WATER-WORKS OF AMERICA.

TROY, N. Y.

REPORT FOR THE YEAR ENDING MARCH 5, 1861.

The amount of rents for the water rent year, commencing May 1, 1860, assessed on premises liable to rent, and payable into the chamberlain's office, at the same time as the annual city taxes on such premises, and as a part thereof, was—

In First District	5,178 52
In Second District	8,001 69
In Third District	10,304 40
	$18,479 61

Increase over the year 1859.....$516 78.

In addition to the assessed water rent, receivable in the chamberlain's office, the clerk has received in the water-works office, during the year, and paid to the chamberlain, the sum of $4,122 90 from these sources, viz.:

For special rates on seminary, schools, churches, jail, etc	339 50
For mason uses, erecting buildings	425 41
For four quarters' rent of tenant-house at reservoir	60 00
For street sprinkling with small hose	20 50
For job work, and pipe sold	3,287 49
	4,122 90
Total income for the year	$22,603 51

The receipts in the office, by the clerk, were $1,682 07 less than the previous year; for the reason that no permits for street sprinkling, because of the short supply of water, were issued, except to a small amount, in September; and that the job-work, which varies materially from year to year, was less. As job work is done at cost, of course the expenses for labor, lead pipe and iron pipe were much less than the previous year.

EXPENDITURES FOR THE YEAR 1860.

These are embraced under the following heads:

Interest on Water-Works debt	4,059 06
Monthly pay-roll, including clerk's salary	3,270 17
Superintendent's salary	700 00
Lead pipe	666 01
Surveys and maps	225 00
Work and materials, in part, on construction	8,888 74
Iron pipe for laterals	102 00
Brass castings, $106 20; iron castings, $111 08	217 28
Stop-cocks, $220; hydrant posts, $55	275 00
Hardware	202 92
Force-pump, near State Dam	800 00
Rent of building and water-power for pump, 6 months	500 00
Ground rent and release thereof, on lake in Brunswick	869 00
Cleaning reservoir and fire-dam	823 75
Printing annual reports and advertising	69 88
Blacksmithing, $77 02; anthracite coal, $42 25	119 27
Lumber, $90 96; old metal, $76 12	167 08
Charcoal, $46 95; Straw, $23 66	70 61
Taxes on property in Brunswick	43 81
Team work and horse hire	50 05
Freight, $15 50; paint and oil, $22 85	38 35
Rent of barn for storage	31 50
Stebbin's patent draught-cocks	69 15
Water-gauge, $26 81; stone, $24 75	51 06
Carpenter's work	78 87
All other expenses, contingent	81 70
Total expenditures	$21,659 21

The income, it will be seen, exceeds the expenditures $943 30; leaving this amount of the year's income unexpended, in the chamberlain's office, to the credit of the works.

The expenditures are thus classified:

For interest, salaries, labor, materials, six months' rent of power for pump, and all ordinary expenses of the works	11,518 41
For construction	10,140 80
	$21,659 21

This reservoir dam, which was commenced under contract in September, 1859, the contractor failed to finish at the time limited, and after settlement with him, it was directed that the dam be finished under the charge of the superintendent.

There was expended upon this reservoir for land, surveys, and labor, the previous year, to March 1, 1860, the sum of	6,653 82
Add the expenditures of this year	9,016 61
Total cost thus far	$15,669 43

There is due for land to Robert P. Winne, four hundred dollars, for which he holds a city bond, at six per cent., to be paid whenever he removes the incumbrance and gives a clear title. This sum, together with the expense of fencing the reservoir, which has not yet been done, will make the total cost something more than $16,000.

COMPARATIVE STATEMENTS OF RECEIPTS AND EXPENDITURES FOR SIX YEARS.

