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NEW YORK, SATURDAY, OCTOBER 8, 1859.

A VISIT TO THE MANHATTAN GAS-WORKS.

THE manufacture of illuminating gas is a very simple operation; and as this substance is now in daily, or rather nightly, use by a very large portion of the community, we suppose our readers would like to understand how it is made. Having recently gone over one of the two large establishments of the Manhattan Company, in this city, we are able to give a reliable description of the process, which we shall do with the utmost brevity possible.

Illuminating gas is made by subjecting bituminous coal to a red heat in a tight retort for the space of five hours, during which time the coal is decomposed and the gas is driven off through a pipe which communicates with the retort. When the hot gas is first driven off, it is mingled with three other compounds (tar, ammonia and carbonic acid), either of which would injure its illuminating properties, and which have to be separated by three different processes. The tar is condensed by cooling the gas; the ammonia, being readily absorbed by water, is removed by exposing the gas to a shower bath; and the carbonic acid is separated by passing the gas through successive layers of dry lime.

The apparatus by which the several processes are performed is, though extensive, very simple, and we can, in a few words, give a clear idea of it. The retorts are made of iron or clay, 7½ feet long, of semi-cylindrical or D shape, with the straight side at the bottom. Five of them are set over one furnace, in one bench as it is called, though the benches are joined together, forming one long pile of masonry, with the retorts facing outward on both sides. The inner end of the retort is cast solid and tight, but the outer end is made open, and is closed by a movable door or plate. The retort is kept at a cherry red heat, and when the time arrives to change the coke in it for fresh coal, the workman removes the door and hauls out the red-hot coke with an iron hoe into an iron wheelbarrow, when it is wheeled away and extinguished with cold water. A long iron shovel, shaped somewhat like a grocer's scoop, is filled with fresh coal, two men place a crooked iron bar beneath it, while a third takes hold of the long handle which extends directly from the end; the scoop is lifted and entered into the retort and pushed home to the end, when it is turned over and withdrawn. Each retort is charged with 150 lbs. of coal, and when it is charged the door is taken up from an iron wheelbarrow, by which it has been brought, readily prepared with a channel full of moistened clay or loam around its edge, and is screwed against the end of the retort by a clamp which takes hold of a flange on the the end of the retort. The heat immediately begins to expel the gas, which continues to pass off for five hours. It passes up a pipe which communicates with the retort, and is bent over into a long cylinder, passing down under the surface of the water with which the cylinder is partly filled. The object of this arrangement is to prevent the gas from flowing back from the main reservoirs and escaping through any one of the retorts while it is opened. The gas bubbles up through the water in the cylinder last mentioned, and flows on through a large pipe to the condenser.

The condenser consists simply of a series of large long pipes standing vertically over a vessel of water, and so divided that the gas must pass through them in succession. The tar is condensed and runs down into the water, and is drawn off through a stop cock. About 10 gallons of tar are produced from a tun of coal. To remove the ammonia, the gas is carried to the shower-bath or scrubber. This consists of a large upright cylinder, filled with successive layers of coke supported on horizontal lattices, with a jet of water coming in in spray at the top. The gas is admitted at the bottom, and as it struggles up through the wet coke the ammonia is brought into contact with the water and is absorbed by it. The purifier for removing the carbonic acid is a series of three large low boxes, some two feet high and eight or ten feet square, with a tight cover which can be lifted off by means of a pulley, block and tackle. The burnt lime is spread about three inches thick on a series of iron plates, which are perforated with numerous holes. The gas being admitted below passes up through the lime with which the carbonic acid combines, forming carbonate of lime, the same substance as the limestone before it was burned. This is sold to farmers as a fertilizer. From the purifier the gas passes into the great receivers, and is ready for distribution to the elegant parlors, the dirty workshops, the sad sick chambers, and the noisy drinking cellars of the great city.

