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THE DAVIS ISLAND DAM ON THE OHIO RIVER.

In the olden days, when Fort Duquesne was on the extreme colonial frontier, the restless waters of its two encircling rivers met below the old fort to form the broad Ohio, and together flowed toward the sea in unrestrained freedom. In winter and spring mighty torrents rushed hurriedly past the fort and onward to the great valley. In summer and autumn, when heat and drought had quenched the tributary fountains, these torrents were replaced by broad, shallow streams, scarcely navigable for heavier craft than the frail canoes that formed their only fleet. But when the old fort had grown into a famous trading post, and then into a brisk city, this intermittent navigation became extremely disadvantageous. The large mineral resources of Western Pennsylvania were being developed, and their product of coal and iron distributed throughout the South and West by means of the natural waterways afforded by the Ohio and Mississippi.

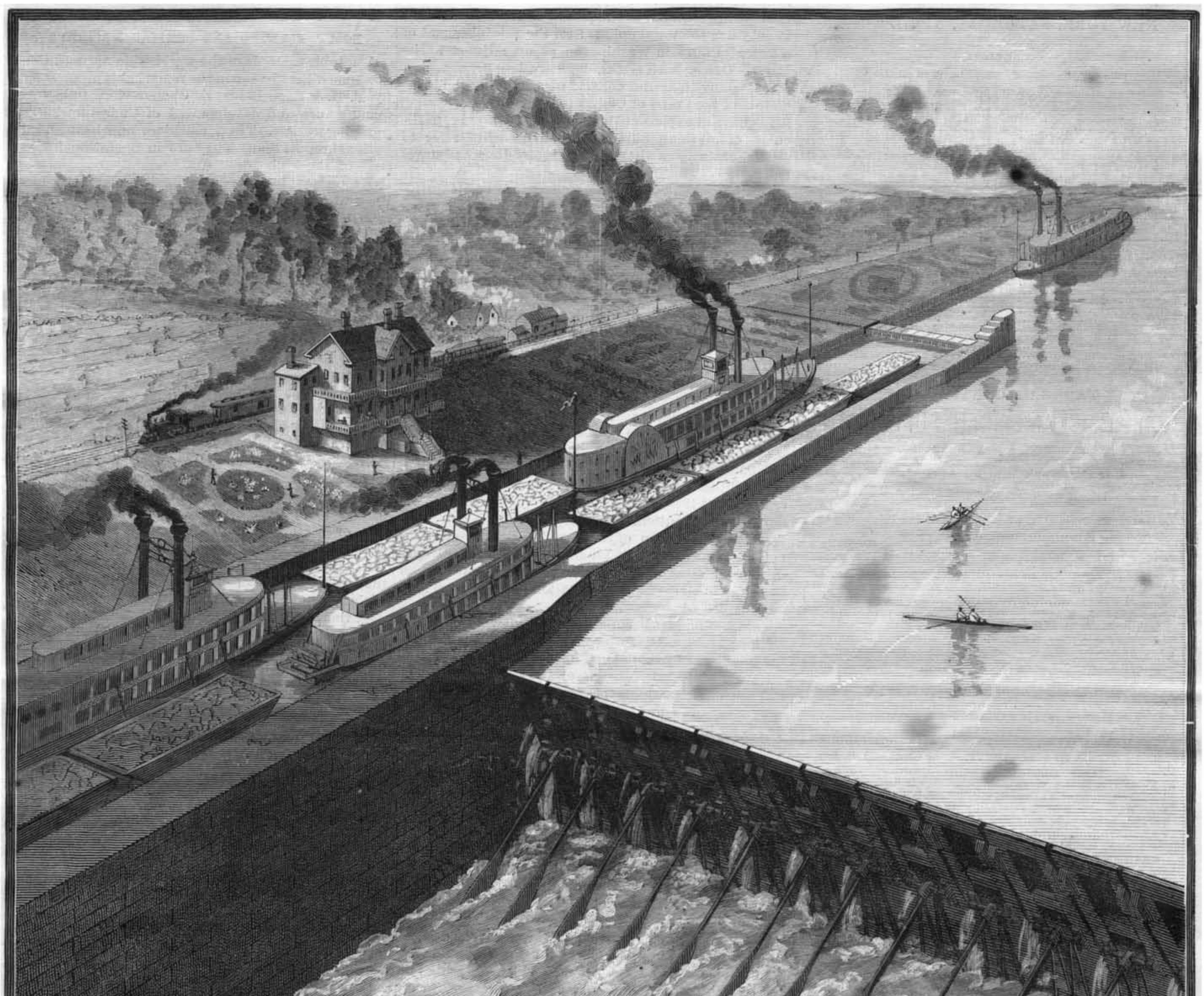
Pittsburg's commerce had stretched out its hands until her steamers had gone into the Northwest as far as the Upper Missouri, a distance of 4,300 miles, and on the South as far as New Orleans and the Gulf. Each year the traffic grows larger, until at the present time the tonnage of the port of Pittsburg exceeds that of New York.

