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Official Copy of Proceedings

CITY OF ALBANY, N. Y.

IN COMMON COUNCIL

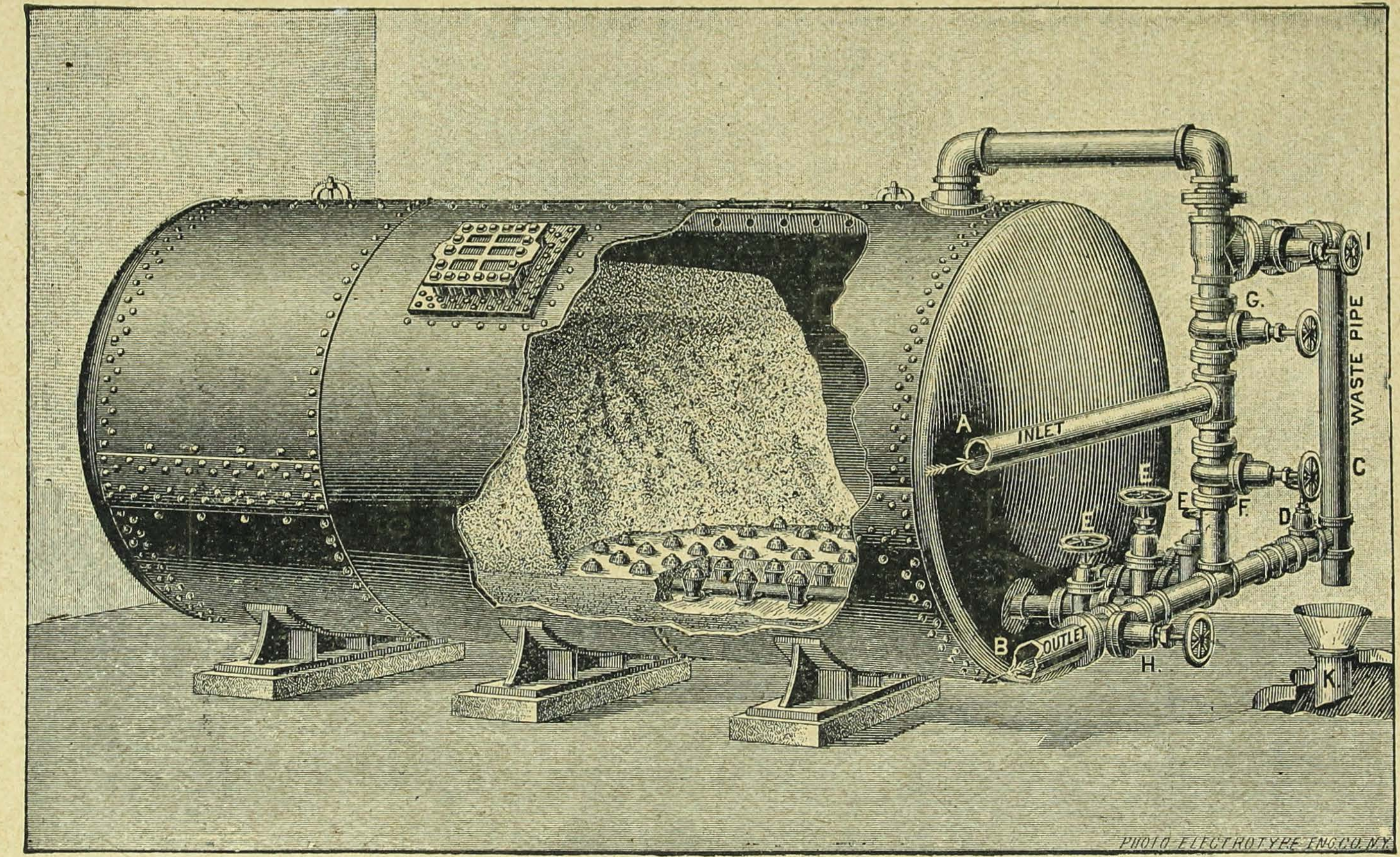
MONDAY, MARCH 1, 1897.

SHOWING DIFFERENCES IN COST BETWEEN THE AMERICAN SYSTEM OF MECHANICAL FILTRATION AND THE EUROPEAN PLAN OF SAND FILTRATION.

WITH COMPLIMENTS OF

NEW YORK FILTER MFG. CO.,

120 Liberty St., N. Y.



HORIZONTAL SECTIONAL WASHING PRESSURE FILTER.

Suitable for City Water Works.

NEW YORK FILTER MFG. CO.

CITY OF ALBANY.

IN

COMMON COUNCIL,

MONDAY, MARCH 1, 1897.

REGULAR MEETING.

The Board convened at 8.45 p. m. and was called to order by President Donovan.

The roll being called the following Aldermen answered to their names:

JOHN F. DONOVAN, President.

Alderman	Bailey,	Alderman	McKiernan,
"	Brady,	"	Pauly,
"	Clancy,	"	Pritchard,
"	Collins,	"	Sheehan,
"	Corscadden,	"	Slattery,
"	Cox,	"	Smith,
"	Ebel,	"	Stevens,
"	Golden,	"	Wirth,
"	Havens,		

Quorum present — 18.

The minutes of the regular meeting, February 15th, and adjourned regular meeting of February 23d, were approved as printed.

COMMUNICATIONS FROM CITY DEPARTMENTS.

The following, from the Chamberlain, was received and ordered filed:

CHAMBERLAIN'S OFFICE,
ALBANY, *March* 1, 1897.

To the Honorable, the Common Council:

Gentlemen.— I respectfully report amount of audited Almshouse accounts paid during the month of February, 1897:

D. J. Hartnett, meat	$137 46
G. L. Thomas, fish	50 25
Joseph Fitzgerald, meats, etc.	78 36
M. F. Delehant, groceries	49 86
A. Whitmore, groceries	30 12
W. E. Drislane, groceries	24 88
A. Banfill, groceries	24 90
E. J. Duggan, groceries	28 22
J. H. & F. A. Mead, produce	38 53
J. B. & D. C. Slingerland, flour	103 00
William Sautter, drugs	21 70
F. Shields, tobacco	26 10
G. M. Burhans, feed	68 50
American Soap & W. Co., soap	65 00
Mulderry Bros., carting	32 00
Henry Dumary, carting	40 00
John Kingsbury, sleigh	40 00
P. M. Frank, shoes	52 80
John Alex, cutting ice	116 48
Mann, Waldman & Co., dry goods	10 32
Welch & Grey, lumber	18 64
Times-Union, advertising	3 00
William Doyle, plumbing	43 60
W. G. Ostrander, milk	32 25
Electric Illuminating Co., lighting	10 54
Albany Hardware & Iron Co., supplies	8 50
M. Delehanty & Son, plumbing	12 80
W. M. Whitney & Co., supplies	9 38
Mackey & Palmer, produce	19 75

Bell & Ledger, crockery	$11 75
V. Magin, repairs to harness	18 25
Pay-roll	566 99
M. Scheiberling, repairs to buildings	23 00
G. D. McDonald, fish	19 95
Help account	416 00
W. C. Smith's Son, pork	17 50
	$2,270 38

JAMES ROONEY,
Chamberlain.

