of Congress. The construction of the monument was in no department of the government. It came within the sole jurisdiction of Congress. So much was it considered outside the departments that it was with the greatest difficulty that I secured a penalty clause on the office envelopes. The Post Office department would not put it on, and the only way I got it there was to put it on myself without authority. I have told Congress that it will cost about $612,000 to improve the base with a marble wall, while the cost for an earth terrace will only be about $167,000. In my opinion, the latter is the more desirable in every respect. A pretty irregular slope, leading gradually up to the monument, would be much more effective."

"But then my work is done" said the colonel, leaning back in his office chair, "and I am glad of it. No one knows how anxious I was to complete the structure in time for dedication this month. And yet, last summer even, there was no certainty that it would be done. The delay in delivering material scared us for a while, and then the laborers soldiered like everything. It would take them almost twice as long to cut a stone as necessary. I couldn't help it. If I put on the airs of a martinet a strike might follow. In fact there were one or two embryo strikes. I had to give in right and left, and be as easy and good natured as possible. It would have been dangerous to do otherwise. All serious hitches were fortunately avoided, but then there were innumerable dangers. The breaking of a hook or the ruin of a stone might have delayed the work for another season. But it's all over," with a sigh of relief. "If that monument, though, were my private property I'd have Babcock lake filled up."

THE BEGINNING AND THE END.

Two Notable Days in the History of the Monument.

HOW THE CORNER-STONE WAS LAID—AN IMPOSING DISPLAY IN 1848—THE SETTING OF THE TIP-TOP STONE LAST DECEMBER.

When the Monument society had raised funds enough to warrant them in beginning work on the monument they concluded that it was appropriate to have the corner-stone of the monument laid on Independence Day, the anniversary of the day when the corner-stone of the republic was laid. Consequently, on the 4th of July, 1848, the first stone of the monument was laid with imposing ceremonies and a great display. "Since the inauguration and the funeral of Harrison," said a local chronicler of that day, "our streets and public avenues have never been so thronged with people, and never was the day signalized in this capital of the nation as it has been on this occasion." It is estimated that 20,000 people attended the ceremonies. Among the guests on the stand were Mrs. Alexander Hamilton, then ninety-one years old; George Washington Park Custis, Mrs. Dolly Paine Madison, Mrs. John Quincy Adams, Chief Justice Taney, Lewis Cass, Mr. Van Buren, and Millard Fillmore. Not the least prominent in the assembly was a live eagle, twenty-five years old, which twenty-four years before had appeared in the pageant to celebrate the arrival of Lafayette. The address was delivered by Speaker Winthrop. B. B. French, then the grand master of Masons, in laying the corner-stone, used the Masonic gavel of Washington.

THE SCENE ON THE MALL.

A writer in the *National Intellegencer* thus described the scene preceding the ceremony at the foundation of the monument: "The finest portion of the show, however, was yet in reserve. It was on the mall, which presented one of the most beautiful subjects for the pencil which the painter could desire. The surface of the mall is undulating, and the whole of it covered with green sod, now fresh from the recent rains. The heights were occupied by groups of carriages of every description, by booths with refreshments and by the various erections constructed for the display of fireworks. As the space was ample, the crowds that had been confined to the streets here burst abroad, and spread and scattered themselves in all directions. From space to space arms were stacked—guarded—while all along the grassy slopes ladies and gentlemen, citizens and soldiers, on foot, on horseback, singly and in little squads, strayed about in the cool breeze and bright sun, seeming to enjoy their existence. Further down was the seat of action. Here, in a hollow, spread with boards and surrounded with seats, a crowd began to gather to witness the ceremonies of laying the corner-stone and to listen to the addresses with which it was accompanied. Around two sides of this space were high and solidly constructed ranges of seats, hired out to spectators, covered with awnings, and affording a favorable position for seeing and hearing. A temporary arch was erected, covered with colored cotton and suitably embellished. But its most interesting and attractive ornament was a living American eagle, with its dark plumage, piercing eye and snowy head and tail, who seemed to look with anxious eye on the unwonted spectacle below. This we understand is the same eagle which in Alexandria surmounted the arch of welcome then erected to Lafayette; and to complete its honors and its public character it has since been entrusted to M. Vattemare, to be presented to the national museum in Paris. He is now forty years old, but is sufficiently vigorous to warrant the idea that the eagle lives a century. [This one, at least, will live in our columns that length of time.] On one side was a gallery or shaded rostrum for the committee of arrangements and the orators of the day; on the other a smaller one, and more ornamented, for the Masonic officer who was to preside in the ceremony of laying the stone. Here the crowds gathered. The vast sloping amphitheater of seats presented an unbroken sheet of human countenances. In a conspicuous position seats were provided for Mrs. Madison and Mrs. Hamilton, to whom the orator, in his address, most touchingly and eloquently alluded. While over the whole the banner of the Union, spread and displayed by the willing breeze, seemed proudly to extend its ornament and protection."

