The Composition of our Hydrant Water.

The following report was presented to the Directors of the Water Co. on Wednesday:

STATE LABORATORY,
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TRENTON, Oct. 30, 1855.

MR. SHERMAN—*My Dear Sir*:—After many unavoidable delays and interruptions, I have at last been able to complete the water analyses with which I was charged by you some weeks ago, and beg leave in the following brief report to lay before you the results.

The water of the Delaware which was submitted to analysis, was collected from the river on the 11th day of September last, at a spot opposite the pump house of the Water Works, and immediately over the grating through which the water is drawn to supply the reservoir. A specimen was also obtained upon the same day, of the water in the reservoir, for the purpose of comparing the proportion of foreign ingredients in the reservoir water, with that in the river water. The spring water analysed was obtained some days later, from one of the tanks from which the city was formerly supplied, in the rear of the residence of Mr. Closson.

The proportion of solid matter found in the several waters was as follows:

	Grains.
In one gallon of Delaware water,	3,5346
In one gallon of the reservoir water,	3.8555
In one gallon of the spring water,	3.6077

For convenience of comparison, I will here quote the results of Professor B. Silliman, Jr., obtained some years ago with the Croton and Schuylkill waters.*

Solid matter found by Prof. Silliman:

	Grains.
In one gallon of Croton water,	10.93
In one gallon of Schuylkill water,	5.50

The most remarkable thing about these results is that notwithstanding the quantity of sand, mud, and other sediment which is suspended in the river water, so much as to injure the pumps, and which must be in great measure deposited and separated from the water in the reservoir, the latter, nevertheless, actually contains more solid matter than the river water itself. This can only be accounted for by the favorable conditions presented in the reservoir foa the growth of minute animals and plants, whose remains add of course to the weight of the solid residue obtained on evaporation. My pupil, Mr. Howland Bill, has at my request submitted the water in the reservoir, and the deposit formed at the bottom, to a microscopic examination, and reports to me that he finds in the water several varieties of animalcules and lichens or minute plants, and that the sediment especially is almost wholly composed of forests of minute plants through which roam herds of such animals as *Volvox globator*, or "globejelly," *Vibrio anser*, or "goose animalcule," and several species of *Bacillaria* and *Navicula*. On the surface of the water he found a slight green scum, which when magnified resolved itself into collections of the *Cercaria mutabilis*, an animal production characteristic of stagnant water. Numerous large green water weeds may also be seen floating in the reservoir.

Recurring to the results given above, it may also be remarked that the river water is really somewhat less charged with foreign ingredients than that of the springs, although the latter is is so much more pleasant to persons possessing delicate organs of taste. This probably arises from the fact that the principal mineral ingredient in spring water, as shown by the analysis, is *chloride of sodium* or common salt, while the river water is principally contaminated with carbonates of lime, magnesia, potash, etc., which give water a bitter taste.

The analyses will be found below in a complete form and arranged so as to admit of a comparison between the composition of the river and the springs.

	RIVER.	SPRINGS.
	Grains in one gallon of 58,372 grains.	
Whole solid matter found,	3.534581	3.607750
Carbonate of lime,	1.300000	——
Carbonate of magnesia,	.889272	——
Carbonate of potash,	.172471	——
Chloride of sodium,	.106834	1.021225
Chloride of potassium,	.012190	——
Sulphate of lime,	.185847	.009233
Phosphate of lime,	.142338	.144659
Silica,	.497587	.755894
Sesquioxide of iron, with trace of alumina,	.027453	.126778
In combination with the silica and organic matter: Lime,	——	.277662
Magnesia,	——	.355620
Potash,	——	.493059
Soda,	——	.173518
Oxide of manganese,	trace.	——
Carbonic acid,	——	trace.
Organic matter containing ammonia,	.634852	.558342
Specific gravity,	1.00071	.99972

The specific gravity of the Reservoir water was 1.00064.

On comparison of this analysis of the waters of the Delaware with other analyses of river waters, the fact is rendered apparent that few rivers exist whose waters are so free from impurity. All causes of complaint which have arisen are due to the improper mode of storing the water for use. Open reservoirs, in which the water is kept standing for several days to stagnate in the heat of the sun, are perfect hotbeds for the growth of animal and vegetable life. Finding every necessary requisite to their germination, light, heat, and an unlimited supply of fertilising mineral substances, phosphates, sulphates, carbonates and silicates of lime, potash, ammonia, etc., infinite numbers of minute seeds spring forth into growing plants, which in their turn furnish nourishment to innumerable swarms of living animals engendered from their embryos pre-existent in the water. The breeding of these microscopic creatures, under favorable circumstances, is so rapid that in a very few hours the water will become alive with them. It was to one of these animals, a species of *Cyclops*, that the so called "fishy" taste and smell of the reservoir water which has at two or three periods been found so annoying, was due.

I have here a simple plan to suggest, which has occurred to me in considering this matter, and which, if adopted, would undoubtedly prevent all difficulty in all future time. It is to *floor over* the reservoir. Keep the water stored in the dark. Deprive the organic germs of the light and heat of the sun, which constitute their means of life, and they will cease to germinate. The water being kept in a cool, dark place, will always be cool and pleasant.