In the large and elegant laboratory connected with these great works is a perfect gas-work in miniature, for making gas in small quantities from different kinds of coal, in order to test the coal. This test gas is then conducted into a dark room and its light is accurately measured by means of a photometer. The photometer in use at this establishment is the invention of a gas engineer of Liverpool, and is a beautiful device. It consists simply of a disk of paper, one portion of which is oiled and rendered translucent, while the remainder is left unoiled and opaque. The disk slides on a long graduated bar, which has the standard spermaceti candle (burning 120 grains an hour) at one end, and the standard gas-burner (a five-feet Argand burner, 15 holes, 1-23 inch diameter, 7-inch chimney) at the other. If the paper is placed very near the candle, on looking at the side next the candle, we see the opaque portion of the disk much brighter than the oiled portion, the quantity of light from the candle which is reflected being greater than the quantity from the gas which is transmitted. On looking at the other side of the paper, the oiled portion presents the brighter appearance. The paper is slipped along until the distinction between the oiled and opaque parts disappears, and all portions present a uniform brightness which is seen on both sides, when the comparative distances between the paper and the candle, and the gas and paper, being measured by the graduated bar on which the paper slides, a simple calculation gives the quantity of light emitted by the gas as compared with the candle.

The manufacture of coal-gas is one of the many arts which have grown up within the present century. It was first made at Redruth, in Cornwall, England, by William Murdoch, a Scotch engineer, who lighted his house and offices with it in 1792. Improvements continue to be made in the manufacture, the latest important one being the use of clay instead of iron for retorts. English coal has heretofore been almost exclusively used in this city for gas, but American coal is now being gradually substituted.

DEATH OF BRUNEL.

Lately the news came bounding gladly over the waters of the Atlantic, detailing the success of the *Great Eastern* on her first trip, but swiftly on the heels of this came other intelligence of a sad character, having a close connection with this event. When shouts of joy were reverberating along old Albion's chalky cliffs as the mighty steamship moved majestically down the classic Thames, tears were falling fast for her projector, Mr. Isambard K. Brunel, C. E., who at that period was sinking in the arms of death from paralysis. He departed life on the 16th ult., like a general struck down with the shouts of victory ringing in his ears. He was the son of M. I. Brunel, a French royalist and a man of wonderful inventive powers, who had to flee from his native country, in 1793, and found refuge in this city (New York), where he was engaged for several years as a surveyor, engineer and architect. Having invented a machine for turning irregular forms, and specially adapted for making ships' blocks, he went to England, and the British government at once employed him to put up his machinery at Portsmouth, and from that moment he became a justly conspicuous character. His distinguished son, now deceased, was born in Portsmouth in 1806, and received a collegiate education in France, where his father sent him. Having a taste for engineering, he devoted himself to this profession, and was first employed as assistant to his father in the Thames Tunnel. He also was of an inventive turn of mind, and in 1826 became a patentee for an engine to be driven by carbonic acid gas. This was shortly after the gas had been liquified by Sir Humphrey Davy, and when there was a most intense excitement regarding it superseding steam, because it was so sensitive to heat; but it was a failure in practice. He was a man of great ideas, and seemed to delight in mighty projects. He designed the Great Western (7-foot broad gage) Railroad, the most magnificent line in the world; also the steamship *Great Britain*, the largest known when built; and now his life concludes with the completion of the greatest naval wonder the world has ever seen. Mr. Brunel was also the engineer of the Tuscan portion of the Sardinian railroad, and he built the Hungerford Suspension Bridge over the Thames, at London, which is said to be the largest span in England, and is a model of elegance. He was a man who had great self-confidence, and this was manifested in his controversy with George Stephenson in regard to the comparative merits of the broad and narrow gage railroads, called "The Battle of Gages," which agitated Parliament and the whole country for several years; but experience has proved that Stephenson was correct. Being very enthusiastic as well as ingenious, he committed many mechanical and scientific errors by overlooking some important feature which ought to have been taken into calculation. Thus, when the steamship *Great Britain* was built, lo! and behold, the dock had to be dismantled before it could be launched; and he was also unfortunate at the first launching of the *Great Eastern.* At one period, atmospheric railroads were taken up by Brunel, Dr. Lardner, and several other great men, and it was argued they would soon supersede locomotives and steam. Two lines of such railroads were actually built and opened in England in 1845, and General Pasley, the government engineer, reported in favor of this mode of transit. In three years the atmospheric railroads were abandoned, their air tubes were pulled up, and among the rest, the huge one by Brunel on the South Devon Railroad. But there never lived a great man—engineer, inventor or statesman—who did not commit many errors; and although Brunel had his faults, still he was a great engineer and inventor, and he has left behind him many works which will endure for centuries, as a testimony to his skill and genius; and it is to be hoped that his great ship will long plow the waters of the ocean, in safety and with success, as the noblest monument of them all.