THE PROCESSION.

The procession, which was considered the finest ever seen in this city, and was over a mile in length, was marshaled by Joseph H. Bradley, whose special aids were Major P. G. Howle, Major S. S. Lewis, Capt. J. E. Stewart, of Baltimore, and J. P. Key. The military was under the command of Major Gen. John A. Quitman, with Lieutenants R. P. Hammond and G. W. Derby as aids. Col. Chas. May with Lieut. A. D. Tree as adjutant commanding the calvary, and Gen. Cadwallader, with Lieutenants Keger, of the Voltegeurs, and Henry, of the N. Y. volunteers, on his staff.

The line was formed in front of the City Hall, and on the right of the line was the Maryland Light Horse, of Laurel, commanded by Col. Horace Capron, followed by the Prince George dragoons (Capt. Tuck's company) of Marlboro, commanded by Lieut. Hillary, Mounted Carbiniers of Baltimore, Capt. Murdock, and Ringgold cavalry of Alexandria, commanded by Lieut Corse.

The Eagle Artillerists, of Baltimore, commanded by Col. George P. Kane, and the Rough and Ready Artillery, Capt. Robinson, a company of youths, with two small field pieces drawn by hand, formed the artillery in the line. The infantry portion of the procession was formed of two companies of U. S. marines (Col. Walker commanding the battalion and Lieuts. Queen and Hays the companies); the Independent Blues, Capt. A. P. Shutt, and Independent Grays, both of Baltimore, Capt. Hall, of the latter, commanding the battalion; Baltimore City Guards, Lieut. McDonald; Fredericksburg, Va., Guards, Capt. Jackson; Washington Light Infantry, Capt. Joseph B. Tate; National Blues, Capt. P. F. Bacon; Maryland Cadets, of Baltimore, Capt. Harris; Light Guards, of Boston, Capt. Clark; Mt. Vernon Guards, of Alexandria (Capt. Lammond's company), Lieut. Price; Independent Grays, of Georgetown, Capt. Wright; Baltimore Sharpshooters, Capt. Lilly; and Columbian Riflemen, of Baltimore, Capt. McAllister.

The civic divisions were in charge of Major A. A. Nicholson, Major S. R. Hobbie and J. A. Blake.

The firemen's division was composed of the Vigilant fire company, of Baltimore; Washington Hose company, of Baltimore; Howard fire company, of Baltimore; the Anacostia, Columbia, Franklin and Perseverance companies, and a delegation from the Northern Liberties company of this city.

The District lodges of Odd Fellows were next in order. The Red Men followed. The Young Men's delegation of Baltimore; delegations from the various states. Then the temperance divisions, the Washington Benevolent association, the German Benevolent association, the corporate authorities of Washington and other cities. Then came a carriage containing the venerable Mrs. Hamilton, her daughter, Mrs. Holly, G. W. P. Custis, esq., and General Walter Jones. Carriages containing the committees, Hon. Robert C. Winthrop, orator of the day; Rev. J. N. McJilton, of Baltimore, chaplain; President Polk, Secretary of State Buchanan, Col. J. Knox Walker, private secretary; Hon. R. J. Walker, Secretary of Treasury, and J. Y. Mason, Secretary Navy; Cove Johnson, Postmaster General; W. L. Marcy, Secretary of War, and Isaac Toucy, Secretary of Navy.

