CONSTITUTION AND BY-LAWS

OF THE

AMERICAN WATER WORKS ASSOCIATION

TOGETHER WITH THE

PROCEEDINGS

OF THE

1st, 2d, 3d, 4th, 5th and 6th Annual Sessions

HELD AT

ST. LOUIS, MO., 1881; COLUMBUS, O., 1882;
BUFFALO, N. Y., 1883; CINCINNATI, O., 1884;
BOSTON, MASS., 1885; DENVER, COL., 1886.

MINNEAPOLIS.
CHAS. E. COSBY, PRINTER.
1887.

To the Officers and Members of the American Water Works Association:

GENTLEMEN:—Your Committee to whom was assigned the duty of revising and reprinting the Proceedings of the First, Second, Third, Fourth, Fifth and Sixth Annual Sessions, have, to the best of their ability endeavored to perform that duty, and have furnished electrotype plates of the entire work, for future use, if desired, and respectfully submit this work for your approval.

G. E. BEACH, Chairman.

COMMITTEE OF ARRANGEMENTS

SEVENTH ANNUAL SESSION,

MINNEAPOLIS, MINN., JULY 13th to 18th, 1887.

J. W HENION, Chairman.....Minneapolis, Minn.
ANDREW RINKER,..... " "
JOHN T. FANNING,..... " "
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EXECUTIVE COMMITTEE—Officers above, *ex-officio*.

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PRESIDENT—L. H. Gardner, New Orleans, La.
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PRESIDENT—Peter Milne, Jr, Brooklyn, N. Y.
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OFFICERS FOR 1886-7.

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PAST PRESIDENT—Peter Milne, Jr., New York, N. Y.
EXECUTIVE COMMITTEE—The officers named above.

COMMITTEE ON REPRINTING

PROCEEDINGS OF

THE AMERICAN WATER WORKS ASSOCIATION.

First to Sixth Sessions Inclusive.

G. E. BEACH, Minneapolis, Minn.

I. L. LYMAN, Lincoln, Neb.

W. L. CAMERON, Memphis, Tenn.

PROCEEDINGS OF SECOND ANNUAL MEETING

Held at Columbus, Ohio, March 14, 15 and 16, 1882.

FIRST DAY, MARCH 14, 1882.

MORNING SESSION.

The Association met in the City Council Chamber and was called to order at 11:30, A. M., President Foster in the chair. The roll called with the following members present:

ACTIVE.

Prest., J. T. Foster, Chicago.
J. G. Briggs, Terra Haute.
W. C. Stripe, Keokuk.
Ira A. Holly, Burlington.
J. B. Quigley, Atchison.
M. X. Chuse, Bloomington.
H. D. Wood, St. Louis.
B. F. Jones, Kansas City.
H. H. Harrison, Stillwater.
J. James R. Croes, New York.
Wm. Molis, Muscatine.
Edwin Darling. Pautucket.
G. W. Pearsons, Kansas City.
Sec'y, J. H. Decker, Hannibal.

HONORARY.

Dennis Long & Co., Louisville.
N. O. Nelson & Co., St. Louis.
Union Water Meter Co., Worcester.
Jarecki, Hays & Co., Erie.
James Flower, Detroit.
Bingham & Morgan, Buffalo.
Ludlow Valve M'f'g Co., Troy.
Chandler & Swift, Buffalo.

Reading minutes dispensed with.

THE PRESIDENT—Gentlemen of the Association: We have now met for our second annual session, and I am proud to say that we have an active association and a society that bids fair to be one of the best in the country, and one that I think will be as much of a benefit as any society of Engineers, either mechanical on civil, and that by conferring with each other we will benefit ourselves and the corporations we represent, thus amply repaying us for the trouble which we may incur in coming from remote distances. The duties of the Secretary of the past year have been quite arduous, mailing his communications to every water company and those interested therein throughout the country, and attending to the several other duties of his office. I will say to the Association that the accounts of the Secretary and Treasurer have been ex-

amined by the Executive Committee and found satisfactory, showing that we are progressing and have considerable of a fund on hand.

On motion the reports of the Secretary and Treasurer were adopted.

Several letters of regret were received and read.

On motion of J. G. Briggs, the Secretary was allowed a compensation of $100 for services rendered during the past year.

The President announced the following topics for discussion, and committees on each, as having been prepared by the Executive Committee.

Fire Hydrants—W. C. Stripe, J. G. Briggs and H. G. Belcke.

Pressure Systems—T. J. Whitman, Prof. Chas. A. Smith and J. B. Quigley.

Work of Plumbers—F. Wm. Raeder, W. L. Cameron and Wm. H. Burnham.

Engine Duty—John P. Hely. M. Donahue and Wm. Ratekin.

Records—Ira A. Holly and H. D. Wood.

Mr. Kelley suggested that owing to the small attendance, it might be well to adjourn until to-morrow at 10 o'clock, when more of the members would be in attendance, and also inquired if the above topics were the only ones to be considered by this convention.

The President replied in the negative.

Mr. Kelley inquired as to the position of honorary members, whether it was the same as active members, so far as presenting matters.

The President replied that he so understood it; that they had been treated so at our last meeting.

On motion convention adjourned till 3 o'clock P. M.

FIRST DAY, MARCH 14, 1882.

AFTERNOON SESSION.

Convention was called to order at 3 P. M.; President Foster in the chair.

The Secretary announced that Prof. Orton, of the Ohio State University, and Mr. McClung, President of the City Council, were present, and moved that they be invited to be at home with us during our session. Carried.

The following applications for membership were presented by the Secretary:

FOR ACTIVE MEMBERSHIP.

S. P. Axtell, Columbus, Ohio,; Fred E. Hoyt, East Saginaw, Mich.; Orson G. Stanley, Canon City, Col.; Peter Milne, Jr., Brooklyn, N. Y.; Geo. A. Ellis, Springfield, Mass.; D. I. Holcomb, Sedalia, Mo.; Richard Holme, Jr., Denver. Col.; Sidney M. Dyer Indianapolis, Ind.; G. C. Stevens, Newport, R. I.; Calvin S. Brown, Toledo, Ohio; Carl Schon, Toledo, Ohio.; A. G. Moore, Cincinnati, O.; Thos. J. Bell, Cincinnati, O.

FOR HONORARY MEMBERSHIP.

National Meter Co., New York.; Jas. P. Michellon, Gloucester City, N. J.

On motion the above named applicants were declared duly elected members of the Association.

Mr. Dyer here offered the following resolution which was adopted.

Resolved: That a committee of three be appointed by the Chair to draw up and submit an amendment to the Constitution regulating the privileges of Honorary Members, and establishing their rights as regards discussions and voting, and report at once.

The Chair appointed as such committee, Messrs. Briggs, Ellis and Dyer.

The President read a commucation from Mr. Whitman presenting for consideration Furney's Water Monitor.

Mr. Briggs, chairman of the committee appointed to amend the Constitution, made the following report:

We herewith propose the following addition to Section 2, Article III of the Constitution:

Provided, That in no case shall such members be entitled to vote upon any question coming before the Association, but may with permission of the Association address it upon topics pertaining to their respective avocations.

