COMMUNICATIONS PRESENTED AT A SPECIAL MEETING, HELD MARCH 25, 1899, TO DISCUSS THE PRESENT PROBLEM OF THE WATER-SUPPLY OF PHILADELPHIA.

WATER-SUPPLY OF PHILADELPHIA.

JOHN C. TRAUTWINE, JR.

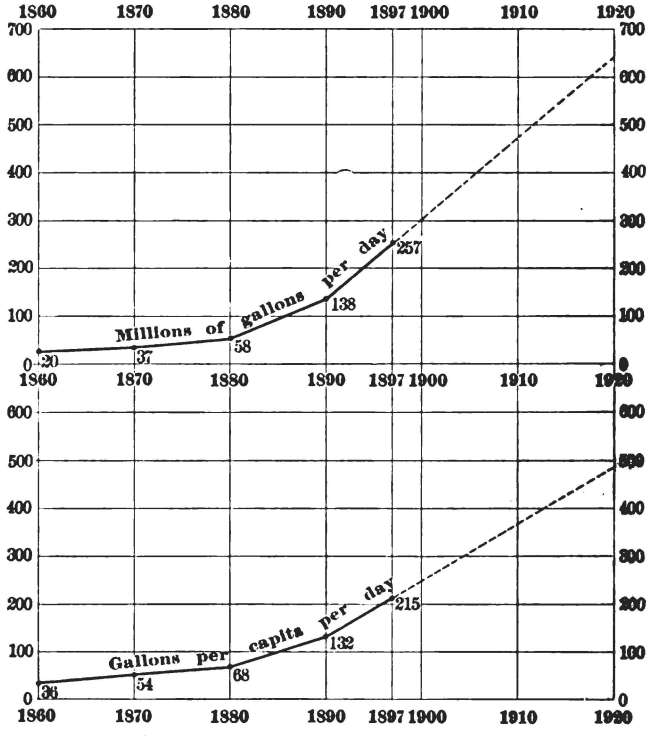
An intelligent discussion of the water-supply of Philadelphia presupposes the possession of information respecting the existing conditions of that supply. I may, therefore, with propriety set before you certain of the fundamental facts respecting our supply, although my position as Chief of the Bureau of Water forbids my entering into the discussion proper. In water-supply, as in other manufacturing business, the question of first importance is that which concerns the quantities handled. I therefore ask your attention to the following diagram, which shows the total and the per capita consumptions in each tenth year from 1860 to 1890 inclusive, and also that in 1897:

Tabulated, the corresponding figures appear as follows:

		Average Daily Consumption of Water. Gallons.	
Year.	*Population.*	*Total.*	*Per Capita.*
1860, ...	565,529	20,398,198	36
1870, ...	674,022	36,692,625	54
1880, ...	847,170	57,698,719	68
1890, ...	1,046,964	137,736,703	132
1897, ...	1,200,000	257,500,000	215

The popular mind probably has no conception of the volumes represented by the figures giving our average daily pumpage; and even the engineering mind may be surprised to learn that the average daily pumpage of 1897, amounting to more than two hundred and fifty million gallons, is equivalent to a prism 100 feet square and 3300 feet long. Such a body would fill Market Street from house-line to house-line (100 feet) to a depth of 100 feet, and would reach from the Delaware to beyond Seventh Street. The average daily pumpage of 1898 (275,000,000 gallons) would, of course, extend farther west, and that of 1899 would probably reach to Ninth Street.

Perhaps the most important feature of this table and diagram is the light they throw upon the *rate of increase* of consumption. The



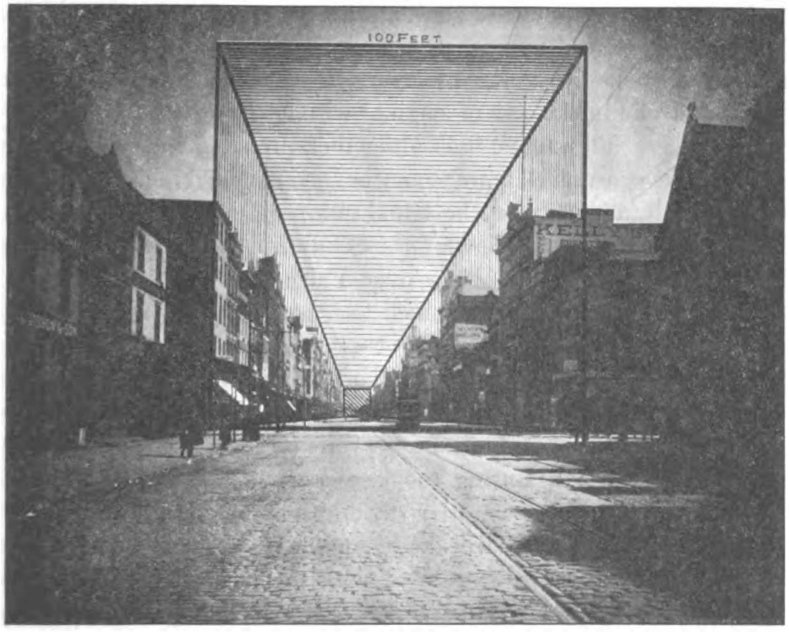
Consumption of Water, Total and per Capita, in Philadelphia.