The Masonic lodges, marshaled by J. B. Thomas, closed the procession.

THE CORNER-STONE.

The copper plate covering the deposit recess in the corner-stone bore the following inscription:

4th July, 1776.
Declaration of Independence of the United States of America.

4th July, 1848.
This Corner-Stone Laid of a Monument,
By the People of the United States, to the Memory of George Washington.

James K. Polk,
President of the United States and Ex-Officio President of the Board of Managers.
William Brent, 1st Vice President.
William W. Seaton, Mayor of Washington, 2d Vice President.
Gen'l A. Henderson, 3d Vice President.
J. B. H. Smith, Treasurer.
George Watterston, Secretary.

Then followed the names of the board of managers, the building committee, the committee of arrangements and the architect.

A long list of documents in print and manuscript were placed in the recess of the stone, besides seventy-one newspapers and copies of magazines of the day and other periodicals. The Washington press was represented by copies of the *National Intelligencer*, the *Union*, the *National Era* and the *Saturday Evening News*, all journals which have passed out of existence. Among the documents placed in the stone was a "Description of the Magnetic Telegraph," by A. Vail; a description of the daguerrotype process, by John S. Grubb, of Alexandria, Va., together with daguerrotype likenesses of Gen. and Mrs. Mary Washington, and a design of the monument, small plate produced by a process called electrotype, which was in those days considered a marvel.

SETTING THE CAPSTONE.

The actual completion of the shaft, which was dedicated to-day, was celebrated with due solemnity, but no pomp or parade, on the 6th of December last. Two o'clock that day was the hour fixed by Col. Casey for setting the capstone, and he carried out the program he had previously arranged, notwithstanding the fact that a perfect gale was blowing at the time. Thousands of telescopes and glasses, from every part of the city, were at that hour turned towards the top of the monument. The naked eye could see only black, diminutive objects moving about on the scaffolding and platforms erected about the pyramidion. The topmost platform was 550 feet from the ground. The only persons who were admitted to this lofty place were Col. T. L. Casey, the engineer officer in charge; Capt. Davis and Mr. Bernard R. Green, his assistants; P. H. McLaughlin, the superintendent of the work of constructing the monument; Dennis O'Leary, the principal mason; James Hogan, the rigger; Edward Wayson, the elevator conductor, and Louis O'Brien, the colored man whose name goes down to history as the man who mixed all the cement used in setting the stones of the monument since the work was resumed.

On the larger platform, twenty feet below, were assembled Gen. W. McKee Dunn, Horatio King, Dr. J. M. Toner and Dr. Daniel B. Clarke, of the Monument society, ex-Mayor Emory, Mr. Harvey, secretary of the joint Monument commission, the draughtsmen and clerks of the Monument office and several representatives of the press. Each of the persons on the upper platform spread some cement upon the bed of the stone, Col. Casey being the last to handle the trowel. The stone, which was swung from a derrick, was then lowered into its place. This was the capstone, but the aluminium point, which forms the top of the monument, was still to be adjusted. In the cement spread in the bed prepared for this tip of metal, each of those present on the upper platform deposited a coin. When Superintendent McLaughin placed the tip on the stone and Col. Casey had secured it, a shout went up; the stars and stripes were unfurled and a salute was fired by a cannon in the White Lot. Immediately afterwards the members of the Monument society present assembled on the elevator platform, 500 feet from the ground, and held a brief sermon, at which a resolution was adopted, setting forth: "That we are thankful to have the opportunity of this occasion and, at this elevation, to congratulate the American people on the completion of this enduring monument of our nation's gratitude for the Father of His Country."