[Signed] J. G. BRIGGS, GEO. A. ELLIS, S. M. DYER, } Committee.

Mr. Darling moved to reconsider the motion for continuing reports of committees until to-morrow for the purpose of taking up that part that alludes to Fire Hydrants this afternoon. Carried.

Mr. Briggs, of the Committee on Fire Hydrants, stated that he had prepared no report on this subject, but had collected a large number of drawings and models of the different Fire Hydrants in use, and that he would place them for the inspection of the members present. Here followed an explanation of the various showings, eliciting a general informal discussion of the merits and demerits of each.

(The spirit with which the subject was handled by all present made it one of the most interesting and profitable during the convention.)

Moved that a committee of five be appointed by the Chair to place in nomination officers for the ensuing year. Carried.

Committee were as follows: Geo. A. Ellis, J. G. Briggs, Orson G. Stanley, Peter Milne, Jr., and D. I. Holcomb.

On motion the Convention adjourned until to-morrow (Wednesday) morning at 10 o'clock.

SECOND DAY, MARCH 15, 1882.

MORNING SESSION.

Convention met at 10 o'clock, President Foster presiding, who stated that the first thing in order would be the report of the Committee on Nominations.

Geo. A. Ellis, chairman, submitted the following:

President—J. T. Foster, Chicago, Ills.

Vice-Presidents—J. C. Briggs, Terra Haute, Ind.; W. C. Stripe, Keokuk, Ia.; J. James R. Croes, New York City; Thos. J. Bell, Cincinnati, O.; Edwin Darling, Pawtucket, R. I.

Secretary—J. H. Decker, Hannibal, Mo.

Treasurer—Horatio D. Wood, St. Louis, Mo.

The report of the committee was adopted.

On motion, Geo. A. Ellis cast the vote of the Association for the candidates named, who were thereupon declared elected.

The President addressed the Convention as follows:

I thank you, gentlemen, for your election of myself again as President of your Association. Having endeavored during the past year to increase the membership and support the interests of our Association, I can but ask the hearty co-operation of all members in my work for the coming year. It affords me much pleasure being at the head of an association of this character, inasmuch as I feel it is, and will surely become,

of great interest to all engaged in the management of waterworks, and to many not directly interested therein; and I will say in this connection that I would be pleased to hear from our honorary members, not only in relation to the merits or demerits of their own particular kind of manufacture, but on any subject which may properly come before our Association as a matter of interest to all. There are many of them, I know, who have spent a great portion of their lives in this special direction, and their knowledge and experience would doubtless prove of great value to many of us.

I ask that all be free in the interchange of ideas and opinions, that our meetings may be of great profit and enjoyment.

Again, gentlemen, I thank you for my re-election as your President. [Applause.]

Here the Secretary read an invitation for the Convention to attend the first annual opening of the Columbus Buggy Co., which was accepted.

The President said he would be glad to hear from the Committee on "Engine Duty," if there were any members of the committee present. There being no response, he remarked that he would dislike to pass along and not hear the report of this committee; and, if agreeable, he would entertain a motion that a committee be appointed to report on "Engine Duty" to-morrow, whereupon Mr. Bell moved that the suggestion of the Chair be approved, and that it appoint such a committee to report to-morrow at 10 o'clock. Carried.

The President named upon such committee, Messrs. Bell, Darling and Holly.

The topic of "Pressure Systems" was taken up by vote of the Association. The Secretary presented a report from Mr. T. J. Whitman, of St. Louis, Chairman of the Committee on that subject. Mr. Geo. A. Ellis read the report.

The Committee appointed on Pressure respectfully submits the following report:

The word "pressure," applied to water works, is usually intended to mean the pressure in the distribution pipes tending to burst them, and is usually expressed in lbs. per square inch, or in feet in height of a column of still water whose weight on a square inch of base is the pressure in pounds avoirdupois per square inch.

The head of supply may be produced either by actually taking the water from a level higher than the distribution, or, by forcing it into the distribution by pumps driven by external power.

At any given point in a system of distribution pipes, the pressure must either be constant or variable. The former only occurs either when no outlet is open, and there is a constant head of supply, or in case of a steady flow where an equal quantity of water passes out of any outlet in equal times, and there is a constant head of supply. In this case the pressure is always less than when no outlets are open.

Practically, there are only two classes in which pressure can be considered. Those cases in which the head of supply is nearly constant, and those in which the head of supply may be varied at will, as the real pressure at any point is always varied by the flow at the neighboring outlets.

We have then only to consider how the head of supply may be varied, and how the variation at any given point in the distribution system may be affected thereby.

Variation in the head of supply may be produced by the following methods:

By increase in speed of pumps used for supply until the increase of pressure is such that the pumps slacken speed again and continue to deliver the quantity into the distribution which flows from the openings thereof, and by actual change of the supply from one level to another.

VARIATIONS OF PRESSURE PRODUCED BY SPEED OF PUMPS.

At every stroke of a pump a change of pressure occurs in the force main near the pump, and to a less degree a change occurs in the entire distribution. To lessen the extent of such changes, air chambers are placed on the pump discharge, and in some cases upon the distribution system, although their object is then to lessen the effects of changes in the flow of water in the distribution caused by changes of openings or of speed in the pumps. For the same purpose relief valves and stand pipes are placed on the force main to prevent sudden changes of pressure in the distribution. Elevated storage reservoirs act of course as equalizers of pressure, but serve also another purpose in storing water, and thereby contributing to the permanence of the supply.

When no relief is given to the distribution other than the air chambers of the pumps, large changes of pressure are continually occurring.

The choice of means to amend is to be governed entirely by the external conditions as to the cost of construction and operation, and whether it is desired to make large changes of pressure in the distribution or not. It may be regarded as a fixed fact, that low pressure in the distribution pipes tends to reduce waste, and that high pressure tends to increase it, and therefore this is an important item, if high pressure for fires is required, and also at what elevations such pressure is required. The extent of the distribution is also a very important factor, and of course the size of the pipes.

In cases where the cost of construction and operation is nearly the same the order of preference is considered by your committee to be the following, for constant head of supply:

Storage Reservoirs of large capacity, of which the works at Baltimore are an excellent example.

Storage Reservoirs of small capacity, of which Cleveland may be considered an illustration.

Storage Stand Pipes of large capacity, as at Sandusky.

Stand Pipes of small capacity, of which perhaps Louisville may be taken as the best example. for although an extensive storage reservoir is used, yet the water is pumped to a constant elevation and passes up one portion of the stand pipe and down the other.

Air Chambers in place of stand pipes, of which the committee have no personal knowledge.

For widely varied pressures, the order of preference is as follows:

Storage Reservoirs at different elevations, of which the works at Cincinnati would afford the best example.

Storage Reservoirs for low pressure and Stand Pipe for high pressure, as at Henderson, Ky.

Stand Pipes of small capacity, of which there are many examples where variations of pressure can be made by the pumps, but very few where such changes can be rapidly made.