increase in the average daily consumption, in the several periods shown, was as follows:

	Increase in Average Daily Consumption of Water. Gallons.	
Period.	*Total.*	*Per Capita.*
1861–70, ...	16,294,429	18
1871–80, ...	21,006,094	14
1881–90, ...	80,037,984	64
1891–97 (7 years), ...	119,763,297	83

The remarkable increase in the rate of increase, since 1880, or, perhaps, more properly, since 1885, seems to be explainable, in part at least, by a regulation of the Board of Health, which went into effect about 1885, requiring the abandonment of all cess-pools and the sub-

stitution of outside water-closets. Unfortunately, the form introduced was an extremely wasteful one. In the foregoing diagram the dotted line, in each case, extending from 1897 to the limit of the diagram (1920), shows the figures which would be reached if the present rate



TWO HUNDRED AND FIFTY MILLION GALLONS.
(One hundred feet square, 3300 feet long.)
Market Street, Looking East from Seventh Street to Delaware River. Average Consumption, Philadelphia, 1898, 275 Million Gallons per Day.

of increase were maintained. These figures are approximately as follows:

	AVERAGE DAILY CONSUMPTION OF WATER. GALLONS.	
Year.	*Total.*	*Per Capita.*
1900, ...	300,000,000	245
1910, ...	470,000,000	360
1920, ...	640,000,000	480

Stupendous as these figures appear, it must be borne in mind that they represent a conservative assumption—viz., that the present rate

of increase of consumption continues unchanged; whereas our past experience teaches us that the rate of increase does not remain constant, but itself increases. Unless, therefore, some means are adopted to control the rate of increase, we must inevitably reach even more startling figures as we march into the coming century.

The foregoing estimates of consumption are based upon the plunger displacements of the pumps, after making what are supposed to be proper deductions for sources of error, such as the inevitable slip and the short stroke in the case of engines without fly-wheels. Notwithstanding these allowances, it is altogether probable that the figures given for the consumption are somewhat exaggerated; but that they do not grossly misrepresent the actual pumpage may be inferred from the fact that, the summer flow of the Schuylkill being approximately known, water would be flowing over Fairmount dam at all times if the actual pumpage were very much less than that given in the foregoing tables and diagram. Our observations, in the case of mains exposed for excavations, etc., lead us to believe that no very great loss takes place through leaky mains. It has been suggested that the building of three of our largest reservoirs (Queen Lane, East Park, and new Roxborough) during the last dozen years may account for the large increase of consumption during the same period; but here, too, the evidence of material leakage is negative. A year ago, Queen Lane reservoir, after being relined with asphalt, was found to be losing, when full, not more than about half a million gallons per day by leakage. East Park gives every reason for believing it to be practically tight; and the new Roxborough reservoir, owing to excess of demand above supply, has never yet been filled. Indeed, during most or all of 1898 it was entirely cut off from the distribution and from pumpage, in order to prevent it from being entirely emptied.

Finally, observations of the consumption in many separate properties give us abundant reason for relying upon the substantial correctness of the Bureau's figures respecting consumption. Even if gross exaggeration took place, it is altogether probable that this exaggeration bears no greater ratio to the whole consumption now than during earlier years. It, therefore, does not affect the deductions drawn as to the proportional *rate of increase* and the *increase* of that rate.

Next in importance to the quantity of water to be handled are the

means provided for handling it. During the last four years no additions have been made to our pumping or distributing machinery, and the service is in a condition bordering upon water famine, acute distress having been already experienced in many localities, notably in portions of Germantown. The reason for the failure of the Bureau to make the necessary extensions is found in the following table, which shows our annual estimates for extensions for the years 1896, 1897, and 1898, respectively, and the amounts left in the appropriation bills for that purpose by the Finance Committee:

	Estimates.	Appropriations.
For 1896, ...	$2,484,150	0
For 1897, ...	3,339,450	0
For 1898, ...	3,735,050	0

I quote as follows from my annual report for 1898:

"Year after year, through you, I have warned Councils of the condition of our works, and have appealed for the means necessary to avert disaster. Year after year, my warnings and appeals have been disregarded.

"During my administration, not one cent has been appropriated for extensions of the works, until, within the past year, a few trifling amounts have been granted, barely sufficient to prevent absolute water famine in one or two cases, but leaving entirely untouched the great and urgent needs of our system as a whole.