The flag displayed after the capstone was set, floated from a flag-staff, the top of which was 600 feet from the ground. The capstone is a cruciform keystone, 4 feet 5¾ inches in height on the outer faces, with a shoulder on each side of 7 inches to tie the ashlar face of the pyramidal cap; below this shoulder the stone is 10½ inches, making the total length from top to base, 5 feet 2½ inches. The stone at the base is 3 feet 9-17 inches square, and at the top, where the aluminium tip was placed, 5½ inches square.

THE ALUMINIUM TIP

is the largest block of that metal ever cast in any country. The base is 5½ inches square and its height 9½ inches. Its weight is 100 ounces. This metal was selected for its wonderful durability and its freedom from wear or corrosion by atmospheric influences. The surface is whiter than silver, and so highly polished that it reflects as a plate-glass mirror. This metal tip is connected by wires with the iron work of the elevator posts, which, in turn, have a ground connection, so that it plays the part of the tip of a lightning rod. On the four faces of the metal point the following inscriptions are engraved: "Chief Engineer and Architect Thomas Lincoln Casey, colonel corps of engineers; assistants, George W. Davis, 14th United States infantry; Bernard R. Green, civil engineer; master mechanic, P. H. McLaughlin;" "Corner-stone laid on bed of foundation July 4, 1848. First stone, at height of 152 feet, laid August 7, 1880. Capstone set December 6, 1884." "Joint commission at setting of capstone: Chester A. Arthur, W. W. Corcoran (chairman), M. E. Bell, Edward Clark, John Newton, act of August 2, 1876," and upon the last one "Laus Deo."

THE POPE'S STONE.

A Sensational Incident in the History of the Monument—The Rape of the Stone Attributed to Know-Nothings—A Mystery Which Has Never Been Entirely Cleared Up.

The Pope of Rome sent a contribution to the monument in the shape of a slab of rich marble, variegated with veins of pink. This slab, which was about three feet long, eighteen inches wide and six inches deep, was placed, with other like gifts, in a shed or lapidarium south of the structure, in which most of these stones received from foreign lands were stored. The winter of 1853 was quite a severe one and work had not been resumed in March following. The day watchman in the grounds was Mr. George Hilton, and he lived in the house since occupied as the house. He had a good watch dog, and besides a regular night watchman, Mr. John Stewart, was employed. At this time the know-nothing party here was "booming," and there were large lodges in each of the wards of the city. One of them, it was believed, on account of the large number of people seen going into the stable at the corner of 13½ and E streets, met in that place. When on the morning of March fifth it was found that the Pope's stone had disappeared it was thought that the work was planned in that council or lodge, and persons reputed to belong to that council were looked upon as the perpetrators. The report that the stone had been carried away caused much excitement, and every effort was made to get a clue as to the perpetrators. When inquiry was made it was found that the watch dog had been poisoned and the night watchman

MADE A PRISONER

in his box by a long line of rope being passed around it and securely fastened. He was found in this dilemma in the early morning by the day watchman. The all-important question was where had the stone been carried, and what had become of it. It was natural that the know-nothings should be suspected, and also to suppose that the council or lodge meeting at 13½ and E streets should have done the job. Indeed, when in a few weeks the following words were sung on the street, to the tune of "Jordan am a Hard Road to travel," the suspicions against the know-nothings were strengthened:

"Oh, the Pope of Rome,
He sent a stone,
To be placed in the monument accordin',
But know-nothings thought it best
Not to let it rest,
But pitch it on the other side of Jordan."

Rewards were offered and the police worked up every clue without success, though at one time they were confident as to one or two persons having had a hand in the act, but could get no tangible evidence against them. Notwithstanding the efforts made from time to time there never has been any reliable information obtained. The secret both as to the participants in the affair and the disposition of the stone has been well kept. It has been stated variously that the act was committed by Baltimoreans, that it was the work of Navy Yard people and that the men were selected from several parts of the city, but the statement most generally received was the following:

HOW THE STONE WAS STOLEN.