THE AMERICAN SCIENTIFIC ASSOCIATION.

Under this title a correspondent (S) of the *Railway Review*, of the 15th ult., makes an attack upon all the papers which presumed to criticise unfavorably some of the proceedings of the above association at its late convention. Of us he says, "One paper of large circulation and considerable influence, and moreover, calling itself *scientific*, is pleased to say: 'In reading the proceedings of the Scientific Association we are driven to the conclusion that it is directing itself in a great measure to useless scientific objects. It is a waste of mental power, and a misdirection of learning to enter upon long disquisitions on the tails of comets, or whether the curious tracks on the Connecticut red sand-stone are those of an extinct kangaroo, or of a goose.'"

These quotations are taken from page 137, Vol. 1, New Series, SCIENTIFIC AMERICAN, and they seem to have shocked the moral sensibilities of this writer, as he says respecting them: "To my mind this approaches very nearly to blasphemy." How our language should thus have affected him he gives no good reason; indeed he does not seem to comprehend its very plain meaning. In the "middle ages" the school-men held many long and grave discussions as to the possibility of two spirits occupying the same place at the same instant of time, and to have questioned the utility of such intellectual absurdities, as we have done of some of the speculations at Springfield, would, no doubt, have been called blasphemy by persons entertaining just such views as the correspondent of the *Railway Review.* It is very plain to any candid and careful man that our remarks only reflected upon the waste of time and learning exhibited by members of the association in speculative and curious philosophy, to the exclusion of experiment and strict induction, and every unbiassed man will sustain us in this position. Men eminent for talents and scientific attainments frequently fly off at tangents and waste both time and learning in profoundly useless speculations. Let us give a case to the point. A few years since one of the most distinguished professors in Oxford published an anonymous tract on the "Plurality of Worlds," in which he attempted to prove scientifically that the Earth alone was inhabited, and that none of the other planets were in a fit condition for the existence of sentient beings. To this pamphlet the Rev. Baden Powell, F. R. S., published a long reply, and Sir David Brewster, another, in a volume of no inconsiderable size. The latter *savant* (whose work has been re-published in this city) endeavored to prove scientifically that not only the planets, but the very Sun itself may be inhabited. We believe there is not a man of plain common sense in our land who can doubt the assertion, that the efforts of these very eminent scientific gentlemen, on this subject, were a "waste of mental power, and a misdirection of learning."

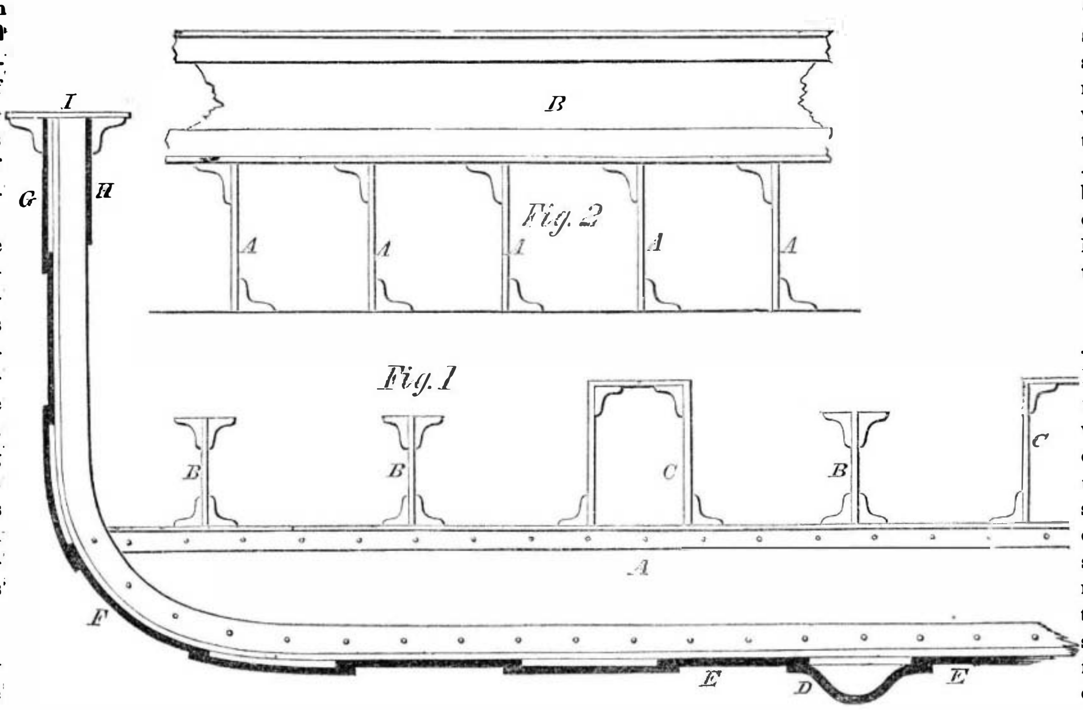
It is evident that the correspondent of the *Railway Review* is not a frequent controversialist, as he takes cases from experimental philosophy as arguments for speculative philosophy; he is like a counselor using opposing evidence in proof of his case. Thus, he cites Franklin's experiment with the kite and the lightning, and Prof. Henry's with the electro-magnet, as bearing against us, while they are the very kind of investigations we have commended. Science is built on truths, but some truths are certainly more valuable than others, just as a man "is of more value than many sparrows." We have spoken against the undue prominence given to certain scientific subjects of little value, because they excluded the consideration of others possessing more importance. By elevating paltry scientific subjects to a position with those of paramount consequence, general science is subjected to contumely. The correspondent of the *Review* exalts the speculators in the fossil foot-prints to the dignity of benefactors to the coal-miners who furnish fuel for our engines, and as a sequence "newspaper makers" are also held to be the recipients of their benefactions. We exclude such an idea; we consider the miner to be the geologist's "best friend," not the latter the best friend of the former, as he has been called.