"Every effort has been made to meet the conditions with the inadequate means provided. Our boilers and engines are strained to the utmost night and day, and in some cases disabled; there is no opportunity for thorough repairs; we dare not stop pumping during seasons of muddy water; in spite of all manner of pitiful expedients, we are compelled to cut off our reservoirs from the distribution in order to keep them from being entirely emptied; and from all sides come well-grounded complaints from citizens who pay for a water-supply, but do not get it."

The following comparison between the engineering forces of the water departments in New York and in Philadelphia will be of interest from an engineering standpoint:

NEW YORK GENERAL ENGINEERING FORCE.

Bureau of Chief Engineer.

	Per Annum.
Chief engineer,	$7,000
First assistant engineer,	5,000

Aqueduct Repairs, etc.

Transitman,	1,500

Laying Croton Pipes.

Assistant engineer,	3,600
Transitman,	1,500
Leveler,	1,200
Draftsman,	1,350

Water-main Fund.

Consulting engineer,	5,400
Assistant engineer,	3,600
Assistant engineer,	3.600
Transitman,	1,500
Rodman,	1,200
Rodman,	1,000
Transitman,	$1,400
Draftsman,	1,500

Croton-water Fund, Construction and New Surveys.

Topographic engineer,	3.000
Assistant engineer,	3,000
Two assistant engineers at $2,400,	4,800
Assistant engineer,	2,000
Two assistant engineers at $1,800,	3,600
Transitman,	1,500
Draftsman,	2,000
Three draftsmen at $4.50 per day,	4,050
Two levelers at $1,400,	2,800
Two levelers at $1,200,	2,400
Two rodmen at $1,200,	2,400
Two rodmen at $1,000,	2,000
Chainman,	900

Total, thirty-six men, $74,800 per annum.

Croton Aqueduct Commission.

Chief engineer,
Three division engineers,
Eleven assistant engineers,
Three transitmen,
Two levelers,
Six rodmen,
One chainman,
Twenty-three axmen,
Four draftsmen.

Total, fifty-four men.

PHILADELPHIA.

	Per Annum.
Chief of Bureau,	$6,000
Chief draftsman,	1,800
Two draftsmen at $1,000,	2,000
One draftsman,	900
Three rodmen at $2.50 per day,	2,250
Assistant in charge of distribution,	2,000

Total, nine men, $14,950 per annum.

In this connection I venture to quote again from my annual report for 1898:

"WHAT THE ENGINEERING FORCE SHOULD BE.

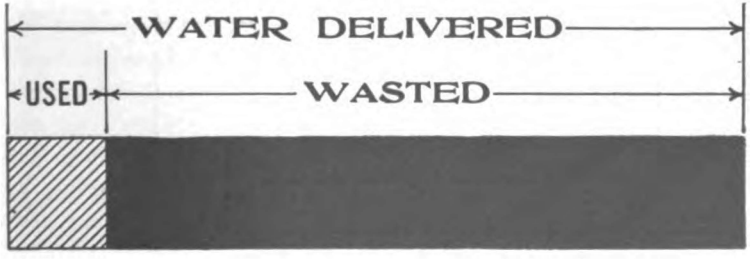
"The proper development of a large water-supply requires that it be placed in the hands of a sufficient force of intelligent, well-informed, and skilled persons, capable of understanding the present

and estimating the future conditions and needs of the service. This force must be given every possible facility for investigation and experiment, and must not only be unhampered by capricious legislative interference, but must be assured of intelligent, hearty, and loyal legislative support. Under these auspices an harmonious plan for the development of the system, for many years in advance, should be mapped out, adopted, and followed; and every proposition for extension or other change should be carefully studied in the light of this plan and made to conform to it."

Scarcely less startling than the enormous quantities of water which our waterworks are strained to the utmost to furnish is the fact that more than half of this quantity is absolutely wasted, benefiting no one—not even those who waste it. And it is perhaps equally important to note that this waste is perpetrated by a small fraction—hardly more than one-fifth—of our population, as witness the following results of investigations by the Bureau respecting the quantities used and wasted by private residences:

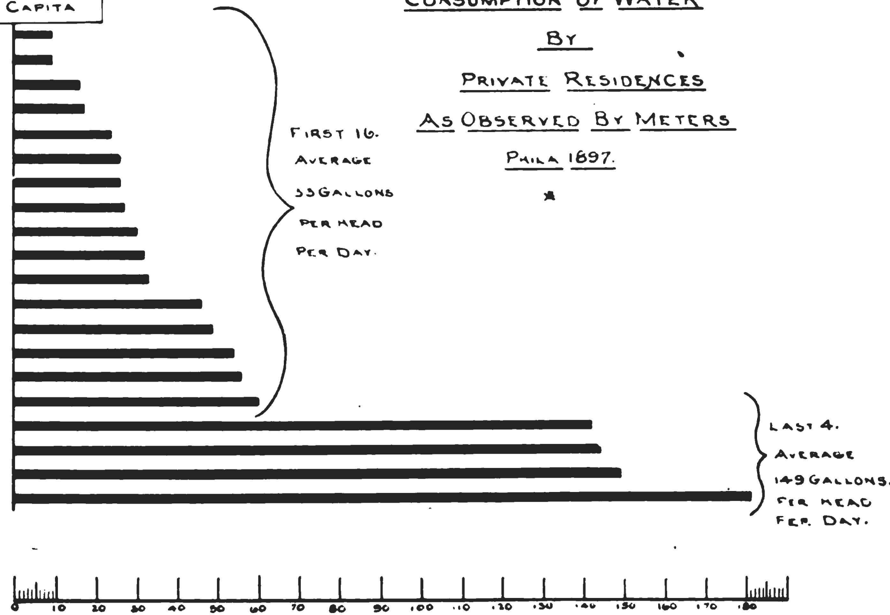
TWO INTERMEDIATE STREETS WITH ONE HUNDRED AND FORTY-TWO MODERN SEVEN-ROOM TWO-STORY DWELLINGS.