The Water-Works have been under the charge of the present officials for six years. During these six years the receipts and expenditures have been thus:

	Assessed Rents payable to the Chamberlain.	Paid to Chamberlain by the Clerk.	Total Receipts.	
1855	15,324 60	5,520 94	20,845 54	
1856	16,005 57	5,169 16	21,174 73	
1857	16,898 47	5,043 19	21,941 66	
1858	17,131 11	4,770 66	21,901 77	
1859	17,963 83	5,807 97	23,770 85	
1860	18,479 61	4,122 90	22,602 51	
Total receipts				132,237 06

	Paid for Interest and Ordinary Expenses.	Paid for Construction.	Total Expenditures.	
1855	12,511 88	0,000 00	12,511 88	
1856	12,124 59	8,863 69	20,988 23	
1857	11,378 58	11,555 08	22,933 94	
1858	10,857 36	11,484 69	22,342 05	
1859	12,141 81	8,769 43	20,924 74	
1860	11,518 41	10,140 80	21,659 21	
Total expenditures				122,264 60
Balance of six years earnings, in chamberlain's office unexpended				$9,972 46

It will be seen that the water rents, assessed, have increased each year, owing to new buildings, new uses, and chiefly to the extension of street mains.

The payments for interest, salaries, labor, materials, and all ordinary expenses of maintaining the works during these six years were	71,181 91
Surplus earnings during the same time	61,105 15
	$132,237 06

Of these surplus earnings there has been expended:

For new reservoir	15,669 43
For force-pump	1,062 18
For iron pipe and street mains	34,401 08
Expended	51,132 69
In chamberlain's office unexpended	9,978 46
	$61,105 15

STREET MAINS LAID.

The street mains laid in six years, consist of:

325 feet 3-inch pipe.
2,642 feet 4-inch pipe.
821 feet 6-inch pipe.
5,075 feet 8-inch pipe.
4,022 feet 20-inch pipe.

12,885 feet, equal to 2 miles 2,325 feet, nearly 2½ miles.
19 stop-cocks, of different sizes.
16 fire plugs.

COST OF THE WATER-WORKS.

The entire cost, to March, 1860, was	215,991 89
Add for construction this year	10,140 80
Total cost of construction to March, 1861	$226,132 69

WATER-WORKS DEBT.

This debt, in 1855, when the present officials took charge of the works, was $100,000. There was paid upon it in May, 1857, $10,000; in May, 1860, $10,000, and $9,000 of the bonds, held by the Commissioners of the Sinking Fund, cancelled. The money for these payments was raised $2,500 a year in the taxes, as provided by law, for a sinking fund, and from the rent of the Female Seminary.

There remains due	$71,000 00

This is payable:

May 1, 1863	10,000 00
May 1, 1866	10,000 00
May 1, 1869	10,000 00
May 1, 1872	6,000 00
May 1, 1875	15,000 00
May 1, 1880	20,000 00
	$71,000 00

Interest 5 per cent., semi-annual.

THE NEW RESERVOIR.

This is situated on the Piscawen Creek, about fifty rods east of Oakwood Avenue, and about half a mile east of the Distributing Reservoir. It was commenced in September, 1859, and, as before stated, but partly finished in that year. The land purchased for its site was ten and fifty-six one hundredths acres, and when full to top-water line, the flow will be about eight acres. The water in the deepest part is thirty-five feet, and the average depth from fifteen to eighteen feet. It was finished, except the waste-wier, and this shortly thereafter, by the first of July, 1860, and will contain forty million gallons.

A full description of the manner in which the dam is built, after the most approved plan of building earth dams, was published in the last annual report, an abstract of which will be found on page 289, vol. II., of this JOURNAL.

As the water which supplied the city came from the rivulets and lakes in Brunswick and passed through the pipes in this dam, and the season remarkably dry and water low, no surplus was accumulated in this reservoir till the latter part of August, at which time it became full. From that time, during all the fall and winter, it has supplied the city, continued full, and discharged, almost daily, a surplus over the waste-wier, and this without drawing from the lakes in Brunswick. At the time of the thaw and freshet in February, the pipes in the dam, two twelve-inch and one eight-inch, and the waste-wier, a circular brick sewer four by five feet in diameter, were not sufficient to pass off the water, and it made its way over the ground on the south side of the dam. The surplus water, which thus passed off to the Hudson, during two days, was probably sufficient to fill two additional reservoirs of the size of this new one.

The capacity of the Piscawen Creek and its tributary springs and rivulets to supply the city with water can be fully and fairly tested only by building additional reservoirs as often as needed, and as long as there is surplus water to fill them.

THE FORCE-PUMP.