The following, from the Chamberlain, was received and ordered filed:

CHAMBERLAIN'S OFFICE,
ALBANY, *March* 1, 1897.

To the Honorable, the Common Council:

I respectfully report the expenditures of the Finance Department for the month of February, 1897:

Rubber stamps	$4 51
Regulator (Tax Department)	30 00
Coach hire, taking tax deposit to bank	25 00
Bond values	3 00
Postage, expressage, etc.	1 61
Numbering machine, blanks, printing and stationery,	66 15
Engraving checks, and blanks for Sinking Fund	66 00
Stamped envelopes	24 00
Official paper (lithograph)	70 00
	$290 27

JAMES ROONEY,
Chamberlain.

The following, from the Chamberlain, was received and ordered filed:

CHAMBERLAIN'S OFFICE,
ALBANY, *March* 1, 1897.

To the Honorable, the Common Council:

Gentlemen.— I respectfully report the receipts and expenditures of this office for the month of February, 1897:

	Receipts.	Expenditures.
City Water Works	$3,067 40	$33,408 25
Almshouse	247 43	2,270 38
Contingents	235 00	3,224 71
Board of Public Instruction	272 00	26,060 74
Police Court	58 00	500 00
General Debt Sinking Fund	60,000 00	11,495 33
Redemptions	27 99	27 99
City Taxes	82,968 83	....
Police Department	520 54	11,687 35
Police Pension Fund	21 91	....
Fund for Relief of Disabled Firemen,	890 35	685 50
Fireman's Insurance Fund	147 00	....
Interest	650 71	21,955 33
Street improvements	8,028 42	....
Redemption of bonds	....	65,000 00
Assessments for drains	....	1,500 00
City poor	....	1,791 65
Street contingents	....	1,506 32
Fire Department	....	6,503 48
Printing and advertising	....	455 06
Salaries	....	4,929 11
Refund of excise, 1896	....	3 29
Elections	....	40 00
Electric lighting	....	7,859 18
City Engineer	....	133 33
Stationery	....	483 97
Legal expenses	....	209 50
Removal of dead animals	....	41 65
Street cleaning	....	42 00
Civil Service Commission	....	83 33

	Receipts.	Expenditures.
City Court	....	$500 00
Centre Market	....	105 25
City Hall	....	604 07
City Building	....	230 48
Board of Health	....	752 35
Northern Boulevard, construction..	....	9,604 05
Albany Free Library	....	950 00
Beaver Park awards	....	78 27
Board of Plumbers	....	44 17
	$157,135 58	$214,766 09

JAMES ROONEY,
Chamberlain.

The following was received and referred to Committee on Water:

ALBANY CITY WATER WORKS,
SUPERINTENDENT'S OFFICE, ALBANY, N. Y., *March* 1, 1897.

To JOHN F. DONOVAN, Esq., *President of the Common Council:*

My Dear Sir.— There have been many inquiries made at this office as to when there would be a hearing given on the report of the Water Board recommending filtration for the city water supply. I have informed all persons that the matter was in the hands of the Water Committee of the Common Council, as I supposed that the report had been referred to this committee, as all reports of this kind have been heretofore.

Yesterday I saw in the printed minutes of the Common Council that the report had been simply received by the Council.

May I ask that at the meeting to-night that you refer it to the Water Committee or some other proper committee, so that a hearing may be given the citizens on this very important matter?

Yours truly,
Albany City Water Works,
GEO. I. BAILEY,
Superintendent.

The following, from the Board of Contract and Apportionment, was received and ordered filed:

OFFICE OF THE BOARD OF CONTRACT AND APPORTIONMENT,
ALBANY, *March* 1, 1897.

To the Honorable, the Common Council:

Gentlemen.— The Board of Contract and Apportionment at a meeting held this day adopted the following resolution:

"Resolved, That this Board recommends to the Common Council that the assessments for the expense of the paving, etc., with vitrified bricks of Knox street, from Clinton avenue to Canal street, and of Orange street, from Knox street to Robin street, as petitioned for by the owners of the abutting property, be and become due and payable in five (5) equal annual installments."

Also the following:

"Resolved, That this Board recommends to the Common Council that the assessments for the expense of the work of paving with vitrified brick, etc., Second street, from Watervliet avenue to Colby street, as petitioned for by the owners of abutting property, said street being 80 feet in width, be and become due and payable in ten (10) equal annual installments."

Respectfully,

THOS. J. LANAHAN,
Clerk.

COMMUNICATIONS.

The following, from James H. Blessing, relative to the filtration of city water supply, was received and referred to Committee on Water:

ALBANY, N. Y., February 27, 1897.

To the Honorable the Mayor and Common Council of the City of Albany:

GENTLEMEN: I beg to present to you the following communication:

I do not desire to antagonize in any way, any system of filtration, for I feel and know, that the time has come when we must do something to counteract the clamor about our water supply. I wish simply to explain and appeal to your good judgment a few matters in connection with the report of the Board of Water Commissioners to your Honorable Body, in relation to the construction of a filtering plant for our city. This report also contains the report of Mr. Allen Hazen, a Consulting Engineer employed by the Water Commissioners, to examine and determine the best means of filtration, and its cost, for our city. I do not wish to be understood as in any way questioning Mr. Hazen's ability, as I feel grateful to him for showing to the citizens of Albany the possibility of purifying Hudson river water. I however feel that he has made some errors in his calculation as to the cost of construction and maintenance of the two different plans of filtration as given in his several estimates on pages 27, 28, 29 and 30 of the report. Before taking the matter of estimates up, I would like to digress from that subject for a short time.

Question of Experiment.

I wish to say that I fully concur with Mr. Weaver, President of the Board of Water Commissioners, when he says, "In the adoption of any measure involving the expenditure of so large an amount of public money. as either of these plans would, we believe that the city cannot afford to experiment, but should adopt a safe, sure and proven plan." In regard to this question of experiment, I wish to call your attention to what Mr. Hazen says on page 18 of his report. "In speaking of this system of filtration, it should, of course, be borne in mind that in the fifty years during which filters have been constructed on a large scale, many improvements have been introduced, both in construction and manipulation, and the best modern practice is not at all represented by some of the earlier filter plants now in use; and, further, some of the American plants have been constructed on very economical principles, not in all cases adapted to securing the best results."

The American filters that Mr. Hazen refers to are the sand filters constructed on the European plan, for the cities of Hudson and Poughkeepsie, in this State, and, I believe, St. Johnsbury, Vermont, about twenty years ago. From this it would appear, if the experimental stage has passed, it must have been at a very recent date, in fact long since the introduction of the American system of mechanical filtration, as it is now about twenty years since their first introduction. And we learn from Mr. Hazen's report (page 20) that there are now in the United States and Canada one hundred and six cities and towns that have adopted the mechanical filtration. He says these five cities, namely, Atlanta (65,-533), Oakland (48,682), Wilkes-Barre (36,718), Quincy (30,-494) and Terre Haute (30,317), had populations above 30,000 each, and there were eleven cities with a population from twenty to thirty thousand, nineteen cities having a population from ten to twenty thousand, twenty-six cities having a population from five to ten thousand, and forty-five cities having a population of five thousand and less.