Number of appliances,	Total,	782
	Leaking slightly,	22
	Turned on continually,	32
Gallons per twenty-four hours,	Total,	119,800
	Used,	16,120
	Wasted,	103,680
Gallons per capita per twenty-four hours,	Total,	222
	Used,	30
	Wasted,	192
Percentage of total,	Used,	13½
	Wasted,	86½



Consumption of Water by Private Residences as Observed by Meters Phila 1897.

Persons Supplied	Annual Cost of Water: By Schedule	Annual Cost of Water: By Meter	Gallons per Day: Total	Gallons per Day: Per Capita
4	$13.00	$5 00	35	9
7	13.00	8 00	62	9
6	15 00	5 00	97	16
7	16.00	5 00	120	17
7	13 00	5 00	165	24
4	13 00	5.00	104	26
6	13 00	5.00	156	26
8	13 00	5 00	216	27
12	12 00	5 00	354	30
5	13 00	5 00	157	32
6	15 00	5 00	194	33
18	40 00	20 00	832	46
6	20 00	5 00	296	49
6	17 00	5 00	319	54
5	16 00	5 00	216	56
6	16.00	5 20	354	60
8	13 00	16 53	1132	142
7	13 00	14 67	1005	144
10	20 00	21 80	1493	149
3	13 00	7 93	543	181



Scale of Gallons per Head per Day.

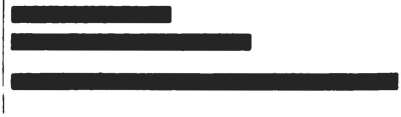
Such investigations as these certainly justify the statement that more than half of all the water pumped is wasted.

The following diagram, which shows the result of the investigation of the consumption of water in twenty dwellings, confirms the statement that this waste is perpetrated by a small fraction of our people, this small fraction thus victimizing the careful consumers, who are in an overwhelming majority. It illustrates also the inequities of the system of charging for water by the year. The first sixteen residences averaged 33, the last four averaged 149, and the last of all consumed 181 gallons per head per day, and pays $13.00 per annum, whereas one which took only 46 gallons per head per day pays an annual water bill of $40.00. Two other consumers, each paying $20.00 annually, took, respectively, 296 and 1493 gallons daily (total).

The result of wasting more than half of all the water pumped was summarized as follows in a paper which I presented to this Club, October 1, 1898:

"If the waste, or even the major part of it, were stopped, the capacity of our works would be practically doubled, and there would be plenty of water for all. The cost of installation of filter plants, or that of bringing water from a distance, would be cut in two. Even without the adoption of means for purifying the water, the quality of that furnished would at once improve, for pumping could then be stopped during seasons of muddy or coal-polluted water, and the water in the reservoirs would have longer time for sedimentation. The minimum flow of the Schuylkill would once more greatly exceed the city's maximum draft upon it, the city's annual conflict with the Schuylkill Navigation Company would be avoided, and the specter of the city's acquisition of that company's properties would be once more suppressed. Finally, the improvement and development of the supply would be brought well within the city's own means."

The following comparative tables show the effect of waste upon the cost of putting our works in proper order, and of installing means for the improvement of the quality of the water. The first of these gives the figures as related to the entire supply. The second, which refers only to the West Philadelphia district, shows a case where the contrast is even more striking.

For Water Used.	Extensions, . 1,000,000 Filtration, . 2,500,000 Total, . . $3,500,000	
For Water Used and Wasted.	Extensions, . 5,000,000 Filtration, . 7,500,000 Total, . . $12,500,000	

Estimates of Cost of Improvement of Water-supply in West Philadelphia for 1900.