Its growing requirements strongly demand improved facilities of water communication. The Monongahela has already been made navigable for many miles above the city by an elaborate system of fixed dams and locks. The Allegheny remains for the most part unimproved. Penetrating, as these rivers do, to the North and South, they bring a large region of rich and productive country into communication with the city at their mouths, and further improvements to navigation will extend the area of the tributary district. But the actual port of the city has not until recently been free from the interruptions caused by the low water of summer.

The only practicable way of improving it lay in damming the Ohio, and so raising the water level. But it would have been a manifest disadvantage to turn this immense tonnage through a lock all the year round in order to make the traffic continuous from one ice-bound season to the next. The two conditions necessary to be considered—an open passage at high water and a navigable pool surrounding the city and extending as far down the river as possible, at all seasons of the year—made a movable dam highly desirable. It was, therefore, decided to construct a wicket dam, on the plan devised by M. Chanoine, by which the river could be left open at high water, and during the dry season could be so far confined as to make a navigable pool surrounding the city.

Davis Island, five and a half miles below Pittsburg, was chosen by the Government engineers as the site for such a dam. The work was begun in August, 1878, and finished last fall. It was formally opened on October 7. A channel-way, 456 feet wide, between Davis Island and the southern shore has been closed by a permanent dam. The main channel of the river, between the island and the northern shore, is 1,344 feet wide. It is across this water-way that the movable dam has been constructed. A lock, 689 feet long and 110 feet wide, has been built on the northern shore. A land wall, having a total length of 1,649 feet, extends along the bank. A wall of solid masonry, 19½ feet high, 11 feet wide at its base and 8 feet on top, sepa-

(*Continued on page* 214.)



MOVABLE DAM ON THE OHIO RIVER AT DAVIS ISLAND.

THE DAVIS ISLAND DAM ON THE OHIO RIVER.

(Continued from first page.)

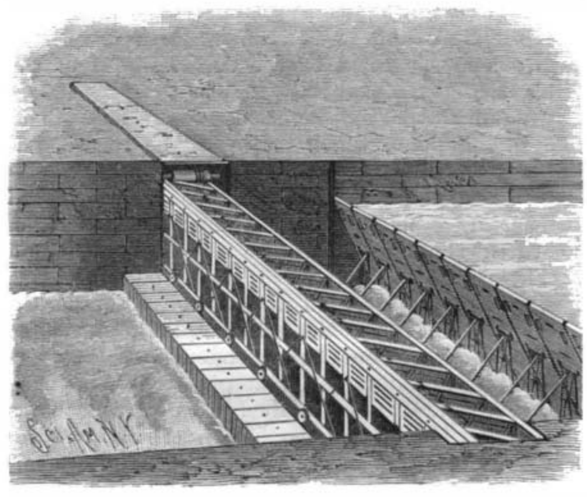
rates the lock from the river. Between the wall and the island the channel is divided into the Pass, 559 feet wide, and three weirs of 224, 224, and 216 feet respectively. The weirs are separated from each other and from the ship channel—the Pass—by masonry piers. The dam consists of a series of 305 movable wickets, which lie flat on the river bed during high water, and are only raised into position when the river has fallen so low as to make navigation difficult or impossible.