Air Chambers, on the distribution of which your committee have no personal knowledge.

In the opinion of your committee, pumping directly into the mains without relief should only be resorted to when no other expedient can be resorted to without largely increased cost.

The annual cost of operating, other things being equal, will be nearly in the order given above.

As a method of examining the flow of water and pressure in the distribution pipes the committee venture to add as an appendix to their report a valuable paper by Mr. M. L. Holman, C. E., member of the Association, which, although written and printed for another body, is yet considered as a desirable addition to their labors:

GRAPHICAL METHOD OF STUDYING EFFICIENCY OF WATER DISTRIBUTION SYSTEMS AND PERFORMANCES OF FIRE ENGINES, AS ILLUSTRATED BY THE BURNING OF THE COLLIER LEAD AND OIL WORKS, ST. LOUIS, MO.

By M. L. Holman.

The burning of the Collier Lead and Iron Works and some adjacent buildings situated on the block between Ninth and Tenth streets and Clark avenue and Walnut street, furnished material for considerable discussion, and many different opinions have been expressed in regard to the supply of water and the efficiency of the distribution system of water pipes in this locality. It seemed that a study of the supply would be of interest to some of the members of the Club, and for this reason only was the work undertaken. The graphical features are brought forward on account of their simplicity and facility of application to similar cases.

The location and sizes of the different pipes in the vicinity of the fire are shown on the plan. The primary system, as it may be called, consists of a 20-inch pipe on Fourteenth street, a 20-inch pipe on Seventh street, a 15-inch pipe on Pine street, and a 15-inch pipe on Clark avenue. These pipes are connected at the intersection ot Seventh street with Pine street and Clark avenue, and Fourteenth street with Pine street and Clark avenue. The supplies to these pipes beyond the connections are independent of each other, and by reference to the pipe map of the city will be found ample for any demand that can be made upon them. The secondary system is made up of 4-inch, 6-inch, and 10-inch pipes, connected to the large pipes and to each other.

The locations of the engines in use are also shown on the plan, and we see that the supply to the engines at Tenth and Chestnut streets, Tenth and Spruce streets, Eighth and Clark avenue and Seventh and Walnut streets, is in a greater measure independent of the supply to the remaining engines, and appears to be ample. The supply to the remaining engines is more complex, as the pipes are connected to each other, and the question of supply will be confined to these engines.

The first step is to find the probable amount of water that each engine was delivering on the fire. To do this it is assumed that the engines were all in good order, that the hose was well laid out on the shortest route to the nearest point of the fire, and that smooth nozzles of $1\frac{3}{8}$-inch diameter were used.

The only authority at hand on this subject is a book by Geo. A. Ellis, and is entitled, "Work Done by and Power Required for Five Streams. as Determined by Experiments made in the Springfield Fire Department by Chief Engineer A. P. Leshure."

Diagram B is a graphical representation of some of the tables of this book, and is used for estimating the quantities of water thrown by each engine.

The quantities represented on the diagram are:

1. Quantity of water per minute in U. S. gallons.

2. Friction loss of pressure in pounds per square inch in 2½-inch rubber hose for lengths up to 1,000 feet.

3. Effective pressure necessary on smooth nozzles from 1-inch to 1⅜-inch diameter.

4. Vertical distances reached by jets.

5. Horizontal distances reached by jets.

The sum of Nos. 2 and 3 for any particular case gives the pressure necessary at hydrant or steamer.

Quantities of water from 600 to 400 U. S. gallons per minute are represented by distances on line *A B* from *A* to the right.

The loss by friction of water in hose in pounds per square inch is plotted as ordinates from *A B* upwards or towards the top of the diagram. The length of hose is marked on the curves.

The effective pressures necessary on nozzles are plotted as ordinates from *A B* towards the bottom of the diagram. The curves are marked with the size of the nozzle to which they correspond.

The distance along the ordinate, through the point on *A B* (corresponding to a given quantity of water per minute), from the curve above *A B* (representing the length of hose used), to the curve below *A B* (representing the nozzle used), represents the total pressure necessary at the hydrant or steamer to discharge the given quantity of water

The vertical distances reached by jets as shown by broken lines below *A B*, and the corresponding heights, are marked to the right.

The horizontal distances reached by jets are represented by full lines and the distances are marked to the left.

For further particulars see example on diagram.

The following are the quantities estimated for each engine:

Number of engine.	Location.	U. S. gallons of water thrown per minute.
1.	Eleventh street and Clark avenue	300
4.	Eleventh street and Walnut street	335
19.	Eleventh street and Market street (west)	265
17.	Eleventh street and Market street (east)	265
15.	Tenth street and Clark avenue	700
14.	Tenth street and Walnut street	380
13.	Tenth street and Market street	800
18.	Eighth street and Walnut street	300
9.	Eighth street and Market street	265
12.	Ninth street and Market street	265

The above estimates, with the exception of No. 15, are based on the supposition that a pressure of 200 pounds per square inch was maintained in the air chambers. Engine No. 15 was using two short lines of hose, and the quantity estimated is in all probability fully up to the quantity the engine was throwing. The above amounts are below the capacity claimed for the engines, but are somewhat in excess of the amounts as found from the diagram corrected for differences in level between engines and nozzles.

For the loss of head due to friction of water in the distribution pipes the following formulæ are selected for illustration:

Let h=loss of head by friction in meters.
l=length of pipe in meters.
d=diameter of pipe in meters.
v=mean velocity of flow in meters per second.
g=9.81 meters.

$$h = \left(0.01439 + \frac{0.0094711}{\sqrt{v}} \right) \frac{l}{d} \frac{v^2}{2g} \quad [Weisbach.]$$

$$h = \left(0.0273346 + \frac{0.0013597}{v} \right) \frac{l}{d} \frac{v^2}{2g} \quad [Prony.]$$

$$h = \left(0.01989 + \frac{0.0005078}{d} \right) \frac{l}{d} \frac{v^2}{2g} \quad [D'Arcy.]$$

The following by Kirkwood is also given for tuberculated pipes:

h=loss of head in feet by friction.
l=length of pipe in feet.
v=mean velocity of flow in feet per second.
d=diameter of pipe in feet.

$$h = \frac{v^2 l}{1600 d}$$

Plot A is a graphical illustration of the loss of head for 100 feet of 6-inch pipe according to the above formula.

Distances on the line $A B$ are laid off from A toward B to represent velocities from 2 feet to 10 feet per second.

Ordinates from $A B$ upward represent the loss of head in feet per 100 feet of 6-inch pipe. The curves are marked with the names of the auth rities giving the formulæ by which the curves are calculated.

The pipes in question are not in as bad condition as the tuberculated pipes from which Mr. Kirkwood derived his formula. The formula used for calculating loss of head in the present case is as follows:

h=loss of head in feet by friction.
l=length of 6-inch pipe in feet.
v=mean velocity of flow in feet per second.
$h = 0.001\ v^2\ l$.

The curve corresponding to this formula is also shown on plot B.