	Water Used.	Water Used and Wasted.
Maximum per day, ...	Gallons. 15 million.	Gallons. 45 million.
Improvements Required.		
Additional pumps, ...	$0	$75,000
Annex to engine-house, ...	25,000	40,000
Condenser, ...	6,000	6,000
Additional pumping main, ...	0	92,000
Additional supply mains, ...	0	186,000
Additional reservoir, ...	0	500,000
Total, exclusive of filtration, . . .	$31,000	$899,000
Filtration plants, ...	250,000	750,000
Sedimentation basins, ...	0 (?)	200,000 (?)
Total cost of installation, ...	$281,000	$1,849,000
Annual expense of operation of filters, at $4.00 per million gallons, ...	$20,000	$60,000

In making these comparisons I have assumed that the cost of installation and of operation of filtration plants would be proportional to the consumption; whereas it is almost certain that, in our case, the cost would increase more rapidly than the quantity to be filtered. On the Schuylkill side, at least, the difficulty of finding suitable sites for slow filter beds would be enormously increased if we were to continue wasting water as at present. The provision necessary for sedimentation would also be greatly increased.

In the first of these two comparisons (that covering the entire city) I have included, for extensions, $5,000,000 in the case of water used and wasted, and $1,000,000 in the case of water used; but in this connection it is important to notice that our works, exactly as they are, are abundantly able to furnish all the water that could possibly be used and enjoyed by a city of twice the size; and the $1,000,000 set down for extensions is required simply for such extensions as will bring the whole system to a condition of nearly uniform efficiency and make needed repairs; whereas the $5,000,000 for extensions in the case of water used and wasted is absolutely needed, and needed at once, if we are to be enabled to supply the enormous quantities wasted, in addition to those used. One million dollars expended for extensions in the case of water used would give not only an ample supply for the entire city, but also a surplus of pumping capacity of about 100 per cent.; while $5,000,000 expended for extensions in the case of water used and wasted would barely meet the present demands.

THE WATER PROBLEM IN PHILADELPHIA.

EDGAR MARBURG.

WE are met this evening to do our part, as engineers and as citizens of Philadelphia, in an effort to bring about a rational solution of what has come to be known as the water problem. Aside from the simple question of finance and the complex one of "practical" politics, the problem is purely an engineering one. It is not necessary, however, that one should be versed either in finance or in engineering, much less in machine politics, to arrive at sound general conclusions—that is, to discern a straight, clear way through the maze of visionary, corrupt, or quack schemes that have been proposed or "promoted" in endless variety and number. Disinterested honesty and plain, common sense are the only real essentials.

To squarely meet the issues as they stand to-day, what are the facts?

1. That the net revenues to the city from its water-works are about one million dollars per annum.

2. That for the past several years, practically no appropriation has been allowed for extensions, however urgent the need and the demand.

3. That for the present year the estimates for bare maintenance—that is, current necessities—have been scaled down to sums known by experience to be absolutely inadequate.

4. That, through lack of restrictive measures against wanton waste, the average daily pumpage has reached the stupendous aggregate of 275,000,000 gallons, or about two hundred and thirty gallons for every man, woman, and child in the city of Philadelphia.*

5. That most of the pumping machinery must be kept in perpetual operation, in its ceaseless race against impending water famine.

6. That, through accident to the machinery, a crisis may be reached at any moment, to cause widespread suffering in our community.

7. That some districts are feeling even now the infliction of an inadequate water-supply and insufficient pressure.

8. That, with the present extravagant rate of consumption, mere sedimentation for a limited period is impracticable.

9. That, through lack of timely measures for effective purification, our city is now scourged by a visitation of typhoid fever more appalling in its death-rate than any experience of the past.†

10. That the earnest recommendations and appeals of the Bureau of Water, renewed for these many years with unfailing regularity, are cast to the winds. That this bureau, instead of receiving proper aid in carrying out the sound policies it has proposed, finds its energies largely wasted in vain attempts at making serious responses to absurd inquiries and formal reports on impracticable schemes.

These are the salient facts in the situation as it exists to-day. The remedy may be summed up in a dozen words. *Let the public and the press unite in loyal support of the Water Bureau.* If the officials of

* This estimate is based on an assumed present population of 1,200,000. According to the census of 1890, the population of Philadelphia was then 1,046,964.

† The highest death-rate in Philadelphia from typhoid fever during the past thirty-eight years (for which records are available) was reached in 1865, at the close of the Civil War. The deaths numbered 124 per 100,000 of population. In 1876, the year of the Centennial, the number was 92. During the first twelve weeks of the present year, to March 25th inclusive, there have been 444 deaths, or at the rate of 1924 per annum for the entire population. Estimating the latter at 1,200,000, the deaths per 100,000 number 160 per annum, or 30 per cent. greater than the average death-rate for the year 1865—the worst on record. It is to be especially observed, however, that the average of a twelve weeks' period is here compared with that of an entire year. It is, perhaps, not reasonable to assume that the present high death-rate will be long maintained.

this bureau should prove themselves incompetent or faithless to their trust, the officials should be changed. The principle itself remains unaffected. In the campaign against recalcitrant members of City Councils, let the watchword be, "Support our Engineers." Let matters of engineering be entrusted to the unhampered control of engineers. No profession has shown itself more worthy of trust in matters coming within its sphere. Let laymen not presume to dictate policies or to obtrude advice in matters purely professional. Let Councils confine themselves to the honest discharge of their own special functions—that of providing ways and means for the speedy and effective execution of such measures as are recommended by the engineers.