Less than a dozen persons, some of them reputed members of the know-nothings composed the party, and they were bound by pledges not to betray one another. They started out simply for the purpose of doing something big, and after midnight they went to the monument grounds, poisoned the dog, tied the watchman in his box, broke open the shed, placed the stone on a hand truck, ran it down a ravine, southwest of the structure, to the river shore, where it was placed on a sand boat. Large spalls of it having been knocked off the boat was poled out to the channel, when the stone was heaved overboard. When the marauders returned to the shore some of the party rolled the truck back and they then separated. Although many attributed the act to the know-nothing party many persons reputed to be members of the party disapproved of it and have always claimed that it was simply an attempt of irresponsible parties to do something that would make a noise in the world. If those who had the credit of this deed were really the guilty parties there is good reason to believe that this theory is correct. Some of those thought to have been in the job soon afterwards turned out badly. Five of them were arrested for a crime which sent all but one, who jumped his bail, to the penitentiary. The reputed leader was said to have gone to Texas and to have assumed another name, under which he served as a field officer in one of Sherman's regiments during the war. Another died in prison, and it is now thought that but one survivor of the depredating party who survives lives in the District.

A SLANDER ON THE MONUMENT.

The Stability of the Structure Questioned Thirty-five Years Ago.

Though the strength of the foundation was not questioned, in the early days of the monument the statement was made that the marble forming the facing wanted strength and durability, and would be crushed by its own weight. These reports, it was thought, did injury to the cause of the Monument society. Tests were made, and the results were announced in an address issued from the Washington National Monument office November 9, 1850, by George Watterston, the secretary, in which he said: "A statement made by Prof. Johnson, in a lecture delivered by him some twelve or fourteen months ago, that the marble forming the exterior facing of the great National Monument, now building in the city of Washington, in honor of the illustrious Father of his Country, wanted strength and durability, and would be crushed by its own superincumbent weight, induced the building committee, in order to correct the error into which he had fallen, and in justice to the board of managers, as well as to arrest the mischief it was calculated to produce, to cause the strength of this marble to be accurately tested by a powerful hydrostatic press at the Washington navy yard. A series of experiments were accordingly made under the direction of the superintendent of machinery at that yard, and the architect of the monument, and they reported, as the result of these tests, that the marble was *equal in strength to the granites*, and that a base of 144 inches, or one foot square, would bear a pressure of 360,000 pounds before it could be crushed, or *four times* the perpendicular weight of a column of marble 500 feet high, and that the atmospheric action on this material was only the *fifteenth part of one grain*, or the moiety of that on the large crystal marble of New York. A repetition of the erroneous statement referred to having been recently made by Mr. Johnson and noticed in distant papers of this country, a circumstance which is operating, it is believed, to the injury of the patriotic objects of the monument association, the board of managers, with a view more fully to satisfy the public mind as to the strength and durability of the marble objected to, ordered additional experiments to be made with the same powerful press, and the result has been still more demonstrative of the absurdity of the opinion entertained and promulgated by Mr. Johnson."

Appended to this is a detailed statement by Wm. W. Dougherty, superintendent of the monument, of the practical tests made together with analyses of the stone by Professors Page and Gale. Mr. Dougherty declared that instead of 500 feet, the monument could, if it were possible to build it, be carried 5,000 feet high without any danger whatever of the marble crushing under the weight. He said also he was confident, from the manner in which the marble was bound in with the main body of the wall which is gneiss rock, that a whole course of the marble casing, eighteen inches thick could be taken out, and the edifice carried up to its full height without endangering the safety of the work.

THIRTY-SEVEN YEARS AGO.

How the City of Washington Looked When the Corner Stone of the Monument was Laid—The Northwest a Tramping Ground for Gunners—Venetian Scenes Along the Old Canal, &c.

Washington at the time of laying of the corner-stone of the monument was indeed a "city of magnificent distances." The city did not then number 40,000 inhabitants. So plain and unpretentious were most of the residences, and so little had been done towards the permanent improvement of the streets that those who then knew the city can scarcely realize that it is now the same place.