The wicket consists of three parts—the wicket proper, the horse, and the prop. The wickets are made of white oak, and are 3 feet 9 inches wide. Their length varies from 12 feet 11 inches in the Pass to 9 feet 9 inches in the weir nearest the island. They are placed 4 feet between centers, thus leaving a space of 3 inches between them, through which the overflow water passes. When the river is too low to permit this waste, pieces of scantling are put down over the openings, the weight of water being sufficient to hold them in place. The wicket is journaled to the horse at a point just a little above its center. The lower part of the wicket is weighted, in order to keep it down. The horse is a frame of wrought iron, 6 feet 8 inches long, which is journaled in a cast iron box in the bottom of the river. These horse boxes are fastened to stout timbers on the river bed, which in turn are secured by iron rods, 9 feet long, to a buried timber which serves as an anchor.

The prop is journaled to the crosshead of the horse, its free end being supported, when the dam is up, by means of the Pasqueau "hurter." This ingenious device is a cast iron box, 9 feet long and open at both ends, which rests upon the bottom of the river. When the wicket is raised into position, the end of the prop slides along the bottom of the box, and up a slight inclined plane occupying one-half the width of the bottom, until it reaches the end of the plane and drops down into a notch, where it is held by the pressure of the water against the wicket.

When the wicket is to be lowered, it is pulled forward slightly until the prop is disengaged from the notch and falls to the bottom of the hurter. As the wicket is lowered, the end of the prop, guided by a beveled edge, slides to one side of the inclined plane, and so along the bottom of the hurter until prop, horse, and wicket are flat on the bed of the river. The Pasqueau hurter, like the entire system of wicket dams, is a French invention. Its characteristic feature, upon which the Pasqueau patent was taken out, is the beveled edge, by which the end of the prop is guided to one side of the inclined plane, and permits the wicket to be lowered.

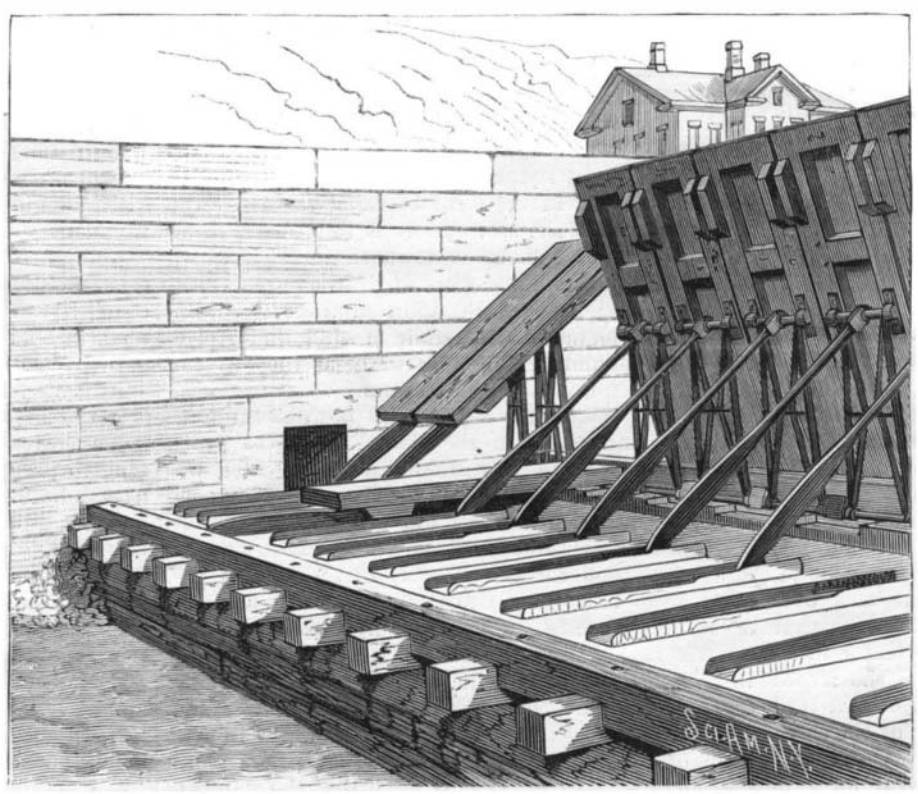
The wickets across the navigable pass are operated from a "maneuvering boat." In closing the dams, a hook is inserted in the lower end of the wicket. This is then drawn forward until the prop falls into the notch in the hurter, the wicket proper remaining all the time like a feathered oar, with its broad side parallel to the current. When the prop is securely in place, the lower end of the wicket is gradually allowed to sink until it rests against a sill in the bottom of the river. The wicket must be held by the hook until it rests against the sill, otherwise the force of the current would soon prove destructive. When the dam is to be lowered, a hook is inserted into the upper end of the wicket, and, by means of a windlass on board the boat, is drawn in until the prop is disengaged, and allows the whole affair to sink to the bottom. Both in raising and lowering the dam each wicket is operated separately. The system of wickets in the weirs is precisely similar to that in the pass and across the head of the lock, but is operated from a "service" bridge in place of the boat. This bridge is a light iron structure, some feet above the dam, and when not in use collapses at right angles to the current. It is built in sections, as shown in our illustration, and stands 15 feet 1½ inches above the river bed. The supports are 8 feet apart, and are hinged at their lower ends to suitable sills. A section of flooring sufficient to span the intervening space is hinged to each support, and goes down with it. A chain connects the free end of the flooring section with the adjoining support nearest the island. When collapsed, the sections lie flat on the river bed, overlapping each other, after the manner of a fallen row of bricks. When the bridge is to be erected, the section nearest Davis Island is first put in place, and by means of the