Now, gentlemen, does this not argue to you, if the mechanical filter is in its experimental stage, it has almost supplanted its more formidable competitor? And while Mr. Hazen admits the use of mechanical filtration for the city of Atlanta, having a population of 65,533, and in use in that city for the past ten years, and which, in February, 1893, was increased from 4,216,000 to 8,216,000 gallons daily, he thinks it would be without precedent and an experiment to install a mechanical filtering plant in Albany with a population of 96,000.

Inefficiency of Sand Bed Filtration.

I quote from Mr. Weaver's letter the following:

"For the reason that slow sand filtration has passed the experimental stage, is wholly free from mechanical or other patents, gives a better percentage of efficiency as shown, is the simplest, and is not dependent on the exact and punctual attendance of employes for its good and thorough operation, we are of the opinion that it is the method that should be adopted by the city."

As to the dependence on the exact and punctual attendance of employes for the good and thorough operation, I will call your attention to the fact that this old and tried system is not free from this defect. I will quote from Mr. Hazen's report (page 12) in relation to the filter at Hudson: "In the last four years the rate has been higher, averaging 5.3, or a little more than half of the Albany rate. During these years the filtration has been less efficient by reason of the fact that the demands of the city have exceeded the proper capacity of the filters, and also because of certain defects in the masonry of the filters." I will also quote from City Document, Forty-third Annual Report of the Water Commissioners, December 31, 1893, containing a report upon a proposed water supply by Frederick P. Stearns, Consulting Engineer: "There has recently come to hand, however, a report issued by the local government board of England, containing the results of an investigation of a severe epidemic of typhoid fever which occurred in Darlington, Stockton, Middlesborough and other places near them, in 1890-91; all of these places were supplied with water from the polluted river Tees, after what appears from the report to be slow filtration through sand filters of the kind generally used in England; and yet the report seems to show conclusively that the use of this water was the cause of the epidemic. Careful tabulations were made of the number of people attacked by the disease, during a period of sixteen months, in the com munities using the Tees water and in other communities in the same river valley supplied from other sources. The population using the Tees water was 219,435, of which 112 per 10,000 were attacked by the disease; while of 284,181 persons living in the other communities, where the Tees water was not used, only 11 per 10,000 were attacked. There seems to be no doubt that this epidemic was caused by the use of the Tees water, but I am unable to state whether it should be ascribed to imperfect filtration, to the admission of water to the pipes without filtration, or to the inability of a sand filter, as ordinarily constructed, to at all times render the water safe for drinking."

I might go on and recite to you many more cases where this tried system of filtration is in use, and notwithstanding, they have experienced the return of typhoid epidemics. But I do not deem it necessary from the fact that in the cases

I have quoted, coming as they do from such eminent authorities as Mr. Hazen and Mr. Stearns. In proof of this last statement I will refer you to a communication from the Water Commissioners' office to the Honorable, the Common Council of the City of Albany, January 15th, 1894, and I quote from it: "No one familiar with sanitary science need be told that Mr. Stearns is one of the leading authorities on this subject in the country. For many years he has been the engineering expert of the Massachusetts State Board of Health, during which time all public water supplies in that State have been subject to his examinations, and his contributions to this branch of engineering literature have become authorities." As regards Mr. Hazen's ability I need but refer to the fact that he has been selected by the present Water Commission as their expert.

In reference to Mr. Weaver's statements in his letter that sand beds are free from patents and give a better percentage of efficiency as shown, I claim by their report that they have not shown a better percentage of efficiency; and I further claim that they are not able to show it. As to patented rights, I know there is no law compelling one to avail themselves of the advantages that might be gained by such use. However, in this progressive age, I do not think it would be good judgment to ignore the advantages gained from the use of a meritorious invention.

Failure to Filter the Whole Supply.

There is one thing that I am unable to understand in this recommendation. It is the fact that they have provided for the filtration of only two-thirds of the city's supply, there being no provision made for filtering the amount supplied by gravitation. As that portion of the city east of Pearl street is supplied from Tivoli reservoir and will not have filtered water unless it be pumped up to Bleecker reservoir and then be allowed to run down into Tivoli, and by this means incurring a loss of pumping of about one-third of the total supply through an unnecessary head of sixty-six feet, I am sure there is no engineer living who would advise such a course. And again, if this was done, all the expense incurred a few years ago in constructing the new reservoirs for the better protection of the Tivoli supply, would have to be abandoned. And I believe you will agree with me, if the city's water supply is to be filtered the whole of it should be and not two-thirds only.

All we find in this recommendation in relation to filtering the gravity supply is found on page 8. I quote as follows: "In this report I shall concern myself only with the filtration of the water from the Hudson river. The water-sheds furnishing water by gravity contain only a scattered rural population, probably in no case exceeding 100 per square mile, and the water obtained in this way is believed to be comparatively pure. If it should require to be filtered at any time, filters can be readily constructed in connection with the various reservoirs without special difficulty; but this is not yet a pressing question."

The statement that there is no pressing need for the filtration of our gravity supply, coming from so eminent an authority as it does, leads me to believe that Mr. Hazen has not for himself looked into this matter, for if he had, he would find that the water-shed supplying Rensselaer lake is sand, and is a fairly good one, while the water-shed that supplies Tivoli reservoir, is twice the area of Rensselaer and it consists a part in clay, a part in sand, and a part in loam, and during a rain storm the mud simply washes into the settling basins and from there it is carried into Tivoli reservoir, and every one living east of Pearl street can vouch for its condition when it reaches the city tap in their homes.

The works with which I am connected are located on Church street, in the Fourth ward, and we have in them a small mechanical filter containing only 1.5 square feet of sand surface. And when the supply becomes dirty the people for blocks around come there for their water, and this running in the shop to get the water from the tap was so annoying that we now have a temporary pipe leading from the tap in the shop to just outside of the building, so that when the water is bad, filtered water can be drawn from the tap in the street, and when the water becomes clear, we remove this temporary pipe.

This is no over-drawn picture. I believe I can get nearly all the people living in the Fourth ward to corroborate this statement. I have seen this gravity supply so objectionable compared with the Hudson river, that if the Hudson river had been as bad, it would have reversed itself and flowed back to its original gathering ground to better its condition before returning.

I do not understand why there should be filters constructed, as Mr. Hazen suggests, for connection with the various reservoirs at an additional expense when all the gravity system, both Rensselaer and Tivoli, could be filtered through one system of filters for this purpose.

Abandonment of Present Intake.