In the fall of 1859, seeing that the new dam would not be finished in December, at the time limited by the contract, and apprehensive that there might be a short supply of water in the spring and summer of 1860, before the dam could be completed and filled, the officials purchased twelve inch iron pipe to be used if occasion required, for a pump at the Hydraulic Canal, near the State Dam, and in the winter of 1860 made inquiries for purchasing a lot on said canal, or hiring the necessary power. It became evident in the spring of 1860—the fall, winter, and spring being very dry, and the lake in Brunswick in April not full—that a pump would be useful, perhaps absolutely necessary as an auxiliary, in providing the requisite quantity of water for the use of the city during the summer.

The delay in putting in operation the pump was caused by the Common Council withholding the appropriation till the 2d of July. As soon thereafter as could well be done, premises and water-power were engaged of the Troy Cordage Company, on the Hydraulic Canal, a pump purchased, capable of raising four hundred and fifty thousand gallons in twenty-four hours, and put in operation the 5th of August. The cost of the pump, pipe, and fixtures was $1,349 34. The annual rent of the building and power was $1,000, definitely engaged for one year from July 15th. Six months of this rent has been paid in this fiscal year. The twelve-inch pipe through which the water was forced, was connected by a branch with the original twelve inch main in River street, and the water was forced directly into the city pipes, and when these were full, the surplus into the distributing reservoir. From the 14th of August, when the rains commenced, the Piscawen Creek furnished an ample supply for the city, but the pump was kept in operation till the 10th of September, for the purpose of enabling the reservoir and fire dam to be cleaned, since which time it has not been worked.

THE STREET MAINS.

During the winter just closing, not a single instance of a break or a leak in the main pipe has occured. Such a thing in any part of the year rarely happens, and it is evident, therefore, that the mains are strong, well laid, and beyond the effect of frost.

WASTE OF WATER.

The quantity of water wasted every year is probably equal to that used for all needful purposes. This waste arises from leakage under ground, by hydrants partly worn out and neglected to be repaired, and from hydrants unnecessarily, and sometimes wantonly being left open, and the water allowed to run. The men employed on the works are directed to be watchful to detect waste, and to punish by shutting off the water; but as the number is small, they cannot, in all cases, be cognizant of a violation of the by-laws in this respect. It is expected and recommended that all takers use freely all that is necessary, and allow no waste, and doubtless if some families in some localities would use water more freely for personal and household cleanliness, their health and comfort would be greatly improved. It is unwise and unnecessary for a city to expend its thousands every few years for an increased supply, while a quantity equal to such an increase is negligently or heedlessly wasted.

WATER-METERS.

In the annual reports of water-works of other cities, complaints are made about the waste of water, and suggestions as to the necessity of some effectual means to check it. Hence, meters have been introduced in Albany, New York, Boston, Detroit, Cincinnati, etc., and applied to large establishments, and the water sold at a fixed price per one hundred or one thousand gallons. Thus, the taker, as in the case of gas, pays for what he takes. The Troy Water Commissioners have on hand one meter, to be tried the coming season, as an experiment. As at present informed, meters are not generally recommended for private dwellings. They will, evidently, however, serve the valuable purpose of aiding to equalize the price of water on breweries, hotels, livery stables, and other premises, where the use, as well as the abuse, is great.

HISTORY OF THE WATER-WORKS.

The Troy Water-Works were built in 1833, on a scale, at that time, adequate to supply the population of the city, which was about twelve thousand, and capable of enlargement, by adding new reservoirs, as population should increase and need require, to an extent not yet fully known. It appears that Troy was the second city in the United States which introduced iron pipe for street mains—Philadelphia being the first. From 1833 to 1853—twenty years—very little was done in the way of extending street pipes, or increasing the storage of water and frequently the city suffered heavy losses by fire on account of the want of water. The Water-Works were treated as finished, and considered by many, and so talked of, as a failure, attended with taxation each year to sustain them. But the Committee on Water-Works of the Common Council, in 1852 and 1853, thought differently; being satisfied that a sufficient quantity of water for the use of the city then, and for some years to come, could be supplied from the present source, if kept in store, they therefore purchased land and enlarged the upper lake in 1853. From that time till the fall of 1858—five years—there were no intimations of a short supply. But during these five years, under the operations of the new law of 1855, when every premises was required to pay rent, and almost every one had the water introduced, this change in the system, with the increase of population and new uses, probably doubled the consumption and the waste of water. Hence, with a dry season, the short supply of 1860.