UPPER GATE AND SHORE RECESS.

chain connection, the succeeding ones are one by one brought into position. The supports projecting from the upper side of the piers are in the line of the bridge, and divide it into three larger sections, corresponding to the weirs.

The lock, in addition to several novel features of construction, possesses an interest as being the largest, both in length and breadth, in the world. A dam of 27 wickets extends across its upper end. This is only



VIEW FROM BELOW SHOWING THE WICKETS IN DIFFERENT POSITIONS.

brought into requisition when the lock is first used or taken out of use. It is for the purpose of giving slack water in the locks, as it would be impossible otherwise to operate the gates. While the lock is in use, the weir will be unnecessary, as the water will always be slack, either the upper or lower gate being at all times closed.

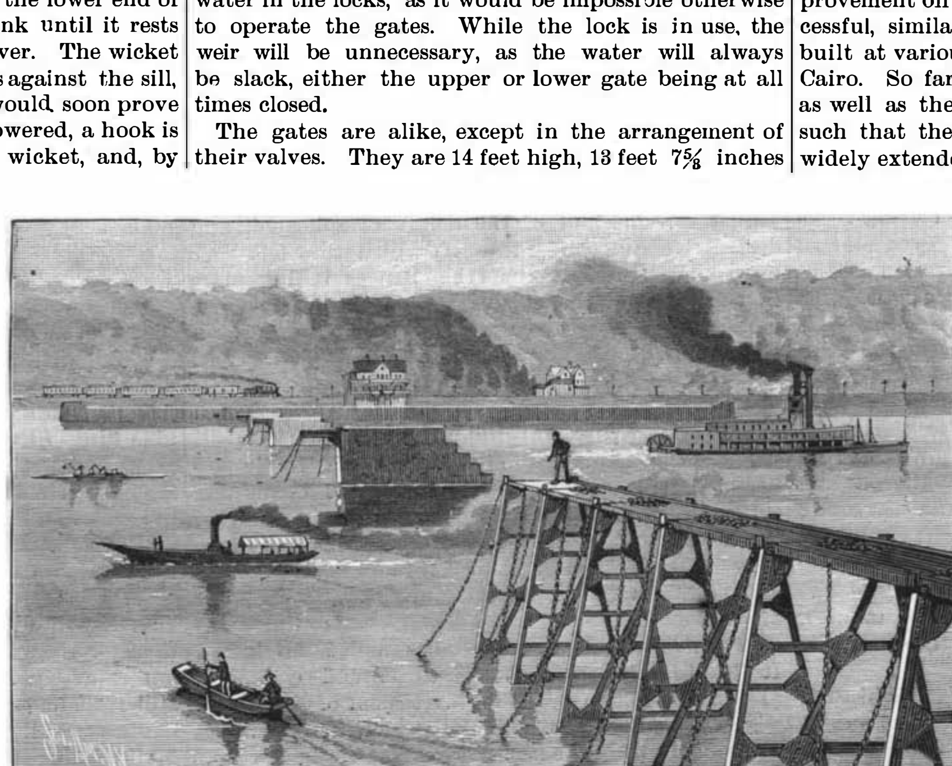
The gates are alike, except in the arrangement of their valves. They are 14 feet high, 13 feet 7⅝ inches wide, and 118 feet long. They are formed of several Howe trusses laid horizontally, and connected by a heavy timber framework. Each gate runs on a track, and when the lock is to be opened, is drawn into a corresponding recess in the river bank. In the lower gate there are 14 butterfly valves, 38 inches in diameter. These are all connected with one shaft, and operate in unison. In the upper gate there are no valves. Each shore recess is provided with seven discharging butterfly valves, 4½ feet in diameter, and in the river wall there are also seven valves, 4½ feet in diameter, making the filling and discharging area of the valves the same. A turbine wheel in the river wall is operated by the water entering the lock through these valves, and its power is utilized to pump water into two tanks on the bank, which have a total capacity of 79,000 gallons. When full, these tanks give a fall of 64 feet, and serve to operate a turbine at each gate. In this manner all power required by the lock is furnished by the river. The turbine at the upper gate is smaller, because less power is required to move the gate. Being so largely of timber, the gate will almost float; and being at the same time so nearly submerged, it has little weight, and requires therefore but little power to operate it. The lower gate, however, is different. It moves almost entirely out of the water, and requires a larger turbine for its operation.