About the abandonment of present intake, I do not know that Mr. Hazen made any test of the water in the river between here and Troy to determine at what point the best is found, and I think this is quite important. If my memory serves me right, it, however, is a matter of public record, along in the years 1887–88 there was a special commission appointed to improve our water supply. One of the first acts of the commission was to select Mr. Albert R. Leeds as their consulting chemist. Mr. Leeds, after examining samples of water taken from different points of the river between Albany and Troy, determined that the best water was found at a point about 1,500 feet above the present intake, and above this point the worst water was found; and ever since that time it has been a mooted question about extending the intake pipe up to this point. If Mr. Leeds was right, it certainly would not be advisable to place the filtering plant so far above this point and take the worst water found between Albany and Troy. As to the second advantage suggested by Mr. Hazen in his plan for locating the filters above the Lumber District, in anticipation that at some future time it might become necessary in order to supply a small, higher portion of the city with water, to build a reservoir on the high ground directly back of the proposed filter site. I do not call to my mind any other high ground excepting such as is known as Shaker hill, and to construct a reservoir of any size on this sand hill would involve a very large expenditure of money. However, when it becomes necessary for the supplying of a higher portion of the city with water the question can be solved in a more simple and cheaper way. I wish to call your attention to another fact in relation to locating the filter plant above the Lumber District. During freshets of the river it will be covered with water at a depth of from eight to ten feet. And quoting from (page 25) Mr. Hazen's report:

"Both the sedimentation basin and the filters would be carried up high enough so that no trouble would be experienced from freshets."

I need not explain to you that this carrying up means the filling in or building up with earth an area of seven or eight acres, to the depth of about six or eight feet, in order to get the top of the filter plant above high water.

I take from Mr. Hazen's report (pages 27–30) his estimates, as follows:

ESTIMATE NO. 1. SAND FILTERS ABOVE LUMBER DISTRICT.

Land	$10,000
Intake, 1,400 feet 54-inch steel pipe, including pump well, complete	14,000
Centrifugal pumps with boilers and house, complete	20,000
Sedimentation basin, capacity 15,600,000 gallons, exclusive of piping	56,000
Eight vaulted filters with extra heavy foundations, each 0.7 of an acre, total 5.6 acres	251,000
Piping about sedimentation basin and filters, including drain pipes and accessories	20,000
Pipe line to present pumping station, 8,000 feet of 48-inch steel pipe laid, complete	64,000
Engineering and contingencies	43,000
Total estimated cost of construction	$478,000

ESTIMATED ANNUAL COST OF OPERATION.

4,000 million gallons pumped 18 feet high, at $1.50 per million gallons - - - - -	$6,000
Operation of filters, at $2.50 per million gallons	10,000
Total estimated annual cost of operation -	$16,000
Cost of construction - - - - - -	478,000
Operating expenses capitalized at 5 per cent -	320,000
Total estimated cost of construction and capitalized cost of operation - - - -	$798,000

ESTIMATE NO. 2. MECHANICAL FILTRATION PLANT ABOVE LUMBER DISTRICT.

Land - - - - - - - - - -	$10,000
Intake, 1,400 feet 54-inch steel pipe - -	14,000
Mechanical filtration plant, capacity 15,000,000 gallons daily; effective area of filtering surface, 5,760 square feet; with buildings, boilers, centrifugal pumps for lifting water from pump well, etc., complete. - - - - - -	178,000
8,800 feet 48-inch steel pipe to present pumping station - - - - - - - - -	70,000
Engineering and contingencies - - - - -	27,000
Total cost of construction - - - - -	$299,000

ESTIMATED ANNUAL COST OF OPERATION.

4,000 million gallons pumped 22 feet high, at $1.75 per million gallons - - - - -	$7,000
Labor, coal, oil, etc., operating filters, at $1.50 per million gallons - - - - - -	6,000
286 tons of alum, 1 grain per gallon, at $32 -	9,150
Total estimated annual cost of operation -	$22,150
Cost of construction - - - - - - -	299,000
Operating expenses capitalized at 5 per cent. -	443,000
Total estimated cost of construction and capitalized cost of operation - - -	$742,000

Estimate No. 3. Sand Filters above Bleecker Reservoir.

Eight vaulted filters each 0.7 of an acre, 5.6 acres	$251,000
Changes in existing piping, drains and accessories - - - - - - - -	20,000
Two 5,000,000-gallon compound high-duty pumping engines at Prospect Hill pumping station, with necessary changes in boilers and house -	50,000
Engineering and contingencies - - - -	32,000
Total cost of construction - - - -	$353,000

Estimated Annual Cost of Operation.

Operation of filters, water not subject to preliminary sedimentation; 4,000 million gallons at $3.50 per million gallons - - - -		$14,000
Additional cost of pumping 4,000 million gallons raised 6 feet higher -	$1,000	
2,500 million gallons pumped twice, extra cost (from River to Bleecker and from Bleecker to Prospect) -	5,000	
		6,000
Total additional annual cost of operation due to filtration - - - - - -		$20,000
Cost of construction - - - - - - -		353,000
Capitalized cost of operation at 5 per cent. -		400,000
Total estimated cost of construction and capitalized cost of operation - - -		$753,000

Estimate No. 4. Mechanical Filters above Bleecker Reservoir.

Mechanical filtration plant complete with building, effective area of filtering surface 5,760 square feet - - - - - - -	$167,000
Changes in existing piping, drains and all accessories - - - - - - - -	20,000

Two 5,000,000-gallon compound high-duty pumping engines at Prospect Hill pumping station, with necessary changes in boilers and house -		$50,000
Engineering and contingencies - - - -		23,000
Total cost of construction - - - -		$260,000

ESTIMATED ANNUAL COST OF OPERATION.

Labor, coal, oil, etc., operating filters, 4,000 million gallons at $2.00 per million gallons - -		$8,000
286 tons of alum, 1 grain of alum per gallon, at $32 - - - - - - - - -		9,150
Additional cost of pumping:		
4,000 million gallons raised 12 feet higher - - - - - -	$2,000	
200 million gallons wash water pumped from river - - - - -	2,000	
2,500 million gallons pumped twice, extra cost - - - - -	5,000	
		9,000
Total estimated additional annual cost of operation - - - - - -		$26,150
Cost of construction - - - - - - -		$260,000
Cost of operation capitalized at 5 per cent. -		523,000
Total estimated cost of construction and capitalized cost of operation - - - -		$783,000

COMPARISON OF DIFFERENT ESTIMATES.

	Construction.	Annual cost of operation.	Operation, capitalized at five per cent.	Total construction and capitalized operation.
No. 1. Sand filtration, Lumber District - - - - - - -	$478,000	$16,000	$320,000	$798,000
No. 2. Mechanical filtration, Lumber District - - - - -	299,000	22,150	443,000	742,000
No. 3. Sand filtration, Bleecker Reservoir - - - - - -	353,000	20,000	400,000	753,000
No. 4. Mechanical filtration, Bleecker reservoir - - -	260,000	26,150	523,000	783,000

In looking over the estimates I wish to call your attention to the first charge, land $10,000, on estimate No. 1. This charge is for the sand filters, and the sedimentation basin requiring an area of about eight acres.

In estimate No. 2, for mechanical filtration plant occupying a space of only about one-fortieth the area, the same $10,000 item appears. This does not seem to be a fair estimate in view of the fact of the great difference of area necessary.

Inadequate Estimates for Vaulted Filters.