The cost of the works to March, 1855, was $175,000; to March, 1861, $226,132 69—a very low figure for a city water-works, and the price of water for a premises is correspondingly low. With the works, as thus far constructed—the debt remaining unpaid, small—the facility for adding storing reservoirs on the Piscawen, great—and the Hudson river available when need requires—the city for all time to come, can be easily and cheaply supplied with abundance of water, and the citizens of Troy may well be congratulated upon these highly favorable circumstances.

BOARD OF WATER COMMISSIONERS OF TROY.

HARVEY SMITH, LIBERTY GILBERT,
WM. F. SAGE, J. M. WARREN.

GAS FROM SUPERHEATED STEAM AND COAL TAR.—It is said that superheated steam, charged with coal tar, produces, with marvellous rapidity, and at an exceedingly low price, any quantity of a very rich gas for lighting. Careful analysis shows it to be composed of free oxygen, 1-8; carbonic oxide 3; carbonic acid, 5-8; bicarburetted hydrogen 17-8, and protocarburetted hydrogen, 17-9. Compared with ordinary coal gas, this artificial gas is found to contain nearly one-half less carbonic oxide, and twice as much bicarburetted hydrogen—its intrinsic value, therefore, being twice as great. It is entirely free from sulphuretted hydrogen, and its composition proves that it is a very permanent mixture or combination, which remains intact for any distance it may be conducted.

GAS EXPLOSION IN A SEWER.—Five men recently went into the Southwark Bridge-road sewer, in London, Eng., to recover tallow which had flown into it from the great fire in Tooley street. An accumulation of gas was ignited by their candles, and violently exploded. The men were taken out, considerably injured.

ROCK OIL, ITS GEOLOGICAL RELATIONS AND DISTRIBUTION.

BY PROF. E. B. ANDREWS, MARIETTA COLLEGE, OHIO.

My investigations have been directed chiefly to the oil of the coal rocks, and I propose in this paper to give some of my results.

The surface indications of petroleum are oil and gas springs. These springs are found scattered over a very large area.

It is doubtless well known to scientific men that there are, in the West, two distinct geological formations from which petroleum or rock oil is obtained. These are the bituminous coal measures and the Portage and Chemung groups, (the Waverly sandstone of the Ohio Reports). The Portage and Chemung rocks sweep around in the form of a quadrant from northwestern Pennsylvania into southern Ohio, and south into Kentucky. Upon these rocks the famous oil regions of Pennsylvania and northeastern Ohio are located. The oil regions of western Virginia and southern Ohio, including a portion of western Pennsylvania, lie in the coal measures. Marietta, Ohio, may be regarded as near the centre of these extensive oil fields.

It is well known that in the manufacture of coal oil a large amount of vapor or gas remains uncondensed. The town of Newark, Ohio, has been lighted for several years by the surplus gas from the oil works there. While it is believed that the oil cannot be produced in the subterranean distillation without the production of gas, it is also reasonable to suppose that at the very low temperature at which this distillation must take place, the formation of gas necessarily implies the formation of more or less oil. Hence in our bituminous coal measures a gas spring doubtless indicates the existence of oil in the rocks below. The great majority of these gas springs are unknown, since they are seldom discovered, except when they appear in streams; and probably the same may be true of oil springs, since the soil would absorb the oil, and in only a few cases would it be detected. I have assumed that the oil is the product of the distillation of bituminous strata, at low temperatures. This theory, which is a modification of the old one of distillation (at high temperatures), has recently been brought forward by Prof. J. S. Newberry, and has received the sanction of many of our most eminent chemists. The chief objection to it is the fact that the coal, cannel and bituminous, in our oil regions gives no evidence of having lost any of its full and normal quantity of bitumen or hydrocarbons. For example, at Petroleum, Ritchie Co., Va., where strata have been brought up by an uplift from several hundred feet below, seams of cannel and bituminous coal appear, which, if judged by the standard of Nova Scotia or English coals, have lost none of their bituminous properties. The cannel coal, although somewhat earthy, yields from forty to sixty gallons of oil to the ton.