I am Sir, very respectfully
HENRY WURTZ.
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N. J. State Chemist, etc.

*Silliman's Journal, II, 2,221.

Philadelphia, Friday, January 5, 1855.

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New York City Gas Works.

Having recently published a description of the Philadelphia Gas Works, the following account of the Gas Works of New York will doubtless be read with interest:

HOW THE CITY IS LIGHTED.—The splendid new works of the Manhattan Gas Company are now on the point of completion, at the foot of Fourteenth street, E. R., and which are thus increased to a scale of magnitude commensurate with the growing wants of the city. An opportunity is thus afforded for presenting some facts of interest respecting the manner in which the city is illuminated artificially at night. These works will cost over $1,000,000, and are the largest in the country. Philadelphia, too, has recently completed very costly works, which would compare favorably, and are chiefly noticeable on account of the enormous size of its gasometer, now building, which will be capable of holding 2,000,000 cubic feet of gas, or as much as the whole six used by the Manhattan Company.

Two large companies are engaged in supplying gas for New York city, viz., the Manhattan Company, which has a capital of $2,000,000, and the New York Company, with $1,000,000 capital. The former lights all that portion of the city above Grand street, the latter all below. The total amount of gas annually manufactured by these two companies, on the enlarged scale of operations, is estimated at 730,000,000 cubic feet, one sixth of which is consumed by street lamps, now numbering about 10,000. The Manhattan Company lights 6,512, and has pipe laid for 700 more, which will soon be added. The New York Company lights 3,068. These lamps each consume about three feet per hour, which is equal to 420,000 feet of gas consumed by the whole number during the long nights of fourteen hours, in mid-winter. The increase of their number averages about one thousand yearly—nearly all on the new streets and avenues. Of the whole amount of gas made about twenty per cent. is unaccounted for, owing to losses by leakage and surreptitious burning, it being a common practice for parties to help themselves, by tapping the pipes unknown to the Companies. Two cases of this description of fraud are now before the courts.

An enormous quantity of coal is required for the manufacture of gas. It is nearly all brought from England. One of these companies uses about 60,000 tons annually. The Manhattan Company has at present in the yards not less than 40,000 tons of coal, valued at $500,000. There are 12,000 tons in a single pile. This Company has one hundred and twenty miles of pipe underground, of which fourteen miles were laid during the year just closed.

The gas coals are the most expensive brought to market. Of these, the Cannel is the most valuable, and next in order the Newcastle and the Pittsburg. The New York Companies usually import all their coals, but during the past year they have been compelled to use the domestic coal to a considerable extent, as a temporary substitute, because of the high price of the foreign article, which was increased by the strikes for wages at the mines, and by the enormous freights. In the early part of the present year, some of the English mines were closed entirely, and Cannel, which usually sells for $8 or $9 per ton, was sold for from $14 to $18 per ton. Newcastle advanced from $6 50 and $7 to $12 and $13

The consumption of gas has increased in a rapid ratio, more being manufactured now in one week than was required during twelve months, eight or ten years ago.

The following is descriptive of the new works of the Fourteenth Street Station of the Manhattan Company:

These immense gas works, now being built, cover 122 lots of ground, recently recovered from the river. They are located on the east side of the city, near the river, and have a front on Fourteenth street of 1,681 feet, and on Fifteenth street of 1,583 feet. On the block between avenues B and C, are placed the gasholders meters and purifyers. On the block between avenues C and D are the retort houses, coal houses, workshops, condensers, washers, engine, office, coke stores, &c. The space between avenues D and the river is reserved for coal.

The gasholders, of which there are to be six, will *each* contain 350,000 feet of gas—equal to a total storage room of 2,100,000 cubic feet. They are "telescopic," 95 feet in diameter and 52 feet high, built of thick sheet iron plates, with strong internal frames of bar and angle iron. They are placed in brick tanks, sunk in the earth. These tanks are filled with water, to prevent the escape of the gas from the holder, and to allow the latter to rise and fall, according to the quantity of gas contained in it. On the tanks and around the gasholders are strong cast iron frames, composed of columns and girders which guide the gasholders, keeping them in a perpendicular position as they rise above the level of the water in the tank. When the gasholders have attained their highest elevation, the lower edges are still immersed in the water.

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The pipes which convey the gas to and from the gas-holders, pass under ground, beneath the bottom of the tanks and rising within, open above the water and within the holder—and as the gas is only about one half the weight of atmospheric air, the holder rises as the gas enters, precisely on the same principle as a balloon rises when filled with gas. When the pipes which communicate with the street mains are opened, the gasholders descend and press the gas forward in a steady uniform flow to every street and dwelling.