There appears to be quite a difference of opinion as to the cost of construction of the sand filters by the different authorities. Mr. Hazen in his estimate for eight vaulted filters with extra heavy foundations, each 0.7 of an acre, total 5.6 acres, is $251,000, equal to about $44,821 per acre. Mr. Stearns in his report to the Water Commissioners, January 15, 1894, in estimating the cost for sand filter beds, says: "The best basis that I have for estimating the cost of such filter beds is furnished by an estimate made last year by the City Engineer of Boston, for similar filter beds, having a total area of seven acres, and intended to filter 10,000,000 gallons of water per day. The proposed location of these beds is about seven miles from Boston, on the shore of Mystic lake, where land is cheap and where it was thought that suitable sand for filtration could be obtained by screening the material found upon the spot. His estimate of the cost of these beds (which are just one-half as large as would be required for Albany,) including all appurtenances, was $575,000. The cost of constructing larger filter beds might be somewhat less per acre and I will therefore place my estimate of the cost of filter beds for Albany at $1,000,000." You will notice this was a very favorable locality, and the estimate cost was $82,142 per acre.

The next reference will be found in a book entited "Water Supply," by Professor William P. Mason, 1896. I will quote from page 110 what he says in relation to the cost of covered filters: "Zurich, covered beds, complete, cost 120 francs per square meter of filtering surface. (About $2.25 per square foot, or $98,000 per acre.) The uncovered beds, previously in use, cost two-thirds of this sum.

Berlin — The covered filters cost $70,000 per acre, and the open ones about two-thirds that sum. Lindley gives a general estimate for the Continental filters, as follows: Open, $45,000 per acre; covered, $68,000.

Poughkeepsie, N. Y.— The two (uncovered) beds cost together (in 1870) $75,694, which is at a rate of $112,641 per acre, including price of land.

Hudson, N. Y.— The plant consists of two filter-beds, one of 9,071 square feet sand surface, built in 1874, and one of 23,017 square feet surface, built in 1888. The initial cost of the smaller bed, together with the clear water reservoir, was $37,450. The newer and larger filter was built for $17,350, the much lower figure for the second filter being accounted for by the partial preparation of its site at the time of the earlier construction.

Ilion, N. Y.— The beds are small, of 3,040 square feet each in sand area. The detailed cost is here given:

170 cu. yds. ashler masonry	@	$10 00	$1,700 00
332 " " rubble "	"	5 50	1,826 00
240 " " concrete	"	5 00	1,200 00
110 " " filtering gravel	"	1 50	165 00
551 " " " sand	"	1 50	827 00
900 " " embankment	"	32	288 00
32.3 M. brick, laid dry	"	8 00	258 00
11.8 " " " in cement	"	12 50	148 00
431 lin. ft. cut coping, 6x30 in.	"	1 25	539 00
176 " " " " 4x12 in.	"	35	61 00
247 sq. ft. 6 in. Hudson R. bluestone flagging	"	40	99 00
Total	"		$7,111 00

This is at a rate per acre of $101,900."

I will say the filter beds at Poughkeepsie, N. Y., are open beds such as are constructed in Europe for $45,000 per acre. The plant at Hudson, N. Y., is an open bed and is about .7 of an acre in area and cost $54,800, or about $66,000 per acre.

The next reference is from "The Filtration of Water Supplies," by Allen Hazen, second edition, 1896, pages 119-121.

Place.	Date of Construction.	Cost per Acre.	
		Covered.	Open.
"Stralu	1874	$62,000	...
Tegel, first part	1884	66,000	...
" second part	1887	70,000	...
Hamburg	1892-3	...	67,000*
Königsberg, first part	1883	...	20,000
" second part	1889	39,000	...
Madgeburg	1876	83,000	...
Warsaw	1885	78,000	...
Zürich	1885	86,000	...
Lawrence	1892-3	...	27,000
Nantucket	1892	...	45,500

Let us consider the case of a city in the United States with 100,000 inhabitants now drawing its water from a polluted lake or river. The quantity of water required is perhaps 80 or 100 gallons per inhabitant daily. Let us assume an average consumption of 8,000,000 gallons daily and an ordinary maximum of 10,000,000 gallons. Half this quantity would be considered an ample allowance in England, and a still smaller quantity would be required by Continental cities of this size. Why do American cities require so much more water than European cities? If there was any reason to believe that the enormous volumes of water used in America contributed to the health, cleanliness, or comfort of those who use or waste them, we should not wish to reduce them, but many European cities are clean beyond the dreams of an American alderman, are bountifully supplied with public fountains, and water is supplied abundantly and at low rates to all inhabitants for domestic and manufacturing purposes. And still the per capita consumption is less than a third of the American requirement. But this is not the place for a discussion of the quantity of water required; the existing condition must be either met or changed.

To supply a maximum of 10,000,000 gallons daily, five filters each with an area of one acre will be ample. Any

* Includes cost of large sedimentation-basins, pumps, and conduits, etc.

four of them can easily furnish this quantity while the fifth is out of use for cleaning or other cause. If the city is north of the line of normal January temperature of 32°, vaulted filters will be required. Such filters have formerly cost on an average $68,000 per acre including everything, in Germany, but the vaultings of these filters were often excessively thick, and the rather small size of the single beds increased the proportion of walls, regulators, piping, etc. Lighter vaulting has been used on some new filters for which I have no statements of cost.

Some estimates recently made by the author in connection with engineers examining the Boston Metropolitan Water-supply indicate that filters fully up to the German standards, but with beds of a full acre each, and with vaulting substantially like that successfully used on the Newton covered reservoir, can be built at present American prices for somewhat less than the cost given above, notwithstanding the higher price paid for American labor.

Including the connection with the (existing) pumping-station we may estimate the cost of our five acres at $350,000, with a probability that with favorable local conditions the expenditure would be still less. A greater number of filters would, of course, be designed to provide for increasing population, but only so many need be constructed as will meet the present requirement or that of the next two or three years, and additional filters can be added at about the same proportional cost when they are needed.

The heaviest cost for operation will be the cleaning of the filters. Estimating that 50,000,000 gallons pass each filter between scrapings, the total number of scrapings of one filter in a year will be 58, or about once a month for each of them, necessitating about 1700 days' labor. The labor for the annual deeper scraping and replacing the sand and for sand-washing can be estimated at as much more, necessitating the permanent employment of twelve men. Three men, one for each shift, will be kept always on duty to tend the gates, superintend work, and act as watchmen. We may then estimate the cost of filtration for a plant of this size as follows:

Cost of Operation.

12 laborers, 300 days, at $2, - - - - -	$7,200
3 gatemen, 365 " " $3, - - - - - - -	3,285
New sand and other supplies, - - - - -	1,000
Superintendence, bacterial examination of effluents, and experiments, - - - - - -	4,000
Total cost of operation, - - - - -	15,485
Interest and sinking fund on $350,000 at 6%, - -	21,000
Total cost of filtering 365 times 8,000,000 gallons	$36,485

Equal to 1.25 cents per thousand gallons."

I think I have fairly shown by all the authorities on the subject that Mr. Hazen's estimate of $44,821 per square acre is entirely too low, being lower than the average price for open filters, and the estimate should be at least $65,000 per acre, this being below the average cost per acre for the covered filtering plants; and if so it would bring the cost of the 5.6 acres to $364,000 instead of $251,000 as estimated.