The total amount estimated for the supply to the ten engines under consideration is a little less than 3.400 U. S. gallons per minute, or an amount equal to that supplied by a 6-inch pipe, with a mean velocity of about 38.3 feet per second.

The supply is assumed as coming through the 6-inch pipe at Seventh and Walnut streets, Seventh and Market streets, Tenth street and Clark avenue, Eleventh street and Clark avenue, and through the 6-inch pipe in alley west of Eleventh street, from Chestnut street.

The supply from the 4-inch pipe between Seventh and Eighth streets, connecting the 15-inch on Clark avenue to 6-inch on Walnut street; the supply around Engine No. 14 by 4-inch pipe in alley west of Tenth street, and the supply from the 6-inch on Market street from alley west has been disregarded. The only result of this is to reduce the pressure as figured at the engines. The reduction is slight, and is nowise detrimental to the performance of the engines. but rather throws the burden of proof as to an efficient supply on the distribution system.

The total supply gives a mean velocity of supply of 7.65 feet per second for each of the five 6-inch feeders.

To find the probable velocities. we first plot the curve whose equation is $v^2 = 2gh$, as shown on diagram C. Velocities from 4 to 13 feet per sec-

ond are plotted as abcissas, and the corresponding values of h as ordinates. The curve

$$h = .5\frac{v^2}{2g}$$

is next plotted with values of v as abcissas; but the ordinates are measured from the curve $v^2 = 2gh$. The curve

$$h = .5\frac{v^2}{2g}$$

is again plotted, using the last curve as starting point for ordinates.

This gives us the three lower curves on diagram C.

The ordinates to first curve give the head due to the velocity or loss of head necessary to generate the velocity.

The ordinates to the second curve, or curve $B\ D$, give the loss of head due to velocity and the connection to large pipe when made with a branch and valve.

The ordinates to curve $A\ C$ represent the loss of head due to velocity and connection when made with a saddle and valve.

The equation adopted for use in this investigation, as before stated,

$$h = 0.001\ v^2\ l, \text{ for 6-inch pipes.}$$

For convenience in plotting the curves used to adjust the velocities in the different pipes the left-hand part of diagram C is constructed.

Distances, from 1 to 1,000 feet, are laid out on the axis of abcissas to a scale of 1 inch = 100 feet.

Radiating lines from the origin are drawn, so that the ordinates to any line represent the loss of head [by formula] due to the velocity marked on that line for the length of 6-inch pipe, as shown by the corresponding abcissa.

By means of the diagram last described we plot the curve representing the loss of head due to friction in the pipe on Walnut street, from Seventh street to Tenth street. The ordinates to this curve are measured from the curve $A\ D$, as the connection at Seventh street and Walnut street is made with a branch and valve. The curve thus obtained is marked $E\ F$, and the ordinates represent the loss of head in the main pipe in Walnut street from Seventh street to Tenth street for velocities from 5 feet to 8 feet per second.

The loss of head in main pipe in Tenth street, from Clark avenue to Walnut street, is next plotted as ordinates from the curve $A\ C$, as the connection at Tenth street and Clark avenue is made by a saddle and valve. This gives the curve $G\ H$.

The loss of head in main pipe from Tenth and Walnut street to Tenth and Market street is plotted in small diagram, in upper right-hand corner of diagram C, and gives the curve $X\ Y$.

The loss of head in main pipe on Eleventh street, from Clark avenue to Market street, is plotted as shown by curve $K\ L$; the ordinates are measured from curve $A\ C$, the connection being made by a saddle and valve.

The curve $M\ N$ represents the loss of head in main pipe from Seventh street and Market street to Tenth street and Market street, and plotted from curve $B\ D$, as the connection is similar to that at Seventh and Walnut street.

The curve $O\ P$ represents the loss of head in 6-inch pipe in alley from Chestnut street to Market street west of Eleventh street.

The loss of head in pipe in Market street from Eleventh steeet is shown in small diagram by curve $Z\ Y$.

For all of the above curves the loss of head is plotted as an ordinate from the abcissa representing the velocity.

The approximate velocities and losses of head can now be easily

found, and the results are shown on plot D. The direction of flow in each pipe is indicated by a small arrow, and the velocity in feet per second is given. The head on the main pipes was found by pressure gauges a few days after the fire, the pressures being taken at the same time of day that the fire occurred. An allowance of 10 feet head has been subtracted from the head, as given by the gauges.

The losses of head in feet, as given by diagrams, are indicated at the points on diagram D, where the loss occurs, by □ inclosing the figures.

The calculated losses of head in feet are shown by O inclosing the figures.

The resulting pressures at the plugs are put down in pounds per square inch.

The diagrams furnish a very good approximation to the velocities and losses of head, and with some little care give results sufficiently accurate for practical purposes.

The time and labor saved is also quite an item, as any one can testify who will assume a complicated case and solve it by the two methods.

Respectfully submitted,

THOS. J. WHITMAN, Chairman.

Report received and adopted with thanks.

Mr. Stripe here arose to an explanation in reference to a topic presented by him at the last meeting, "Ellis' Tables; has anyone verified them?" and stated that it was not with a desire to court criticism on Mr. Ellis' book. He having tested the Tables, was desirous of ascertaining whether others had taken enough interest to do the same. As a result of his examination he found the Tables almost absolutely correct and considered the book worthy the consideration of every water works manager, as it is based on actual experiments of Chief Engineer A. P. Leshure, of the Springfield, Mass., Fire Department.

The Committee on "Plumber's Work," having presented no report, this subject was on motion of the Secretary laid over until tomorrow morning, at which time Mr. Milne be requested to give his views on the subject.

Mr. Dyer now moved that the Committee on "Records" read their report. The following report was read by Mr. Wood:

Mr. President and Gentlemen of the Association:

The Committee on Records respectfully report that in order to insure some uniformity for comparison of reports, that the constitutent companies of this Association be requested to forward to our Secretary a report giving a general description of works, showing:

Height of lift.
Size of inlet pipe.
Kind and capacity of pumps.
Kind and power of engines.
Size, capacity, kind and number of boilers.
Number of square feet of grate surface.
Distance of grate bars from boilers.
Height and capacity of reservoir or stand pipe.
Feet head.
Length of mains in distributing, and sizes.

Kind and number of valves.
Number and kind of fire hydrants.
Number per mile or block, and price paid by city.
Domestic fire pressure.
Number of services.
Number of meters and kind in use.
Steam pressure.
Pounds of water evaporated, per pound of coal.
Kind of coal used and average cost.
Cost of fuel, oil and packing used, and quantity per million gallons pumped.
Expense of pumping one million gallons; include all salaries paid, coal, oil, packing, lights, taxes, and repairs of mains, reservoirs and machinery.

Respectfully submitted,
IRA A. HOLLY,
HORATIO D. WOOD, } Committee.

Mr. Ellis then moved as a substitute to the pending question that the report of the Committee on Records be accepted, and that the subject matter be referred to a committee consisting of Messrs. Croes and Wood, with the request that Mr. Croes embody the facts obtained in his history of American water works. Carried.