The "purifying house" is 123 feet long by 67 feet wide. On each end of this house is a "lime house," each 41 by 67 feet. These buildings occupy the entire front on the west side of avenue C, from 14th to 15th streets. There will be eight purifiers, each 25 feet square; four are completed and at work. Each purifier contains seven rows, or shelves of perforated sheet iron plates, which are covered with lime. The gas enters at the bottom, and passes upward through the lime, and makes its exit through the top. Nine cart-loads, or 280 bushels of lime are required to charge one purifier. The lime deprives the gas of its carbonic acid and sulphuretted hydrogen. Above the purifiers, and extending the entire length of the house, are two lines of railroad, from which the purifier-covers are suspended, and by means of which they can be removed, when it is necessary to open the purifiers to change the lime. The latter is soon changed to a dirty yellow color, from the sulphuric accumulations.

The "meter house" is in the rear of the purifying house, and contains two enormous meters, each fifteen feet in diameter, calculated to register 3,000,000 cubic feet of gas in 24 hours.

The purifying, lime and meter houses have iron-framed roofs, covered with slate, and are fireproof.

On the east side of avenue C are the office, engine and boiler, houses, machine shop and carpenter's and blacksmith's shops. On the top of the engine and boiler-houses is a cast iron tank, 40 feet square and 5 feet thick, and supplied with water from a well placed in the rear of the meter-house. The water is pumped up by a Worthington steam pump. A 30 horse power engine drives the machinery used for drilling and cutting pipes, works the gas pumps or "exhausters," and blows the fires at the forges.

On the south side of the engine house are two cast-iron cylinders, each 10 feet in diameter and 25 feet high. These are the "scrubbers" or washers, and are filled with coke. The gas enters at the bottom and passes upward through the coke, which is kept wet by several streams of water from the tank. These vessels are intended to arrest any coal, tar or ammonia, which may have passed through the condenser.

The "condenser" is a series of cast-iron pipes, 20 inches in internal diameter and 20 feet high, standing on a cast-iron base or box, about 4 feet high. It is 120 feet in length, and contains three rows of pipes, placed side by side. Within the 20 inch pipes are other pipes, 6 inches in diameter, open at each end, and through which the atmospheric air passes. There are over three quarters of a mile of 20 inch pipes and over a mile of 6 inch pipe in this mammoth condenser. The condenser is one of the most conspicuous objects presented to the eye when approaching the works, and the long series of huge block pipes, highly elevated, is suggestive of an enormous church organ, such as might originate the "ocean's eternal diapason."

Before entering the condenser, the gas passes through the "jet washers." These are cast-iron boxes, each 8 feet high and 3 feet square. There are 18 of these boxes, containing two jets each. The jets being placed near the bottom of the boxes, the water is thrown up against the roof, and falling back, fills the boxes with spray. The gas as it issues from the retort is hot and heavily charged with vapors of coal, tar, ammonia, &c., which are here arrested in part by the jets above described.

The retort house is 245 feet long and 186 feet wide. The walls are of brick, the floor of stone, and the roof of iron covered with slate. Of the 900 retorts enclosed, 150 are already at work. Gas was first made here on the 8th ult.

The other works of this Company are on the North River side, between Seventeenth and Eighteenth streets. They contain 600 retorts, and produce, at this season of the year, about 1,800,000 cubic feet of gas a day. The Company pays $6000 weekly for the wages of laborers

The process of manufacture may be described as follows:—The coal being carefully weighed, is thrown into the "retorts" and levelled with a rake. The retorts are of cast iron, 8 feet long and 20 inches wide, of an arched shape, and are placed horizontally. Five of these retorts are set in brickwork, so as to be heated by one fire. Each retort has a mouth piece, which projects from the front of the brick work, and from which there rises an upright pipe about 12 feet in length and 5 inches in diameter, employed to carry the products of distillation into the "hydraulic main." Each retort has a lid, which is kept in its place by holdfast screws, rendered air-tight by clay luting. The hydraulic mains are long horizontal pipes, of a capacity sufficient to convey away the products from 75 retorts, or one range each. The pipes from the retorts dip into the main, so as to be sealed by the fluid which fills the lower half of the main, and which is allowed to run off at that level. This fluid is of a very complicated nature, but tar and ammoniacal liquor are the most valuable parts. The first, is used for a paint, and for the production of naptha and varnish,—the latter is converted into sal-ammoniac, sulphate of ammonia, and into smelling salts for the ladies. From the hydraulic main, the gas passes to the "washers," and "condensers," where the ammonia and tar are entirely removed. It then passes through the "purifiers," where it is deprived of the carbonic acid and sulphuretted hydrogen. The gas being now thoroughly purified, is measured and stored ready for use.

It takes from four to five hours to work off a charge of coal, which is from 150 to 200 pounds of coal for each retort. At the end of that time, the lid is unscrewed, and the coke (which is the charcoal of coal) is removed. This coke is used in the furnaces beneath the retorts, and produces a most intense heat; but a considerable portion, about one-third of the quantity made, is sold and is valued highly as a fuel by bakers, jewellers and others, who prize it the more because it is entirely freed from the sulphur which previously existed in the coal; on this account it is also used to a great extent in the chambers of the sick.