Summed up in brief, what does the Bureau of Water propose in the present exigency?

First.—Adequate appropriations for placing its plant in a state of uniform efficiency.

Second.—Measures for the restriction of wanton waste.

Third.—The installation of filtration plants.

Concerning the first proposition there can be no division of honest sentiment. Its reasonableness will be admitted by every right-minded member of this community. It may be dismissed off-hand on its merits, without argument.

The second and third propositions can not be treated separately. We need no training as engineers to recognize the folly of plunging out upon an elaborate scheme of filtration, unaccompanied by measures for the restriction of our present wholesale waste. Referring first to filtration, it is probably true that the overwhelming proportion of our population have come to recognize its imperative need. This is not the time to discuss the relative merits of various systems. Such questions may be left with confidence to the proper officials, who propose to avail themselves of the absolutely disinterested council of leading experts. The problem of filtration may well be dismissed with these general statements.

It is against the evil of reckless waste that the campaign of popular education should be especially directed, and it behooves us, as engineers, to be leaders, not weak-kneed followers, in this campaign. As engineers, familiar, if only in a general way, with the experiences of other cities, we know that the introduction of meters is the only

proper solution. The proposed substitution of automatic valves for appliances now in common use, especially in connection with hopper-closets, though an encouraging step in the right direction, does not strike at the root of the evil. The present opposition of the public and of the local press against water-meters is but a repetition of the history in many other cities where meters have come to be recognized as the helpful agencies they really are. The oft-repeated popular cry that water should be as free as air and sunlight is as fallacious as many other phrases that captivate the unthinking ear. Water is free to him alone who fetches it with pail in hand from its place in nature and sets no value on his time and labor.

Making all reasonable allowance for errors in the computation of pumpage, for evaporation and seepage from the reservoirs, and for leakage in the distributing system, the stubborn fact remains that from one-half to two-thirds of our so-called consumption is chargeable to the most reckless waste. It is not my purpose to present elaborate arguments and statistics in support—I will not say defense—of meter systems. The experience of the numerous municipalities in which such systems have been adopted all point to the same general conclusions. I propose, therefore, to direct attention merely to a few leading facts, not for the information of engineers, but as an appeal to thoughtful laymen.

The adoption of meters will meet with immediate response in the reduction of waste. With a sufficiently comprehensive system, our consumption will be reduced one-half or more. The reckless consumer must reform, or pay the penalty of his own folly. His waste will no longer fall as a tax upon his more prudent townsmen.

Decreased consumption means a proportionate saving in coal-bills and numerous other operating charges. The capacity of the distributing system will be correspondingly increased. In low-pressure districts, increased pressure will result without the purchase of additional pumps. Pumps now driven night and day may be thrown out of service and kept in reserve for contingencies.

The fixing of water-rates will be changed from mere guesswork to a system equitable to all consumers. With equal net revenues to the city, the cost to the average consumer will inevitably be reduced.

Lastly, if waste is to proceed unchecked, the outlook for filtration seems well-nigh hopeless,—both by reason of its enormously increased

cost and because of the then urgent need for extensions in all directions.* With restricted waste, the existing reservoirs will probably suffice for at least preliminary sedimentation preparatory to filtration.

If the foregoing facts were fully appreciated by the public, the present wide-spread opposition to the meter system would, doubtless, quickly melt away.

The objections urged against meters with some sound of reason may be grouped under three principal heads:

First.—That a charge for water according to consumption would cause the poorer classes to stint themselves in its use, discourage cleanliness, and prove prejudicial to the general health and comfort of the community.

The answer is: Prescribe a fixed minimum charge regardless of quantity actually used, provided the latter does not exceed a certain stipulated, but amply liberal, allowance, and impose an additional pro rata charge on extra consumption only. The per capita allowance may be fixed at will, the main contention being that *some* limit should be set.

Second.—That since water-rents in Philadelphia are borne by property owners, not by tenants, the former would be held liable for waste or leakage which they are powerless to prevent, and that innumerable disputes and law-suits would be the outcome.

The change to a system, exempting the owner and placing the tax wholly on the tenant, however rational, would meet with determined opposition and could not easily be brought about. An obvious solution, in line with the present system, would be to have the lease so drawn that the owner assumes the fixed minimum charges and the tenant is held responsible only for surplus waste.

* Estimates from the "Annual Report of the Chief of the Bureau of Water" (1898), J. C. Trautwine, Jr., Chief of Bureau:

	Without Meters.	*With Meters.*
Extensions	$5,000,000 (urgent)	$1,000,000 (for developing full capacity in excess of need).
Filtration Plants,	7,500,000	2,500,000
Meters.....		1,000,000 (for the partial sytem proposed).
Totals.....	$12,500,000	$4,500,000

Thus, the estimated increased cost, without meters, is $8,000,000. Moreover, with unrestricted waste, future extensions will have to be continued on the same lavish scale as in the past, extending also to the filtration plants.