An invitation from the Trustees of the Columbus Water Works to visit their works in a body, and for which carriages will be provided, was accepted, and the Association decided to start from the Neill House at nine to-morrow morning.

Mr. Bell offered the following resolution :

Resolved: That a committee be appointed by the President to report at our next annual meeting a systematic arrangement for compilation of annual reports, from all, or at least a por ion, of statistics and annual expenses, for the benefit of the Association.

It was decided that the subject matter was embodied in the duties of the Committee on Records.

Mr. Platt here spoke at some length from his experience of the importance of air chambers in preventing the bursting of pipes.

Mr. Parsons, following, said the discussion shows that the use of air chambers on street mains is practically unknown to the members of the Association. At Kansas City, being very much annoyed by the use of elevators, and the air chambers at the pumps being small, I placed one on the main about midway between the works and the centre of the city, choosing a location where it was hoped that the air from the mains would keep it supplied. Unfortunately, this did not prove to be the case, and it soon filled with water. While in use, however, (which is as much of the time as the business of the street superintendent will allow taking care of it), it has proved a very valuable adjunct to our system, taking away all pulsations from the mains and leaving the actions of the pumps about as smooth and uniform as if pumping direct into a reservoir.

In my opinion, the real need of the direct pressure system is something of this kind which will act, so to speak, as a balance-wheel to the whole system, and the nearer it can be placed to the location of disturbance of pressure the more effective it will be. The inertia of water in long lines of pipe with its attendant water-ram is so great that such relief is not only a matter of convenience, but will prove on investigation worthy of being called a matter of necessity. In this connection, I would state that I have patented a stand pipe designed for this purpose, and which is at the service of any member of the Association without royalty. The reason for excessive pressure on a pump-barrel far exceeding in some cases the effect produced on the accumulator, is that the great weight of the plunger and its load may not be able to respond to the sudden shock of the plunger, by reason of the time or duration of the shock not being sufficient to overcome its inertia.

Air, when confined with water at high pressure, seemingly commencing at about 80 lbs. pressure and increasing with the pressure, is absorbed by the water, so the space is sooner or later filled entirely with water. The difficulty of keeping air chambers charged under high pressure is no doubt the cause of their being omitted with accumulators, which are in such case intended to perform the work of both.

Mr. Briggs said very large air chambers were in use in his works, and he had never noticed any vibration of the needle except when some leak was discovered.

Adjourned until three o'clock P. M.

SECOND DAY, MARCH 15, 1882.

AFTERNOON SESSION.

Convention called to order at 3 P. M., President in the chair.

The following applications were received, and on motion were duly elected to membership in this Association:

ACTIVE.	HONORARY.
Frank W. Holly, Lockport, N. Y.	Mohawk & Hudson M'f'g Co., Watford, N. Y.
P. H. Linnee n, Lockport, N. Y.	H. F. Gaskill, Holly M'f'g Co., Lockport N. Y.
H. W. Cannon, Stillwater, Minn.	H. Mueller, Decatur.
Fred Wing, Kansas City, Mo.	C. H. Roosevelt, New Rochelle, N.Y.

Secretary and Mr. Briggs were granted leave for the purpose of visiting Mr. Frank Doherty, Superintendent of the Columbus Water Works, who was lying quite sick at his home.

Mr. Croes offered the following resolution:

Resolved: That a committee of three be appointed by the President with special reference to the question of the waste of water from whatever source it may arise, and to consider the various plans that may be suggested for the detection of waste and the remedy to be applied, and that when the committee's report shall be ready, the Chairman have the same printed and mailed to each of the members of the Association.

The resolution was adopted, and the following committee appointed: J. James R. Croes, W. C. Stripe and Geo. A. Ellis.

The President at this time announced that if there were no objections he would be pleased to hear from Mr. Milne on the subject of "Plumber's Work." He responded by treating his subject in a very able manner, detailing the difficulties and losses to which water companies were subjected by reason of the faulty works of plumbers. The speaker's remarks were ably seconded by Messrs. Pearsons, Ellis and others.

Mr. Stripe presented the following paper entitled,

WATER MOTORS.

My short experience of five years as a water works man has taught me that we are subject to many impositions at the hands of our patrons. Some will make contracts for specific purposes, and use the water for other purposes indiscriminately. Many waste water in a hundred ways—leaky pipes running at night to prevent freezing—carelessness in manipulating baths, water closets, etc., etc. But for cool, deliberate, unqualified imposition, commend me to the water motor. These are advertised to be economical and effective—running at a very small expense for water, in fact (if you take the *ipse dixit* of the dealer), anywhere if it be only a little *damp*.

I have before me an editorial clipped from a newspaper published in Iowa to this effect.

OUR NEW MOTOR.

About two months since we dispensed with our three-horse power engine, and commenced running our presses, consisting of a 30x52 Cottrell & Babcock, one-half and one-quarter medium Gordons, by one of Tuerk's No. 5 (8 inch) Hydraulic Motors, and so far have every reason to be satisfied with the change, the Motor working to our entire satisfaction. The expense for fuel and oil, to say nothing of the time required to attend to the engine, by the old process, averaged twenty dollars per month, while the water tax, at fifteen cents per thousand gallons, accurately metered, foots up seven dollars and eighty cents per month. We are satisfied these Motors are cheaper, safer and more convenient than steam, and they can be used to advantage (in towns and cities having water works) in propelling machinery requiring five horse power or less.

(Putting faith in the truth of this statement we were induced to contract for a supply of water for a precisely similar motor for the consideration of $150 per annum.)

Now, sir, I contend that the item was paid for by the motor man to advance the sale of his machine, as a proof of which that identical motor is now in operation at the same locality, and the same water company now charge $250 per annum for water to run it.

A motor on the piston and cylinder principle is comparatively honest, but a rotary one is the greatest waster of water in existence. If nature furnished the water at sufficient altitude from the motor it alters the case;

but if direct pressure is the principle of the water works, or water has to be pumped to a reservoir to produce the head, then I assert that a rotary water motor is the most patent mode of expending much power to produce little effect in the whole range of mechanism.

Given that your motor is located 50 feet above your pumps, you lose by so raising the water, and by friction 25 to 30 lbs. per inch, and greater loss still in proportion to altitude and distance.

Again, all rotary motors have much slip—the effective power secured being only by impact or percussion on the periphery of the wheel—pressure, per se, having but little to do with it. All things considered, I hold that from ⅛ to ¾ of the power taken from the water works engine is lost, and not at all utilized by the motor. I have arrived at this conclusion by means of actual experiment and know that I am correct. If others doubt this let them make the experiment and I will cheerfully acknowledge my error if such be found. At any rate, the subject is of interest to all of us, and the truth is what we are in search of.

The President stated that Mr. John C. Kelly, of New York, had prepared a very able paper.

On motion Mr. Kelly then presented his paper, entitled,

THE BENEFITS OF THE METER SYSTEM AS SHOWN BY PRACTICAL RESULTS.