Estimate No. 1. Sand Filters above Lumber District.

Land - - . - - - - - -	$10,000
Intake, 1,400 feet 54-inch pipe including pump well, complete - - - - - - -	14,000
Centrifugal pumps with boilers and house, complete - - - - - - - - -	20,000
Sedimentation basin, 15,600,000 gallons, exclusive of piping - - - - - - -	56,000
Eight vaulted filters with extra heavy foundations, each 0.7 of an acre, total 5.6 acres -	364,000
Piping, sedimentation basin and filters, including drain pipes and accessories - - - -	20,000
Pipe line to present pumping station, 8,000 feet of 48-inch steel pipe laid, complete - -	64,000
Engineering and contingencies - - -	43,000
	$591,000

ESTIMATED ANNUAL COST OF OPERATION.

4,000 million gallons pumped 18 feet high, $1.50 per million gallons - - - - - -	$6,000
Operation of filters, $2.50 per million gallons -	10,000
Total estimated annual cost of operation -	$16,000
Cost of construction - - - - - -	591,000
Operating expenses capitalized at 5% - -	320,000
Total cost of construction and capitalized cost of operation - - - - - - -	$911,000

We now come to ESTIMATE NO. 2. MECHANICAL FILTRATION PLANT ABOVE LUMBER DISTRICT.

The first charge is for land, $10,000; this $10,000 is for sufficient land to construct filter beds having a sand area of 5.6 acres, also the sedimentation basin, pumping station and coal sheds covering an area of about 8 acres; and the mechanical filters will certainly not require one-tenth part of this area and we will reduce this charge to $5,000. The item for the 1,400 feet 54-inch steel pipe we will leave the same, $14,000. The mechanical filtering plant, capacity 15,000,000 gallons daily; effective area of filtering surface, 5,760 square feet; with buildings, boilers, centrifugal pumps for lifting water from pump well, etc., we will change in this way: we will use Mr. Hazen's estimated price for centrifugal pumps with boilers and house complete, $20,000. I do this to show at what price the filters are estimated to cost. I do not know what mechanical filters Mr. Hazen had in his mind when he made his estimate. I can however form an opinion from his description. He says: "The filters consist of cypress or southern pine tubs 12½ feet in diameter, with suitable drainage, regulating and stirring devices, apparatus for the introduction of alum, etc." The style of filters that he recommends is one that is largely used by paper makers, and I would not advise a cypress wood tub as a permanent arrangement for filtering water for a city supply. I must however make my estimate in this comparative case on the same style of filters. A filtering plant containing 5,841 square feet of sand surface, with the mains between the filters and all connections made, complete, $59,950. The item for 8,800 feet 48-inch steel pipe to present pumping station will remain the same, $70,000. Engineering and contingencies we will assume to be the same, $27,000.

Making the total cost of constructing the mechanical filter plant:

Land - - - - - - - - -	$5,000
Centrifugal pumps with boilers and house, complete - - - - - - - - -	20,000
Intake, 1,400 feet 54-inch steel pipe - -	14,000
Mechanical filtration plant - - - - -	59,950
8,800 feet 48-inch steel pipe to present pumping station - - - - - - - - - -	70,000
Engineering and contingencies - - -	27,000
Total cost of construction - - -	$195,950

Estimated Annual Cost of Operation.

4,000 million gallons pumped 22 feet high, $1.75 per million gallons, $7,000. Labor, coal, oil, etc., operating filters at $1.50 per million gallons: in this item I will make no allowance for coal or oil, as they are not used in the operation of the filters. The coal, oil and labor that are used in connection with the filtering plant is for pumping the 4,000 million gallons 22 feet high and is included in the $7,000. I will therefore estimate on the labor necessary for the proper cleansing of the filters, namely, $2,902. I will also reduce the alum charge, as I know that in the very worst stages of the river 1 grain per gallon will be a large estimate, and as the river is nine-tenths of the year, ½ grain per gallon will be sufficient. I will therefore make it ¾ of one grain per gallon, making 214.5 tons of alum at $32, $6,865.

Final Estimated Annual Cost of Operation.

4,000 million gallons pumped 22 feet high at $1.75 per million gallons - - - -	$7,000
Labor necessary for cleansing filters - -	2,902
214.5 tons of alum, ¾ grain per gallon, at $32	6,865
Total estimated annual cost of operation -	$16,767
Cost of construction mechanical filters - -	195,950
Operating expenses capitalized at 5 per cent -	335,350
Total estimated cost of construction and capitalized cost of operation - - -	$531,300

And as will be seen from the comparative estimates of Nos. 1 and 2, there is $379,700 difference in estimated cost between the sand bed, or English plan of filters and American plan of mechanical filters, in favor of the latter.

Estimate No. 3. Sand Filters above Bleecker Reservoir.

Eight vaulted filters each 0.7 of an acre, 5.6 acres,	$364,000
Changes in existing piping, drains and accessories,	20,000
Two 5,000,000 gallon compound high-duty pumping engines at Prospect Hill pumping station, with necessary changes in boiler and house	50,000
Engineering and contingencies - - - -	32,000
Total cost of construction - - - -	$466,000

Estimated Annual Cost of Operation.

Operation of filters, water not subject to preliminary sedimentation; 4,000 million gallons at $3.50 per million gallons - - - - -	$14,000
Additional cost of pumping 4,000 million gallons raised 6 feet higher - - - - - -	1,000
2,500 million gallons pumped twice, extra cost (from river to Bleecker and from Bleecker to Prospect) - - - - - - - -	5,000
Total additional annual cost of operation due to filtration - - - - - - - -	$20,000

Cost of construction - - - - - - -	$466,000
Capitalization cost of operation at 5 per cent -	400,000
Total estimated cost of construction and capitalized cost of operation - - . - -	$866,000

The only change that I have made from the original estimate is the increase of the cost for the eight filters from $251,000 to $364,000 which I think I have shown was necessary.

ESTIMATE NO. 4. MECHANICAL FILTERS ABOVE BLEECKER RESERVOIR.

Mechanical filtration plant complete with building, effective filtering surface 5,760 square feet, consisting of 36 steel filters 8 feet diameter, 20 feet long, subjected to a test pressure of 200 lbs., and so arranged that ½, or any part of them can be used to deliver the water either into Bleecker, or Prospect Hill reservoirs, - -	$140,000
Changes in the existing piping to connect the filters with 30-inch mains - - - -	10,000
Engineering and contingencies - - -	20,000
Total cost of construction - - - -	$170,000

ESTIMATED ANNUAL COST OF OPERATION.