Third.—That meters would affect the manufacturing interests unfavorably.

But, as has frequently been pointed out, the meter does not fix the rate, but simply registers the quantity. Without entering upon the merits of any particular line of policy, water might be furnished to the manufacturers at discriminating rates or even gratis, if deemed expedient. Nevertheless, a reasonable limit should be set even to public bounties, and without the meter the common interests can not be safeguarded against gross abuse in individual cases. Unless the present average rates to manufacturers are entirely disproportionate to their average legitimate consumption, it follows, on the basis of the present net revenues to the city, that a saving will accrue to the average manufacturer, without resort to discriminating rates.

The most significant fact in the history of meters is that wherever they have been allowed to gain a reasonable footing, their merits have become recognized by the public, and that in no instance a backward step has been permitted in their use.

GENERAL DISCUSSION.

THOMAS L. HICKS (non-member) (after referring to the history of the agitation of the water question in Philadelphia, and to the value of reservoirs and pumping facilities):

I desire to say that notwithstanding all objection, there is too much advantage to be derived from meters to brush the question aside upon the ground that water ought to be as free as air. In my opinion, with every house in this town metered, water would be still as free as air, for the proper uses of the people, without unnecessary restriction. During the time that I was a member of Councils I spent nearly three months in going into the question of water-meters, visiting dyeing establishments, morocco dressers, and factories throughout this city that were supposed to be large consumers of water—using water, in fact, in the nature of a raw material. The meter rate of water at that time was sixty cents a thousand cubic feet. This is two cents a ton. Now, I ask what manufacturing industry of the city of Philadelphia would be driven out because it had to pay for water at the rate of two cents a ton? So much for the cost of water. Now as to saving: In one part of the city there were two morocco

leather factories facing each other. I can not recollect the exact figures, but I will give the proportions based upon facts, because I took the records, made the calculations, etc. One establishment employed about fifty men, the other about one hundred and fifty, and each turned out goods in proportion. The smaller establishment paid a bill of $142 per year. The larger paid $45 a year. When meters were put into these two establishments the water-rent of one came down and of the other went up, putting them on an equality, and they were taxed by the meter-measurement exactly alike for each dozen of skins turned out thereafter. Another case came under observation at that time. During the course of the inspection of one establishment it was found that at six o'clock on Saturday night a man who had been using a hose dropped it when the whistle blew, and that the water ran until the mill was opened on Monday morning. It was clearly established they wasted 750,000 gallons of water from Saturday night to Monday morning. Had a meter been in that establishment that would have happened possibly once, but after that the proprietor would take good care to see that the water was turned off. There is a good deal in the story of waste, but I have yet to be convinced that there is quite as much in it as the returns of the Bureau of Water show.

L. Y. SCHERMERHORN.—Is not the restriction of waste in the hands of the Water Bureau?

MR. TRAUTWINE.—Theoretically, yes; but our hands are few and weak, relatively to the immensity of the task. Our force of inspectors numbers nineteen, and the population is about a million and a quarter. True, as I have said, only a small fraction of this population does the wasting for the city; but that fraction is not confined to one district, but is scattered over the whole city, and thus involves perhaps nearly as much labor as if the whole population were guilty of waste. Prior to my administration, attempts at waste restriction by house-to-house inspection were made, but resulted only in temporary improvement. We have, however, recently resorted to it again in the case of the Germantown district, where the shortage in certain districts is very distressing. Intelligent laborers have there been detailed to supplement the force of inspectors, visiting the premises and leaving circulars calling attention to the ordinances of Councils respecting waste of water; but we have not yet been able to estimate

the results of the process. Mr. Fuller, Assistant-in-Charge of Distribution, can give us some particulars on this subject.

ALLEN J. FULLER.—In one district, in which the waste was studied with the aid of the Deacon waste-water detector, we succeeded in having all the fixtures put in good order, and the major portion of the waste stopped; but a reinspection, made about six months later, showed water being wasted at an even greater rate than at the time of the first inspection. At one time half the fines imposed were paid to informers, and under this system much was done in restricting waste; but it was abandoned, I think, by ordinance of Councils. More efficient and perfectly satisfactory means for the prevention of waste have been applied in many cities and towns, and always with the most gratifying results.

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1122 Girard Street

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The Board of Directors meets at 4 P.M. on the 3d Saturday of each month, except July and August.

INDEX.