It would, perhaps. be more in keeping with the fitness of things if some one less interested than the writer in the article concerning which most of this paper has reference to, would present its claims for the attention and consideration of the members of this convention. Without doubt, if some one of our able engineers would take the stand I propose to take, and discourse in learned and technical phrases upon the benefits of the meter system, his opinion, at least among the professional class, whose words carry with them so much authorative weight, would have a deeper and more lasting effect. It is characteristic, however, of professional men of all classes that, in many particulars, they lack enthusiasm. They grow so little into the habit of weighing and measuring things by set rules, and of estimating possible results by some carefully contrived mathematical analysis, that it may be said they are rarely. if ever, drawn into warm advocacy of any system or theory, but they have a fashion of according to everything within their professional sphere a measure of faint praise, just enough to make its applicability a doubtful question to the less learned world outside their circle. True enough the advocates and indorsers of the meter system find some of their strongest favorable authorities among the engineering corps of this and other countries. but as a rule, those who have the direction and superintendency of vast and important systems of water supply in many of our cities. are rather indifferent when the cla ms of the meter as a remedy for suppressing waste are advanced. They will tell you when you relate the experience of some city where the application of meters has accomplished wonders, that it may be very true, but it would never work with their population; or, that the same conditions do not prevail with them as may exist in the example cited. One thing they very carefully avoid. and that is. any extended argument upon the subject; they are firm believers in giving the people all the water they want, and firmly, though erroneously convinced that such a thing is impossible where meters are generally applied. It may be that these gentlemen are members of the old school, and so wedded to their idols that nothing can break off the attachment. Like that much abused royal family of France, they never forget and never learn anything. It seems, though. that one plan of solv ng the great question of water supply never lacks supporters, and that is the plan having for its object the acquisition of new water sources and an increase

of the supply. To give our engineering talent full credit, we need not hesitate to say that they are exceedingly liberal, and whenever an opportunity occurs do not fail to record their belief emphatically in favor of an unlimited supply of water, particularly if a proposition looking to that end necessitates the accompaniment of a liberal appropriation.

But as this method of providing for the wants of the public is apt, with much repetition, to grow monotonous, and as it has almost invariably resulted in failing to be of any lasting benefit, we are compelled to look for other means of relief which a practical experience of several years under the most exacting tests of every kind proves to be the only appliance which will remedy all waste, increase to the fullest extent the supply, reform the injustice and abuses which tax payers have suffered by tariff rates for years, equitably distribute and faithfully collect the water revenue, and put out of the range of probabilities everywhere the expenditure of immense sums of money to increase sources of supply which, under proper management, are entirely competent to render the service for which they were constructed.

To satisfactorily set before you the truth of this assertion it is only necessary for me to give you as briefly as possible the experience of those who have the control of water works in cities where the meter system has proven a complete success, and whose ability and reputation entitle their opinions to full respect and confidence. It may be said that in this respect experiences are liable to differ, and what may be good and effectual in one locality would fail in another: but the authorities at hand are so varied, and represent so many different phases of the subject, that this argument if advanced, will not hold good. I shall endeavor to show you what the authorities think; what their experience has been regarding the use of the meter in cities which depend for their supply upon a pumping system; upon a gravitation supply; upon a combination of pumping and gravitation; where the supply is comparatively meagre; where it is sufficient for all present demands, and where also it is ample enough to last for all time, taking into consideration the increase of consumption which a growing population will need from year to year.

In the city of Brooklyn, where I reside, and with whose interests I am somewhat identified, the question of water supply is a constantly recurring one. When the thermometer goes up to 90 or down to zero, the same old water famine comes along with touching regularity. In anticipation of the one due in a few months, and to provide against an enormous daily consumption, much larger than it should be under proper restrictions, a plan is being discussed to expend a quarter of a million dollars to find new water sources somewhere by digging wells or buying lakes, which will give the city a daily increase of only five or six million gallons; while at the same time a contract is about to be awarded for constructing a new pumping engine, the cost of which will be over $100.-000. Of course, the average citizen who takes an interest in such matters is of the opinion that when this money is spent, all fears of any further trouble about the supplying of water may be banished from the public mind. But the history of other and older cities who have in this respect gone over the same road that we are traveling, proves that our work and vast expenditure of money is but a temporary expedient, a short-lived makeshift, and when the bills are all paid and the account closed in the books of our city comptroller, when all the additional water procured is flowing through our conduit, we shall have in a very short time the same trouble over again.

The city of New York, or rather those in charge of its water works, think that an expenditure of several millions is necessary to remedy the defects and dangers of a present insufficient supply. It is due to the water department of New York, however, to state that those at its head are fully alive to the importance and advantages of the meter system,

and a continuance on their part of the determination now shown to meter every building that the law permits them to, will show before long results so favorable that it will surprise even those who have been the warmest advocates of the measure.

The constructors and superintendents of water works and many engineers do not appreciate the fact which statistics so fully bear out, that the waste of water is greatest where the supply is most abundant, and that by forcing upon the people at large the knowledge that there is, so to speak, no end of water available for use, is only still further educating them in habits of extravagance. Take the city of Milwaukee, for example. The water used there is pumped from Lake Michigan into the reservoir supplying the city. Here, certainly, there is no necessity of looking for new sources of supply if Milwaukee should grow to be the most populous city on earth. When the pumping machinery was erected it was supposed that complete provision had been made to insure a supply for very many years, yet the machinery is now inadequate, owing to the immense consumption. According to a late report made by the very capable Water Registrar of that city, Mr. G. B. Seaman, there is consumed an average of 124 gallons for each person daily, for each service 1,551 gallons, and the total consumption 10,600,000 gallons a day.

The experience of Chicago, Detroit and other like cities who have the same facilities for procuring an inexhaustable supply will show similar results. As an argument against the theory, that a sufficient supply is the only thing necessary in solving the water problem, these results and the evidence they furnish would seem to be unanswerable. Now, as a counter argument in support of the position I have taken, let us look at the results obtained in Providence, where the meter system has been generally adopted. I will quote the exact words of the authority mentioned above:

"Providence, R. I., has one of the best, if not the best, managed water departments in this or any other country to-day. The city of Providence, with a population about equal to Milwaukee, and with 855 more service connections, uses but 2,500,000 gallons per day. It uses 25 gallons per day for each inhabitant; it consumes each day for each service 337 gallons; it derives a revenue of over $200.000 for 2,500,000 gallons, while Milwaukee gets $121 555 for 10,603,857 gallons; Providence derives $219 per million gallons, Milwaukee $31. The reason for this vast and important difference in results is simply this: Providence had in use when this statement was made up 3,203 meters; Milwaukee was content with 101."

He concludes by calling attention to the great waste of water, states that they have attempted a remedy in hundreds of cases, notwithstanding which the evil seems to be constantly increasing. Mr. Seaman is evidently of the opinion that such an application of the meter system in Milwaukee as prevails in Providence would rectify all the evils which the former city in the management of its water department seems to be laboring under.