The correspondent of the *Review* is in error, we believe, in one statement. He says: "The mere apparently useless truth that the tubes of the cellular tissues of plants were concentric and shut into one another, led, as is well known, to the greatest improvement in the art of ship-building that this country has made." Such an improvement is certainly unknown to the public.

IRON SHIPS.

The question has been frequently asked why it is that the Americans, who had obtained the lead of the whole world in the art of shipbuilding, have shown so little interest in the experiments which have been made in the use of iron in this art. It may be that the success of our shipbuilders had filled them with some of that conceit which is characteristic of the older nations, and they had got above learning anything from other people. If this is so, they have reaped the natural reward of their folly in the triumph which the English and Scotch have won over them by the adoption of a better material. It is gratifying to see that our people are at last beginning to arouse from their strange lethargy, though with a tardiness which is certainly not characteristic of them, and are beginning to adopt this great improvement. Commodore Vanderbilt has just had an iron steamer built, and two more are being rapidly finished in this city. One of these is the steamer *Alabama*, built by Samuel Sneeden, at Greenpoint, to run on Lake Ponchartrain. As the building of iron ships, now in its infancy, is destined to grow up with a rapidity probably unparalleled even in this country, we presume our readers will be interested in a plain account of the way in which they are made. We have, accordingly, obtained from Mr. Rowland, the engineer who superintended the building of the *Alabama*, a full description of the iron hull of that boat, which we present, illustrated by an engraving.

This boat is constructed in the same manner, substantially, as a steam boiler, with a single thickness of plates of iron riveted together where they lap at the edges. The structure is then braced lengthwise and crosswise in an exceedingly simple manner, which will be readily understood by inspecting the engravings. Fig. 1 is a cross section of the hull, and Fig. 2 is a longitudinal section of a portion of the keelsons. Directly on the bottom of the vessel are placed the cross keelsons, 16 inches apart. The ends of these are shown in Fig. 2, A A A, and the side of one in A, Fig. 1. They are made of plates of iron 12 inches deep and 5-16 of an inch in thickness, set on their edges, strengthened at top and bottom with angle iron, and extending across the boat. The angle iron is 5-16 of an inch in thickness, and measures three inches on each side; that is to say, it is made of a bar or plate of iron six inches wide, bent at an angle in the middle. Five fore-and-aft keelsons, constructed in the same manner as the cross keelsons, only that they are strengthened with four rods of angle iron instead of two, run the whole length of the boat, standing on their edges on the top of the cross keelsons. Besides these, two box keelsons, C and C, 17 inches deep and 16 inches wide, made of plate 5-16 of an inch thick, and strengthened with bars of angle iron as shown in the cut, extend the whole length of the vessel on each side of the middle.



IMPROVEMENTS IN IRON SHIPS.