Labor in operating filters - - - - - -	$2,902
214.5 tons of alum ¾ of a grain, per gal., at $32.	6,865
4,000 million gallons raised 24 feet higher -	4,000
200 million gallons wash water pumped from river	2,000
Total estimated annual cost of operation - -	15,765
Cost of construction - - - - - - -	170,000
Cost of operation capitalized at 5 per cent - -	315,300
Total estimated cost of construction and capitalized cost of operation - - - . -	$485,300

Comparison of different estimates:

	Construction.	Annual cost of operation.	Operation capitalized at 5 per cent.	Total construction and capitalized operation.
No. 1. Sand filtration, Lumber District.	$591,000	$16,000	$320,000	$911,000
No. 2. Mechanical filtration, Lumber District.	195,950	16,767	335,350	531,300
No. 3. Sand filtration, Bleecker reservoir.	466,000	20,000	400,000	866,000
No. 4. Mechanical filtration, Bleecker reservoir.	170,000	15,765	315,300	485,300

You will notice in estimate No. 4, mechanical filters above Bleecker reservoir, I did not estimate for the two 5,000,000 gallon pumping engines to pump the water from Bleecker to Prospect Hill reservoir for the reason that there is no use for them, the water being pumped by the present pumping engines at the Quackenbush street station through the filters direct into Bleecker and Prospect Hill reservoirs.

I beg you will give these comparative estimates your careful consideration. I think I have given you satisfactory evidence that the American mechanical plan of filtration can be furnished for about one-half the money that the sand-bed or English filters can be built for.

Proposal to Obtain Comparative Estimates.

If it is not too late, I would like to offer a few suggestions for the solution of the whole filter subject. I feel that you will not indorse a plan of filtration that only provides for the filtering of two-thirds of the city's water supply, and if the matter is referred back to the Honorable Board of Water Commissioners, I would suggest that they instruct their Superintendent, Mr. Bailey, who, I believe, has the ability to prepare plans of the modern system of sand filters. I will not say European modern system, for the reason that the improvements they have adopted were the invention of an American, Mr. Kirkwood. The apparatus was first designed by him for a filtering plant for an American city, and the proof of this statement you will find in text-books on the subject of filtration, and there are no patented rights to interfere with the preparation of the plans. And after completing the drawings they can be submitted and bids may be invited on their construction, and at the same time bids for proposals to furnish mechanical filters can be invited from all the filter manufacturers.

This will give every one a chance to offer their proofs as to the efficiency of the filters they propose to furnish, and if they are unable to prove to the entire satisfaction of the Commissioners that the American plan of filtration is not as effective in purifying the Hudson river water, both chemically and biologically, for one-half the cost of sand beds, and for a lesser annual cost of operation, by all means adopt the sand filters, even if they cost four times as much.

There must, however, be a limit to this cost, for we are now burdened with as great a water debt as we can stand, and if it has to be increased much more, it will be a question whether we had not best move the city to a place where good water is found. This question of bettering Albany's water supply has become a tiresome one. Ever since the old life Board of Water Commissioners was legislated out of office there has nothing been done except employing experts to inform us how polluted our water supply is, and I say, from my experience, that it has been entirely over-stated. If we have a few cases of typhoid above the normal, it is magnified to a typhoid epidemic. It has also been charged that the jaundice epidemic prevailing throughout the State last year was due to Hudson river water. Therefore I say this clamor of Albany's impure water supply has become a disease, and I know something must be done to stop it.

However, I do not think it so important or necessary that you should advise the expenditure of nearly $1,000,000 without more evidence before you than the opinion and recommendation of one man on the subject of selecting the proper method or device. It may be possible that the representatives of the mechanical filters will be able to prove that their filters have some merits, and if so, it will be time well spent, as the difference in time in the production will more than make up for the few weeks it will require for the proper solving of this question.

I would agree with Mr. Hazen that delays may be dangerous, but our experience on the question of bettering Albany's water supply dates back several years, not so long however that it has escaped the memory of many of our people, that a large sum of money has been squandered in abortive attempts to improve the same, and possibly if this matter was delayed for a short time, the Water Commissioners might submit to you a modification of the plan, now before you for consideration, greatly reducing the estimated cost for sand bed filtration, as a former water board did, in their second report, about one year later for a water supply for Albany from Kinderhook creek, to the Common Council, January 15, 1894. In their second report, they were able to recommend, not only a greater and better supply, but a saving in the cost of construction of over $400,000, and all this appeared to be due to the introduction of another Engineer, as the locality, and natural circumstances were the same in both cases. I wish to again refer you to report of Water Commissioners to the Common Council, January 15, 1894, and I quote from page 7, the following:

"The discovery of this route induces us to recommend to your honorable body a modification of the plan last adopted by you, simply to the extent of removing the intake from Garfield about five miles down the stream to East Nassau, substituting the very simple construction shown on the accompanying plan for the East Nassau reservoir for the elaborate and expensive plan heretofore adopted by you for the Garfield reservoir, and shortening the conduit line about five miles.

The advantages of this modification are indicated in the description of it above given, viz., that it saves the cost of the Garfield reservoir and of five miles of conduit, less the cost of the small reservoir at East Nassau and the slightly increased cost of the conduit of increased size required near East Nassau, and are shown by the detailed estimates appended to reduce the estimated cost of the entire improvement now recommended, more than $400,000 below that of the plan heretofore submitted and adopted."

Plan for Mechanical Filtration.

In conclusion, I would suggest that instead of using pine tubs, or what is known as mechanical gravity filters, that the closed pressure ones be used, such as I have here shown, and to make three different plants, one for each of the distributing reservoirs. Two of the plants, having a capacity of 7,000,000 gallons each, to be housed under one roof, on the land now owned by the city adjoining Bleecker reservoir, one of the plants will deliver the filtered water into Bleecker, the other one into Prospect Hill reservoir. The third plant having a capacity of 6,000,000 gallons daily, should be located between Tivoli distributing reservoir and the city, and as the city owns the land near the Tivoli reservoir, I would say to locate it there.

Such filtering plants will have the combined capacity of 20,000,000 gallons daily and will filter all the water supplied to the city, instead of about two-thirds, as has been recommended by the Water Commission in their report to you. The three plants such as I have just described and located can be erected with the buildings, piping, and including everything, even the connecting of the mains to and from the filters, all complete for the sum of $250,000. In comparison with the above system, covered sand filter beds, with one located at or near Tivoli, as must be done to filter the gravity supply, could not be built for less than $700,000.

In connection with this matter, as to the standard of purity, I will say I know of a responsible company manufacturing filters that will guarantee a standard of purity equal to the certified average standard for the past five years, of any existing sand bed filtering system supplying water to cities having populations from 96,000 and upwards, unless there be alum or other chemical used in connection with their purifying process.

Operation of Mechanical Filters.