It may not be out of place right here to give the opinion of a prominent official connected with the water department of Providence, as to the experience of that city in establishing so successful an administration of the water works. This gentleman thinks that the meter system is an admirable one, and the best way of supplying water. The expense of maintaining the meter branch of the work is a merely nominal one. He would recommend the introduction of the meter system in all cities, because the water supply is more or less limited everywhere, and the use of meters is the only way to check the waste and keep the supply within proper bounds. He thinks the use of meters makes the water cheaper to consumers, lessening extravagance while not affecting the quantity needed for necessary purposes. He considers the meter system as tending to make a great saving of fuel, wear and tear, etc., of pumping

machinery. These are the opinions of Edmund B. Weston, Esq., engineer in charge of the water works, and coming from such an authority they will admit of no question. "It is probable that Providence has nearly 5,000 meters in use to-day, and it is a matter of record that private consumers are changing from paying regular rates and having meters put in. A comparative table shows that this class of consumers pay much less by meters than they did under the old plan."

This evidence comes from a city where the meter system is now regarded as an experiment, but where it has proven in every particular a grand success. If Providence, instead of adopting the plan it has, would do as some cities are fond of doing, increase its supply by building new reservoirs and conduits, would such grand results have been obtained? Upon the principle of giving the people all the water they want, there would have been no difficulty in getting an abundant reserve to draw from. The resource is unlimited, for during a long continued drought, a few years ago, there was passing by the inlet to the pumping station about 115,000,000 gallons every twenty-four hours. In all respects Providence seems to have adopted the best methods in conducting its water department. The fixing of the minimum annual charge of $10 when meters are set secures a sufficient revenue for all purposes, and puts out of doubt the possibility of any excessive economy in the use of water working unfavorably toward the city. In leaving Providence I do not hesitate to hold it up, so far as its water department is concerned, as a model city, having, in the words of our Milwaukee friend, already quoted, "one of the best, if not the best, managed water departments in this or any other county to-day."

The city of Pawtucket, R. I., is an example of the success of the meter system on a smaller scale. Pawtueket has a population of about 30,000, and an average daily consumption of about 1,250,000 gallons. It has about 1,400 meters in use. Like Providence, its source of supply may be said to be unlimited. The storage capacity of its reservoir is about 72,000,000 gallons, and it has a river to draw from. The secretary of the board of water commissioners thinks the meter system the only proper way to sell water, especially where there is more than one faucet used; thinks it a benefit to the city, as it is a protection against the waste of water, and consequently a great help in increasing the revenue. Pawtucket has adopted the same plan as Providence in compelling the payment of a fixed minimum rate; being compulsory, it secures a revenue sufficient to properly conduct the department. Figures which the books of the water department of Pawtucket exhibit would seem to controvert one great objection made to the meter system by those unfavorably inclined toward it, that is, that its application makes water more expensive to the poorer class of the inhabitants of large cities. The records of Pawtucket prove this a fallacy, and I presume if the books of other departments where meters are largely used are consulted, the same results will be found.

A meter in a tenement occupied by twelve families, and in which there is a store and one office, showed that the entire cost for water during one year was $58.25. Omitting the store and office, this would leave an average water rate of only $4.86 for each family. A meter in a tenement occupied by fourteen families cost for one year $58.64; average water tax $4.19. A meter in a tenement house occupied by seven families, total cost for the year $22.26; average tax $3.18. A meter in a tenement occupied by nine families, total cost, $28.64; average tax $3.19; and so it runs all through the list about in that proportion, being from fifteen to forty per cent. less than faucet rates. These figures would seem to be an effectual reply to the argument that the meter system works unfavorably towards the poorer class of society. Pawtucket is entitled to a place as having one of the model water departments. It believes, like Providence, that it has solved the water problem, and will have no trouble in

that regard for the future. Like Providence, it is keeping pace with the spirit of the age in the march of improvement, and is not blind to the facts which increased intelligence and advanced science make so potent to all.

I cannot do better, in concluding this reference to Pawtucket, than by quoting the following extract from the report of its Superintendent of Water Works. of February 1, 1882:

"During the past year there have been added to the works 363 meters, making the total number on the works 1,422, showing that we have more than one-half the services metered. The results show conclusively that it is the most wise and judicious plan of furnishing water, not only to the town, but to the consumer, thereby reducing the waste of water. And here let me say that the waste of water is a very important factor in the water supply problem of large cities and towns. New York, Brooklyn and Boston have, during the past season, experienced great anxiety on this particular point, and I believe these places have now adopted the plan of using meters to a large extent. To illustrate: The city of Newark has 10,000 services with but few meters; the city of Providence has about the same number of services and about 6,000 meters. The city of Newark uses 10,000,000 gallons of water per day, while the city of Providence uses 4,000,000 gallons per day. The city of Newark receives for water $190,000. The city of Providence receives for water $260,000. Providence thereby receiving $177 per million gallons, while Newark receives only $52 per million gallons. Pawtucket receives $128 per million gallons; but it must be remembered that the much greater price charged by Providence for metered water should be considered when comparing the receipts per million gallons with the receipts per million gallons in Pawtucket.

"Still another feature in favor of meters must be allowed, I think, viz., that by the restriction produced on the waste of water by the use of meters, the demand for sewerage is lessened, thereby saving a great outlay which would be demanded of the town. If the waste of water in Pawtucket was in proportion to the waste in Newark, we should be pumping 4,000,000 gallons daily; but under the present system the average for the year has been but 1,068.877 gallons per day.

"In conclusion, I would say that I believe the plan adopted by the Water Commissioners, when they proposed to provide meters for their own consumers, was wise and judicious, and that other cities and towns can well afford to adopt the same plan where excessive waste is apparent."

The experience of Fall River and Worcester has been almost similar, and the opinions of those I have given above are nearly repeated by the water works superintendents of these two cities. In Worcester the judgment of the non-professional tax-payer is on record, and it is decidedly in favor of the meter system. Charles B. Pratt, Esq., President of the National Fire Insurance Co., and ex-mayor of the city, speaks as follows: "I could not say anything but what would be favorable to the use of meters. I know that I save fully fifty per cent. by the system. I paid $32 a year at my residence under the regular rate plan, and it costs me now $15. I am heartily in favor of the use of meters, and I believe that both the city and the consumer are benefitted by it. The reckless waste of water is checked, and, on the whole, the benefit to the city, to the tax-payer, and to the consumer is mutual."

Several of the leading merchants and the proprietor of the principal hotel hold similar views. Mr. George Tower, of the Lincoln House, thus expresses himself: "My opinion is that the furnishing of water by meter is the fairest and most satisfactory way. Under the old system of paying by tariff, my bills were double what they are now: in fact, the expense became so onerous that I requested the water board to put in a meter, because I was satisfied that I was being charged for a great deal more water than I was using. When the meter was attached, the differ-

ence was apparent at once. Now I think my bills are about $90 a year; formerly they ran over $200. I do not restrict the use of water in any way. My help and guests have all they require; in fact I do not force any economy in that respect. Of course, my fixtures are all arranged so as to prevent any waste; but I have never given any orders, nor do I exercise any supervision whatever over the consumption of water. Nothing would induce me to go back to the old system."