PAGE

ALUM in Water, ... 121
Annual Address of President, ... 65
Report of Board of Directors and Treasurer, ... 61
Atbara River Bridge, ... 324

Birkinbine, J., Niagara River Water-power, ... 38
Utilization of Waste, ... 240
Water-supply of York, Pa., ... 46
Discussion on Niagara Gorge Railway, ... 265
Board of Directors, Annual Report of, ... 61
Minutes of, ... 59, 219, 272, 301, 347
Burr, W. H., Long-span Bridges, ... 305

Carter, O. C. S., Coastal Topography, ... 273
Cement and Cement-testing, ... 145
Christie, J., Discussion on Cement-testing, ... 195
Long-span Bridges, ... 321
Utilization of Waste, ... 246
Coastal Topography, ... 273
Comfort, S. G., Discussion on Water-purification, ... 107

Deans, J. S., Long-span Bridges, ... 321

Earle, T., Discussion on Atbara River Bridge, ... 345
Easby, W., Water-purification, ... 105, 106
Eglin, W. C. L., Discussion on Atbara River Bridge, ... 343

Fuller, A. J., Movement of Water-mains, ... 33
Discussion on Subway Construction, ... 37
Water Problem in Philadelphia, ... 216
Furber, W. C., Discussion on Cement-testing, ... 197

Hering, C., Discussion on Mine Haulage, ... 238
Hicks, T. L., Discussion on Water Question in Philadelphia, ... 214
Humphrey, R. L., Testing Laboratory of Philadelphia, ... 178
Discussion on Cement-testing, ... 196, 197, 198

Khuen, R., Atbara River Bridge, ... 324

PAGE

Landis, E. K., Discussion on Water-purification, ... 103, 104
Ledoux, J. W., Sand-filter Plant, ... 108
Leffmann, H., Discussion on Sand-filter Plant, ... 124
Lesley, R. W., Cement-testing, ... 145
Library, Additions to, ... 220, 302, 348
Livingston M., Discussion on Utilization of Waste, ... 245
Long-span Bridges, ... 305

Maignen, P. J. A., Discussion on Sand-filter Plant, ... 121, 124
Water-purification, ... 83, 103, 104, 105
Marburg, E., Water Problem in Philadelphia, ... 209
Discussion on Athara River Bridge, ... 344
Cement-testing, ... 196
Long-span Bridges, ... 322
Mechanics, Phases in Development of, ... 65
Mills, C. M., Discussion on Athara River Bridge, ... 344
Mine-haulage Practice, ... 221
Minutes of Board of Directors, ... 59, 219, 272, 301, 347
Club, ... 58, 217, 272, 301, 346
Myers, H. K., Mine-haulage Practice, ... 221

NIAGARA Gorge Railway, ... 248
Water-power, ... 38
River Water-power, ... 38
Nichols, E. M., Discussion on Cement-testing, ... 198
Mine-haulage, ... 238
Water-purification, ... 106

Pennsylvania Avenue Subway, ... 1
Philadelphia, Water Question in, ... 83, 199
President, Annual Address of, ... 65

Richards, J. T., Discussion on Mine-haulage, ... 238
Ricker, S. A., Niagara Gorge Railway, ... 248

SAND-FILTER Plant, ... 108
Schermerhorn, L. Y., Presidential Address, ... 65
Note on Strength of Tubes, ... 126
Discussion on Cement-testing, ... 197
Sand-filter Plant, ... 123, 125
Subway Construction, ... 37
Water Question in Philadelphia, . . 215
Schumann, F., Discussion on Cement-testing, ... 195, 196, 197
Mine-haulage, ... 237, 238
Smith, E. F., Discussion on Coastal Topography, ... 299
Souder, H., Discussion on Mine-haulage, ... 238
Utilization of Waste, ... 247

PAGE

Spencer, T., Telephone Engineering, ... 129
Subway, Pennsylvania Avenue, ... 1
Work, Movement of Water-mains, ... 33

TELEPHONE Engineering, Problems in, ... 129
Testing Laboratory of Philadelphia, ... 178
Trautwine, J. C., Water-supply of Philadelphia, ... 199
Discussion on Sand-filter Plant, ... 120, 125
Water Problem in Philadelphia, ... 215
Treasurer, Annual Report of, ... 61
Tubes, Strength of, ... 126

UTILIZATION of Waste, ... 240

WASTE of Water in Philadelphia, ... 199, 214
Utilization of, ... 240
Water Problem in Philadelphia, ... 259
Question in Philadelphia, ... 83, 199
Waste in Philadelphia, ... 199, 214
Water-mains, Movement of, ... 33
Water-power, Niagara River, ... 38
Water-purification in Philadelphia, ... 65
Water-supply of Philadelphia, ... 199
of York, Pa., ... 46
Webster, G. S., Pennsylvania Avenue Subway, ... 1
Discussion on Subway Construction, ... 37
Webster, W. R., Discussion on Atbara River Bridge, ... 344
Wennas, C. J., Discussion on Atbara River Bridge, ... 343
Wolfel, P. L., Discussion on Atbara River Bridge, ... 344

York Water-supply, ... 46