Some of our streets and avenues were covered with a coat of gravel dug from banks found in various localities, and many of the avenues now with concreted carriageways had then the original soil between the curb lines, which were imaginary lines, and in some vehicles were so little used that there was not even the semblance of a road. While a few of the streets and avenues down town had been improved with graveled carriageways and brick footwalks many instead of brick for sidewalks had what were called gravel walks, made of coarse red sand, one load dumped after another, which in time made a passable walk.

The Capitol then comprised only what is now known as the old building, and the new dome had not been thought of. It was crowned with a dome squatty compared with the present dimensions of the building, rising to a height of but 145 feet. Two years later the extension was begun, but it was not till 15 years afterwards that the present dome, double the height of the old one, was finished. Then Pennsylvania avenue was not paved even with cobble stones, but macadamized. The only railroad station was that of the Baltimore and Ohio, at the corner of 2d street and the Avenue, a wretched, dingy little brick building, the Tiber creek at that point being crossed by a wooden bridge with brick walls. The fare from Baltimore was $2.50 and $3, and baggage extra. The principal hotels were the National; the Indian Queen (now Metropolitan); Fuller's, at the corner of 14th street, Appler's, 12th street; Baker's, at 8th and D streets, and Casparis', on Capitol Hill. On the site of the Washington market were two long rows of sheds known as

THE "MARSH MARKET,"

the Perseverance engine-house and the police station being located between them. The additional wings of the Treasury had not been constructed. The State, War and Navy departments were housed in plain structures containing 12 rooms on each of the two floors. The State department was just north of the Treasury, and the War and Navy departments west of the Executive mansion. None of the statues of public men now adorning the public grounds had been erected then, except Greenough's statue of Washington at the Capitol. Then the triangular spaces on the avenues were not enclosed. One at 14th street and Pennsylvania avenue was occupied by the Franklin engine-house, and another at 20th street and Pennsylvania avenue by the West market and watch-house. The portion of the Post Office department building fronting on E street had then been erected, and the old portion of the Patent Office building had been completed. In this square the Maryland Cadets, Capt. Harris, the crack military organization of this section, encamped for several days on the occasion of the monument ceremonies. Up to a year before this time the tract known as the mall, extending from 3d street to the river, separated from the main portion of the city by the Washington city canal, had been a waste, broken only by 4½, 7th, 12th, and 14th streets, at which wooden bridges spanned the stream of filth that ran through the mall.

BOATS IN THE HEART OF THE CITY.

Along the banks of the old canal down to 3d street were long piles of wood brought up by boats, and near the market flat-bottomed boats delivered cargoes of vegetables and fruits. The building of the Smithsonian Institution, the corner-stone of which was laid May 1st, 1847, was then in progress. The Armory and Agricultural department buildings had not been erected. The streets south of the mall had no pavement or carriage-ways, and but few of them had brick foot-walks. Walks for foot passengers were then made of gravel. The streets from the canal bridges were open to the river. 11th street, at the foot of which the steamers then landed, was the principal thoroughfare north and south, and Maryland avenue and F street the other principal streets of South Washington. The fare by steamer being cheaper than by rail, some of the Baltimore organizations, including the Eagle artillerists with their guns, came by the old steamer Columbia. Capt. George P. Kane, afterwards prominent as collector of the port of Baltimore and marshal of police of that city and subsequently sheriff of Baltimore, commanded the Eagle artillery. The Fredericksburg company, Capt. Jackson, came up on the southern steamers by way of Aquia creek, and the old steamers Joe Johnson, Phoenix and Salem brought up the Alexandrians. A few of the streets in the neighborhood of the City Hall and east of the Treasury, as far north of the Avenue as H street, were macadamized and had brick sidewalks. So had some of the streets adjacent to the Avenue in the western parfot the city. Northward, however, most of the streets were unopened, and it was not uncommon to see

COWS AND HOGS

disputing the right to use a foot path through the grass and weeds. Although at that period the dignified W. W. Seaton was mayor, having succeeded Peter Force, there were at times what appears some ridiculous issues in local politics. The citizens were alllowed to keep cows, especially in those sections sparsely built upon, and the city councils annually appropriated $15 for the hire of a bull in each ward deemed necessary. In one of the ward campaigns the sole question was whether the candidates favored the bull or opposed him.