The other theory, that the oil was produced at the time of the original bituminization of the vegetable or animal matter, has many difficulties in its way. If the oil were formed with the bitumen of the coal, we should expect that wherever there is bituminous coal, there would be corresponding quantities of oil. This is not so in fact, for, as will be seen presently, there is no oil except in fissures in the rocks overlying the bituminous strata, and these fissures can be shown to have been made since the coal strata became bituminized. Again, upon this theory it will be difficult to explain the large quantities of inflammable gas always accompanying the oil. If it is generated exclusively from the oil, then we should expect to find the quantity of oil least where the gas springs have for ages been the most active, but at such places the oil, instead of being wasted, is the most abundant.

That the oil is accumulated in fissures in the rocks and that these fissures are more or less vertical there is abundant proof. The oil in the same neighborhood is found at very different depths. It is very seldom that two adjoining wells strike the oil at the same distance below the surface. The accompanying diagram shows the relative depths of oil wells on Burning Spring Run in Wirt Co., Va. It is evident that in this case the oil is not contained in anything like a horizontal reservoir. The famous Lewellyn well marked No. 2, struck an oil fissure at one hundred feet, while the Athens Company's well marked 8, struck a large

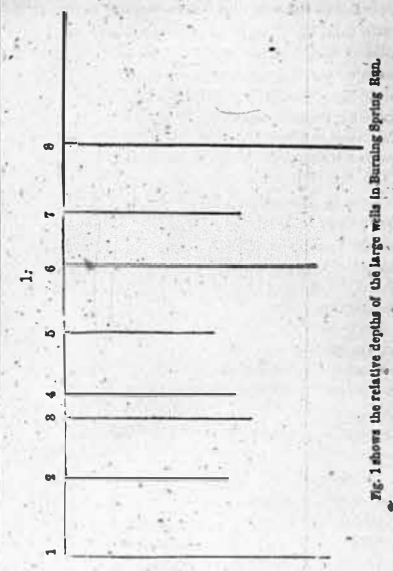

Fig. 1 shows the relative depths of the large wells in Burning Spring Run.

vein at two hundred feet. The oil in the first is said to stand at 41°, (Beaumé,) while that of the latter stands at 33°. On Duck Creek, Washington Co., Ohio, wells very near each other show a difference of ten degrees (Beaumé) in specific gravity.

At Smith's Ferry, in Western Pennsylvania, on the Ohio River, much of the oil is of a light straw color, while it is said other wells yield an oil of the more usual dark-greenish color. On the same lease of land and within six or eight rods of the well marked 8 in the previous figure, is a well two hundred and fifty feet deep. The oil from this well is not only different in its specific gravity from that in the other, but the deepest well contains fresh water, while the other contains salt water. From these and similar facts, it is evident that the oil is in distinct and separate fissures, and that these are vertical rather than horizontal.

The contents of these fissures are generally water, at the bottom, oil floating upon the water, and gas filling the space above the oil. Where the gas finds an outlet through a crevice in the overlying rocks, there is produced a gas spring. When the water finds an outlet it carries the oil with it and an oil spring is the result. I have found oil springs high up on hill sides.

An oil fissure may be struck at any point. The following figure will illustrate this. The letter *a* (fig. 2) shows the position of a well which strikes near the top of a fissure and in that part which is filled with gas. The gas rushes up but no oil. If again the well bored at *b*, it will strike oil, and the gas pent up in the upper part of the fissure will force the oil up through the well *b*. There are several oil wells on Little Kanawha in which the gas has forced up very large quantities of oil. The action of the gas, however, soon becomes fitful and intermittent. If again the well is bored at *c*, it will strike that part of the fissure which contains water. In such case oil can be obtained only by pumping out the water. Doubtless many good oil wells are thought to be worthless, and abandoned because they contain at first only water. If bored at the point *c*, in the water part of the fissure, water alone is to be expected until the pump has been used. There may be floating upon the water, higher up in the fissure, a large quantity of oil.

If the oil is found in fissures in the rocks, it is natural to suppose that in those places where the fissures are the most numerous and largest, the oil would be formed in the largest quantity. This antecedent probably is fully verified by the facts. The