In order to give an idea what a mechanical filtering plant would look like, I have introduced a cut showing a battery of 30 filters, as usually arranged for filtering city supplies, each filter consists of a steel shell 8 feet diameter by 30 feet long, having its independent inlet pipes taken from the large main inlet pipe, as shown. It also has an outlet pipe for delivering the filtered water into a large outlet pipe, which is also shown in the cut. The filtering plant is usually placed between the source of supply and the distributing reservoir. In this case there are, for instance, two 30-inch diameter pipes leading from the pumping station on Quackenbush street to the reservoirs, one to Bleecker, the other to Prospect Hill, and the installing of the plant would simply be the connection of one of the 30-inch mains leading from the pumping station with the large pipe marked "Inlet," and the pipe marked "Outlet" is connected with the pipe leading to the reservoir. The operation is simply this: the unfiltered water is forced through the main inlet pipe into the top of the several filters, and then passes downward through the sand contained therein and finally into the large outlet pipe on its way to the distributing reservoirs, and they can be so arranged that any part of them will furnish filtered water for either reservoir. The other cut shows one of the filters removed from the battery, and a part of the shell is removed to show the interior construction. It shows the shell filled about two-thirds its height with sand, as well as the system of sand valves through which the filtered water passes on its way to the large outlet pipe before mentioned in connection with the battery of filters. It also shows clearly the system of piping. The pipe marked "Inlet" is the one that supplies the water to be filtered. The pipe marked "Outlet" is the one from which the filtered water passes out. The pipe marked "Waste Pipe" is for the purpose of conveying the wash water to the sewer.

Chemical Action of Alum on Water.

Perhaps I cannot better illustrate the chemical action on the water as caused by the use of alum in connection with mechanical filtration than by again quoting from the excellent treatise "Water Supply," by Prof. William P. Mason, page 137, as follows:

"Although the rapid filtration of large volumes of water (usually under pressure) through very limited sand areas is accomplished by appliances patented and controlled by numerous companies, yet the use of such apparatus is so nearly confined to this side of the Atlantic as to warrant the employment of the generic expression "American Filter System."

Roughly outlined, this plan consists in adding to the water to be filtered a minute dose of common alum, averaging between one-quarter and one-half of a grain per gallon, and then admitting the water to the filter, which is a cylinder of wood or boiler iron, three quarters full, of uniformly fine sand. The carbonates present in the water decompose the alum, with the formation of a white flocculent precipitate of aluminum hydrate, quite jelly-like in appearance. The action of this aluminum hydrate is much the same as that of the white of egg in clearing coffee. It entangles all suspended matter, disease germs as well as inorganic material, and deposits the same on the surface of the sand, whence it is removed and driven into the waste-pipe by a reverse current of filtered water at the time of cleaning the filter. The cleaning occupies but a short time, not much beyond fifteen minutes, and can be accomplished by a waste of less than ten per cent. (usually four per cent.) of the daily delivery of filtered water. Thus, it is observed, the mechanical filter produces an artificial inorganic jelly to replace the "bacteriæ jelly" of the English filter-bed. In properly managed filters of this type no alum (or, at most, a trace) reaches the filtrate, for only such a quantity is admitted to the water as will be decomposed by the amount of carbonates present.

A further action of the precipitated aluminum hydrate is to unite with the soluble coloring mattter of the water, thereby rendering the filtrate colorless. The proper "dose" of alum solution is administered by means of a small automatic measuring apparatus exterior to the filter."

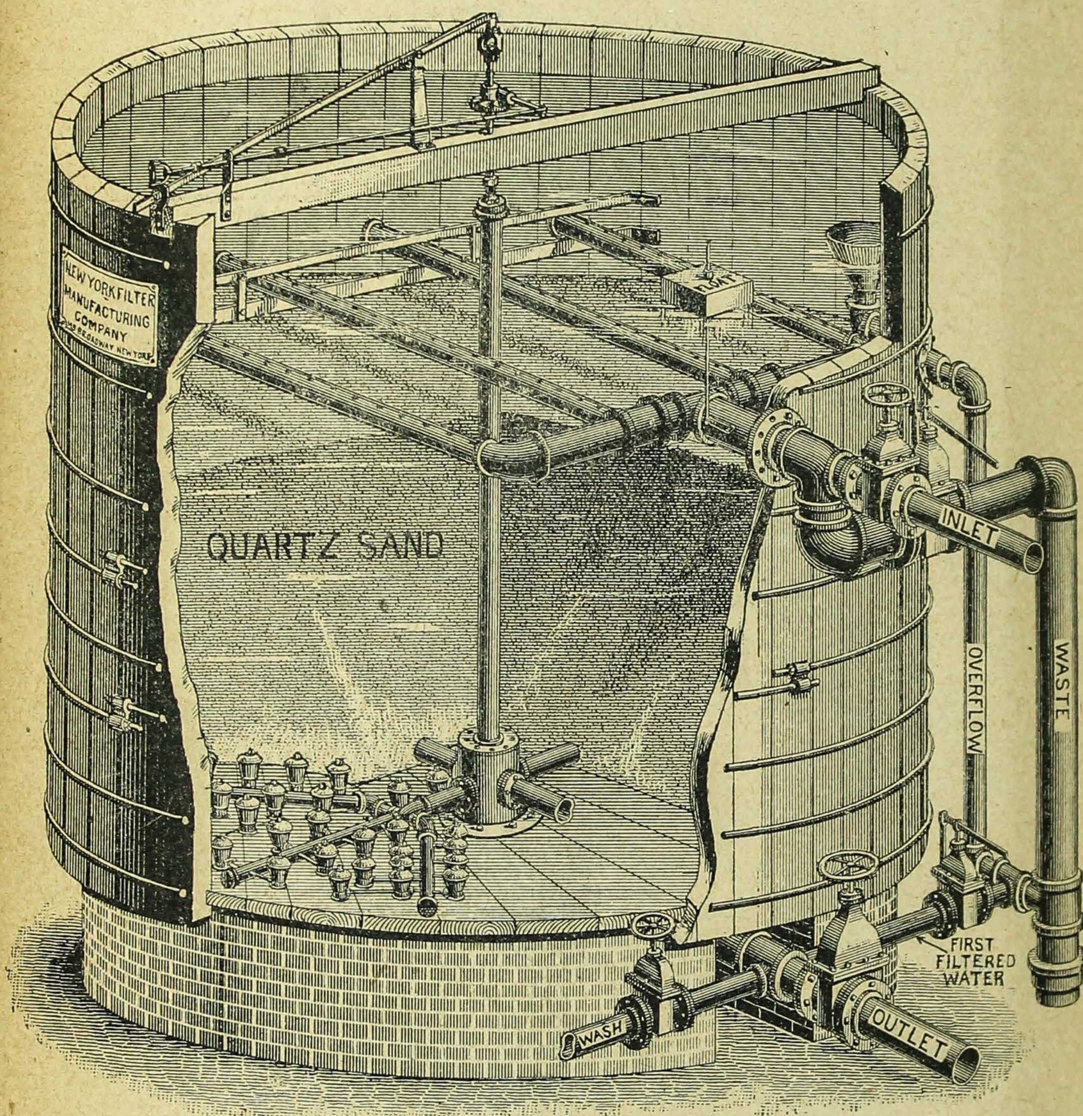
It will be argued against me that I am interested in a filtering scheme of my own. I wish to explain and have it become a matter of record, that I am interested in the New York Filter Manufacturing Co. to this extent: the company is capitalized at $600,000, and I am the owner of 24 shares of its stock at the value of $2400.

I believe my past record in Albany for fifty years will not warrant anyone to question my sincerity in this matter because I am slightly interested in a filter company.

Respectfully submitted.

JAMES H. BLESSING.

WOODEN



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