THE NORTHWEST.

What is now considered the finest portion of Washington—the northwest—was then not improved at all. In fact, the whole northern, as well as northeast and eastern sections, had no public improvements. North of M street there were some graveyards, gardens and slaughter-houses. There was a dense growth of bushes in that section, and the common name of it was "the slashes." Here there was good gunning for small game.

The police force at that time was composed of thirty men, known as the Auxiliary Guard, then under the command of Capt. John H. Goddard.

Potomac water had not been introduced, and the reliance of the public was mostly on pumps, a few of which still remain. The Capitol was supplied with spring water from a spring known as Smith's, east of Howard University; the President's house and executive departments from one in Franklin Square, wooden pipes being used.

THE VOLUNTEER FIREMEN.

Then the old volunteer fire department was in existence, the companies being the Anacostia, at the navy yard; Columbia, on Capitol Hill; Perseverance, at the Center Market; Franklin, at 14th and Pennsylvania avenue, the Union, in the first ward, and Northern Liberties, at 8th and K streets northwest. There was much rivalry among these companies as to which would make the best show. With the visiting companies the firemen's display on the occasion of the laying of the corner-stone was about the finest ever seen here. Each company had in the line a piece of apparatus decorated with flowers and flags, some of them with boys attired as firemen at the brakes, and others having young ladies representing Liberty and the original thirteen states enthroned upon them. The fire companies here, as in other communities, were not always on friendly terms with each other, and the hangers on often brought about bloody riots. Sometimes there was more effort made to throw water on a rival company than to put out a fire.

Some idea may be obtained as to the growth of the city by comparing the appropriation of $21,383 made for the four years ending 1848 for the public schools with the appropriations made in the past few years. There were then less than 20 public schools in the city, and they were arranged in four divisions. The Northern Liberties section and English Hill were just then becoming known. Other localities were known as "Twenty Buildings," "Old Sugar House," "Foggy Bottom," "Frogtown," "Mt. Etna," "Paddy Magee Town," "4 Gun Battery," and by other classical names which have gone out of memory.

SAVING THE CORNER-STONE.

The Patriotic Services Rendered by the Navy Yard Workmen—An Odd Procession.

On the 6th of June 1848, as the large block of marble which was set as the corner-stone of the Washington monument was being hauled to the foundation, the truck bearing the stone broke through the 14th-street bridge over the canal. This fact becoming known at the navy yard, at the noon hour the workmen offered their services to get the stone out. This movement was seconded by the officers of the yard, and Gen. Henderson, of the Marine corps, detailing field music, marshaled the line up Pennsylvania avenue to 14th street, where the truck lay in the mud. In the line were the following, who are still living: Wm. Bland, James Wilson, James Marceron, Richard Warner, Robert Padgett, Jeremiah Cross, John Moss, Thomas Mitchell, W. E. Hutchinson, James Burdine, Chas. Burgess, Jas. Burgess, Theodore Sniffen, John Cook, Stanislaus Edelin, Dennis Callaghan, John Ober, John H. Peake, James T. Boiseau, Joseph T. Mitchell, John F. Tucker, James Kealy, William Hardy, Walter Hardy, John Pic, George R. Wilson, Lemuel Gaddis, Thomas Arnold, Randall Cook, Wm. Cook, John Simmons, E. B. Duvall, Wm. Bayley, J. N. Gates, Thomas Luxon, Michael Robb, Wm. Quigley, William Brown, Thomas Mackey, Elijah Acton, Alex. Maddox Thos. J. Harrison and William Young. As the line moved up the avenue others joined and there were about 1,000 persons collected in the vicinity of the bridge. The task of blocking up the truck was soon performed by the construction men, and two long lines of rope attached to the tsuck were manned. The music then struck up and the stone was hauled to its destination. The stone and truck were decorated with flags, and on it was a live eagle.