The work of building the Davis Island dam has been subject to a great many interruptions and delays. It has cost the Government about nine hundred thousand dollars. It is presumed that the annual maintenance will be about six thousand.

When the dam is up, it gives back water on the Monongahela to Dam No. 1, a distance of 6½ miles, and on the Allegheny to 36th Street, a distance of 7 miles. This makes a depth of 12 feet at the dam and about 6 feet at Pittsburg, giving a pool, therefore, which is navigable in the driest seasons. The dam will only be used for a few months during the summer. Some idea of the enormous tows that pass down the Ohio at this point can be gained from considering a single instance, where 22,000 tons of coal were carried at one time to the markets further down the river. Such a cargo is greater than the famous Great Eastern ever handled, and it is worthy of note that the expense of transportation is lower than in any other system of carriage on record. The coal barges carry about 500 tons each, and the boats about 760 tons. Lashed together, three abreast, and lying low in the water, they look at some distance like immense rafts. The tow boats are large stern-wheel vessels, requiring only about two feet of water. They are always placed back of the tow, and when traveling in a current of much velocity present a curious picture, their large wheels revolving in a reverse direction in order to bring the tow to a controllable speed.

The enormous traffic on the Ohio has reached such a stage that it warrants the systematic improvement of the river in every possible way. The dam at Davis Island is an experimental one, inasmuch as it will probably determine the system of improvement on the entire Ohio. Should it prove successful, similar dams, on the Chanoine system, will be built at various points to the mouth of the river at Cairo. So far, the success of the Davis Island dam, as well as the four on the Kanawha River, has been such that there is little doubt that the system will be widely extended. Forty such wicket dams have been mentioned as being necessary to bring the river into a series of continuously navigable pools between Pittsburg and Cairo.

In addition to its commercial importance, the Pittsburg pool will be the scene of considerable yachting, and already the builders of pleasure craft report a noticeable increase in their business. The slack water and long stretch of several miles make it admirable ground for the oarsman.



SERVICE BRIDGE AND PIERS.