The plating is 5-16 of an inch in thickness, with the exception of the bent piece, D, which forms the keel, which is $\frac{5}{8}$; the garboard strake, E E, which is $\frac{1}{2}$; the bilge strake, F F, which is $\frac{3}{8}$; and the wales, G G, which are also $\frac{3}{8}$ of an inch thick. The side are strengthened with ribs of angle iron 16 inches apart, $3\frac{1}{2}$x$3\frac{1}{2}$ and $\frac{3}{8}$ of an inch thick, extending across the bottom at the angle of the cross keelsons, and firmly riveted to the outside plating and to the keelsons. Opposite the wales on the inside edge of the angle iron ribs, a clamp, H H, 20 inches deep and $\frac{3}{8}$ thick, extends around the vessel. On the top edge of this and the wales is placed a covering plate, I I, 13 inches wide and $\frac{3}{8}$ thick, also extending entirely around the boat, and strengthened with angle iron. The holes for the rivets in the plating are countersunk on the outside to receive the tapering rivet heads and make a smooth surface. To make the seams of the plating water-tight, after the riveting is done the edge is cut straight with a cold chisel, and is then upset with a blow on a blunt chisel or tool, in the same way that a steam boiler is finished. The stern, stern-posts and the rudder are all made of wrought-iron. Four water-tight bulkheads, made of $\frac{1}{2}$-inch plate and strengthened with $2\frac{1}{2}$x$2\frac{1}{2}$ angle iron, extend across the vessel.

The *Alabama* is 225 feet long, 32 feet beam, 10 feet depth of hold, and measures 630 tons. Her draft when launched was 28 inches. The increase in the cost above that of a wooden vessel was about 30 per cent, if reckoned on the hull alone; but this increase, if reckoned on the total cost of the vessel, amounts to only 10 per cent. Iron vessels are not coppered, but are simply painted with either red lead or zinc paint. They require painting about once a year. So far as we know, they may last hundreds of years. One was taken up in the Clyde, which had been to sea 10 years, and the statement was that she had never leaked a drop, and was as good as she was on the day she was launched. A ship made of iron is better in every respect than one made of wood; it is lighter, stronger, sharper, tighter and more durable.

A NEW STEAM BOILER.—Joseph Harrison, of Philadelphia, a Russian contractor, cotemporaneous with the Messrs. Winans of "cigar-steamer" notoriety, has recently constructed and put into operation a newly-devised steam boiler, which, for novelty and probable utility, equals the "ocean shuttle" of his Baltimore friends. It consists of 300 cast-iron globes, six inches in diameter, connected together by tubes two or three inches long. Though the projector alleges perfect safety from explosion and an actual saving of 300 pounds of coal per day for 25-horse power, it is difficult to conceive how thick cast-iron can generate steam faster than the thin copper tubing of a locomotive boiler, or how it is easier to keep the right quantity of water to prevent explosion in 300 bombshells than in a single boiler.—*New York Tribune.*

[Our cotemporary is perfectly right about the inferior conducting power of cast-iron in comparison with copper, or even with wrought-iron tubes, and we must also say this is not altogether a new steam boiler. It is similar in principle (though somewhat different in construction) to Franklin's "duplex steam generator," illustrated on page 192, Vol. VII., of the SCIENTIFIC AMERICAN.

HOW TO MAKE HARD WATER SOFT.

One of our city subscribers—noticing in No. 12 of the present volume, SCIENTIFIC AMERICAN, an article on the above subject—called upon us and stated the fact that over 20 years ago a well was dug, 20 feet deep, on the Cottage Hill Farm, near Ravenna, Ohio, upon which he resided. It contained eight feet of water—after being stoned—the earth about which was blue clay, and the water was very hard. This serious defect was cured entirely, and the water softened permanently, by putting into the well four feet of gravel of the size of beans and upwards. He thinks this a sure remedy in all such cases, and wishes the fact made known through the SCIENTIFIC AMERICAN from Maine to California. If our informant's experiment was thoroughly made, and is correctly stated, no doubt the same results would be produced in all cases in which the essential circumstances are precisely the same, but we do not believe that his plan will render all hard water soft. When foreign substances are held in mechanical suspension in the water, a layer of gravel stones at the bottom may allow such substances to settle, but if the foreign matter is held in solution, the gravel could remove it only by getting into chemical combination with it, which would seldom occur.