AMERICAN TIN.—A 9,000-pound mass of tin ore was recently exhibited at a smelting works in New York. It was taken out of a 29-foot vein in the now well-known Etta tin mine, in the Black Hills. The specimen will be sent to London for the benefit of those British tin-mine owners who have so complacently watched our heretofore unsuccessful search for the metal.

The Explosion of Natural Gas at Murraysville.

One of the most serious and fatal explosions of natural gas that has yet been recorded occurred at Murraysville, Pa., on the 19th ult. In the attempt to make connection with a 16 inch main of the Chartiers Company, a large volume of gas poured into the streets and neighboring houses.

Coming in contact with burning jets of gas, a terrible explosion occurred, fatally injuring several persons and destroying a large amount of property. The fire was then communicated to the big McWilliams well, and a volume of flame at least seventy-five feet high shot up into the air. The flame pouring out of the main was finally extinguished, but it was not until the 22d that the fire at the McWilliams well was put out, and the danger of a general conflagration averted. During this time the entire village was kept in a state of constant anxiety, for there seemed every probability that the neighboring gas wells would take fire, and place the flames beyond hope of control.

For about three days the men employed by the gas companies fought the fire almost incessantly. The heat was so great that they could only work with their heads bound in wet cloths, and then only for three or four minutes at a time. The roar of the escaping gas made conversation impossible anywhere near the burning well. The noise was heard distinctly at a distance of five miles, while the glare of this more than giant's torch kept the night in abeyance over an area of several miles radius.

It was estimated that 3,000,000 cubic feet of gas were being consumed every hour, and that three times that amount escaped into the air unignited. The atmosphere within a radius of 1,500 feet was so saturated with gas that it was almost impossible for a human being to approach the flames and maintain strength and consciousness enough to do any work. As a desperate remedy, it was proposed to cannonade the well, in the hope of either quenching the flame or, by collapsing the pipes, so far reduce the outflow of gas as to bring the flame under control. For this purpose a detachment of Battery B, of Pittsburg, was taken to the scene of the disaster. The suggestion, however, was not carried out, as other means appeared more practicable. Yet it is a curious sight, that of a three inch cannon being dragged twenty miles through mud and rain, to storm this powerful but rebellious servant into submission to his newly found master.

Less revolutionary means were adopted. A trench was dug to within a few feet of the standpipe. Under cover of a fireproof shield, the men gradually accomplished their hard task. A short tunnel was then driven to the pipe itself. By careful chiseling, a ring was cut half way through the tubing. Then began an earnest tug of war. Chains were attached to the standpipe, and 150 men pulled with their might and main. The pipe bent over and broke, and volumes of flame poured out along the ground. The gas afterward became ignited where it issued from the well at the ground. This had one advantage, that it brought the fire all to one spot, the mains having been cut off by the removal of the surface piping. An attempt was then made to drop one end of a long pipe over the jet, so as to extinguish the flame by cutting off the supply of air, but it proved unsuccessful. The force of the outrushing gas threw the pipe to one side. A large funnel like the snuffer of an old-fashioned candlestick was also tried, and failed.

Finally, a large stack was prepared, and one end cautiously pushed toward the mouth of the well. The other end was then raised, and the flame rushed through it with a deafening roar. It was proposed to raise it to some height, and then, by suddenly letting it fall, put out the flame by the draught created. When the stack had reached an angle of about 45°, there was a sudden puff, and the workmen sprang back in alarm. But no further flame appeared. It had been strangled. It is believed the heat was so great that an outward current of air was drawn into the stack in sufficient quantity to form a miniature whirlwind, and thus extinguished the flame.

ARTISTIC ARCHITECTURAL DESIGNS.

The studios and residences of artists always possess a peculiar charm for the traveler and sightseer. With a natural love of the beautiful, and with a taste cultivated by study and elevating association, the artist becomes the exponent of refinement and culture. A glimpse into a painter's home is always a treat. The columns, with their beautiful capitals, in the accompanying cut are from the hallway in the residence of the eminent English artist, Sir Frederick Leighton. This house is situated in Holland Park Road, Kensington, London, and is the achievement of Mr. Atchison. The staircase shown in the lower cut is not Sir Frederick's, but is a design of M. Koekx Wouters, of Brussels, Belgium. The banisters are of wrought iron work and of exquisite finish, and executed entirely by hand. This style of work for stairs is comparatively unknown in this country, although it is often found in palaces and residences in Europe. However beautiful, light, and graceful it may appear, the effect produced is hardly commensurate with the great cost attending its construction.

ARTISTIC COLUMNS AND CAPITALS.

PETRIFIED wood is susceptible of as fine a polish as marble or Mexican onyx, and is taking the place of the latter on the Pacific coast for mantelpieces, tablets, and other architectural parts for which marble, slate, and tiles are commonly used. The raw material employed comes mostly from the forests of petrified wood in the territories of Arizona, Wyoming, and the Rocky Mountains, along the line of the Atlantic and Pacific Railway. Geologists will regret the destruction of such interesting primeval remains, and some steps ought to be taken to preserve certain tracts in their original state.

WROUGHT IRON STAIRCASE AND BANISTER.

Earth Closets.

To those persons who live in smaller cities, in villages, and in country districts where the advantages of a sewerage system are not accessible, and in large cities where sewers are not extended to outlying districts, there is no such easy and economical method of disposing of excreta as by using earth closets.

The primitive and barbaric privy pits are universally condemned and almost as universally used. Earth closets can take their place in a majority of instances without disturbing the habits of the family, and with great benefit to their health. The old privy can, by a little home carpentering, be fitted into a good earth closet. The pit should be cleaned as thoroughly as possible and refilled with clean earth. The lower portion of the back of the old structure may be fixed as a door to raise up, to permit the removal and placing of the soil containers, which should be either galvanized iron pails or strong wooden boxes. The earth may be kept in a box or barrel, in the structure itself.

The trouble with remodeling the outbuilding for an earth closet is that it makes no change in the publicity of access or the disagreeableness of reaching it in stormy weather. As an earth closet, properly constructed and managed, with a due regard to decency and cleanliness, need not be an offense to sight or smell, it can be so built as to place it in some side room or shed attached to the dwelling and under the same roof. In this case a portable, easily managed closet is necessary.

The value of dry earth as an absorbent, deodorizer and disinfecter is not properly recognized. It is said by some to be more powerful in these capacities than any other agent known. If two parts of dry earth are put with one of excrement, and kept in a dry place, the two assimilate, the excreta becoming undistinguishable from the soil after a time, and it may be used over and over again, though it is generally better to bury each pailful in a different place each time, over a portion of the land adjoining the residence. The earth must not be sand or gravel, but soil of a clayey nature, thoroughly dry and finely pulverized. Powdered charcoal, coal ashes, and street dust are equally effective.

Earth closets offer many advantages, chief of which is that, when they are properly cared for, the excreta of one family is rendered harmless and disposed of on the premises, not being liable to soak into a neighbor's well. There is no offensive odor or contamination of the soil. They may be placed under the same roof as the living rooms, and thus be easily accessible to women, children, and invalids.

There are many failures of earth closets to give satisfaction, but the failure is due to an inability on the part of the owner to understand their capacities. They must not be made the receptacle of house or chamber slops, as the ability of the dry earth to absorb moisture is necessarily limited, and any excess of its capacity creates a nuisance. A great improvement has been perfected in earth closets by Mr. William Heap, in an automatic urine separator, which prevents any undue soakage of the earth, and does away with the only source of annoyance in their legitimate use.

The death rate from zymotic diseases has been shown to have been much reduced by the introduction of proper systems of sewerage, as at Memphis. There is no doubt that the uniform adoption of the dry earth system of soil removal in villages would show a corresponding reduction in the death rate, from typhoid fever especially.—*Sanitary News.*

PROF. LESLIE says: "I take the opportunity to express my opinion in the strongest terms that the amazing exhibition of oil and gas which has characterized the last twenty years, and will probably characterize the next ten or twenty years, is, nevertheless, not only geologically but historically a temporary and vanishing phenomenon—one which young men will live to see come to its natural end. And this opinion I do not entertain in any loose or unreasonable form; it is the result of both an active and a thoughtful acquaintance with the subject."