If time permitted, and your patience was not already exhausted, I might continue for a much longer time in support of the position I have taken; but the facts I have given and the evidence furnished must be quite as familiar to all of you as it is to me. It should be a matter of regret that water works officials everywhere do not assume as positive, emphatic and unmistakable an opinion upon this important question as have those whose views I have cited.

It may be that in some of our large cities, where the problem of water supply is torturing the minds of engineers and superintendents, that, after many more millions of the people's money has been wasted, there will be a complete awakening to what is the real remedy.

Perhaps a new generation, seeing the errors and shortcomings of this, will look back with wonder at it, not, however, without due praise for those, who, appreciating the situation so far in advance of their fellows, were prompt and efficient in their treatment of it, and due condemnation for those who, groping blindly in the dark, were willfully negligent of the opportunities which a complete experience had proven so successful. Let those of us who believe in progress and enlightenment; who recognize the potent influences of science in every department where improvement is the watchword, be guided in the administration of our duties by such light as the time gives us.

From those who have the management of water works I should bespeak an honest, candid, fair consideration of the points I have submitted. They are brief and imperfect, but, to my unprofessional mind, conclusive enough when fortified by the evidence obtainable everywhere, that the adoption of the meter system in all cities and towns must ultimately come as the sole and simple solution of the all-important question of water supply.

Mr. Darling moved that the paper be received and made part of the proceedings.

The return of the Secretary and Mr. Briggs from their visit to the bedside of Mr. Doherty was here noted. The Secretary said they had found Mr. Doherty still confined to his bed, and that the physician had stated that he was kept there by his anxiety to be at the Convention. Mr. Doherty expressed his full sympathy with the Association, and his only regret was his inability to meet with us and help welcome the visitors.

On motion adjourned till 7 P. M.

SECOND DAY, MARCH 15, 1882.

EVENING SESSION.

Convention called to order at 7:45, President Foster in the chair.

The President stated that the first order of business was the selection of a place for the next annual meeting.

Buffalo was selected as the next place of meeting.

Mr. Briggs said that he had made a collection from each member present for the purpose of procuring a testimonial of sympathy for Supt. Doherty, of the Columbus Water Works; that Mr. Doherty had worked himself sick in the interest of the Association; and he thereupon moved that a committee of three be appointed to draw up a suitable testimonial and to purchase such token as they saw fit and proper, and present the same to Mr. Doherty in the name of the Association. Carried.

The President appointed as such committee Messrs. Briggs, Decker and Dyer.

The Secretary then read the following invitations:

OFFICE OHIO STATE JOURNAL CO.

To the American Water Works Association in Convention:

GENTLEMEN,—We have the honor to invite you to visit this office and witness the practical working of the Edison electric light, either upon adjournment this evening, or at such other time as may best suit your convenience.

Very respectfully,

OHIO STATE JOURNAL CO.

J. C. BRIGGS, Secretary.

OFFICE PENITENIARY, WARDEN'S OFFICE.

President Water Works Association:

DEAR SIR,—Allow me to extend to you, and through you to your Association, the courtesies of our institution.

Very respectfully,

NOAH THOMAS, Warden.

Mr. Thos. J. Bell, chairman of the Committee on Engine Duty, made the following report:

The time allotted the Committee on Engine Duty will certainly not warrant any extended remarks on this important subject. They respectfully report, however, upon the practical application, or rather the practical deductions, for water works use.

Every engineer has his peculiar adaptation of the term, without, in many cases, the methods. On the other hand, in a number of annual reports, we find only the coal used and water pumped, leaving the investigator to his own deductions, and assuming the other important points. In fact, it is the disposition of some water departments to omit entirely any facts bearing on this subject.

Now, if there is any value in publishing the economic results of

pumping engines, it should be done in an intelligent and systematic manner. The term "duty" of a pumping engine is a conventional one used by engineers to measure the relative merits of performance or effective work expressed by the ratio of product in foot-pounds of the weight of water into the height it is lifted, to one hundred pounds of coal consumed to lift the water. Now, these implements are simple, and, for practical use, should be maintained.

The basis should be upon actual quantities, *i. e.*, upon actual delivery of water, if possible, or deduction per loss of action and slip from indicated cards, to be taken frequently.

The pump should properly have the benefit of any friction beyond its discharge, and for the raising of water. The former of the latter elements may be obtained by pressure gauge. The evaporative quality of the combustible should always be given for proper comparison. Duty should be calculated upon the total coal used for banking, starting fires and pumping, and for the coal used only while pumping. Experts' tests of to-day are looked upon as fanciful results, as they far exceed the practical results.

The question is then, shall these contract tests relate to a more practical basis? For this end we would recommend the method recently adopted by the Corliss company for the two weeks' test of the sewage engine designed for Boston, in which the engine was put to usual daily service, the coal weighed and charged, the water delivery measured, and the fractional attained by actual observation and not by calculation.

Respectfully,

THOS. J. BELL,
EDWIN DARLING,
F. W. HOLLY,
} Committee.

On motion the report was received and placed on file.

The Trustees of the Columbus Water Works, Messrs. D. H. Royce, Wm. B. Hayden and Richard Nevins, through S. P. Axtell, Secretary, tendered the Association an invitation to a banquet prepared for it at the Neill House to-morrow (Thursday) evening at eight o'clock. The invitation was, on motion, unanimously accepted.

Mr. Bell then addressed the Convention.

Mr. President:

If it is in order, I desire to present for the consideration of the society an invention of mine for the detection of waste of water.

The principle is that of a telephone, by which the sound of a running stream is so intensified by the diaphram that the inspector can hear the smallest leak that may occur inside of a premises, without a personal inspection therein.

The simplest method of application is by attaching the detector to an ordinary hydrant key, which is then applied to the service-cock of the house to be inspected. The inspector then places his ear to the instrument, and if no sound is heard the cock is then contracted for the purpose of detecting small flows. If no sound is heard, it is evident that no leak exists. It is the purpose to make these observations after midnight, when no legitimate use of water occurs.

In the trials made in Cincinnati, the water has been peremptorily shut off, where large wastes exist. It is useful in not only detecting abuses, but in ascertaining defects in lead pipes or joint leaks of main pipes.

In my experience I found the water consumers negligent in the use

of water, because they know the water department possesses no means of correcting this abuse. With this instrument this evil is overcome, and a few shut-offs will soon be known in that neighborhood, and the fear of detection will thereafter overshadow that locality.

Mr. Ira A. Holly offered and read the following paper, which was originally submitted to the water board at Burlington, Ia.:

RATES AND REVENUES, WASTAGE AND METERS.

The rates for water by meter have been changed by an action of your Board since my last report. The former rate was 40 cents for 1,000 gallons per day or less; from 1,000 to 5,000, 30 cents; 5,000 and upwards, 20 cents per 1,000 gallons.

The manufacturers' rates, as established by your Board, are as follows:

1,000 gallons per day or less, 25 cents per 1,000 gallons.
1,000 to 2,000 gallons per day, 20 cents per 1,000 gallons.
2,000 to 5,000 gallons per day, 15 cents per 1,000 gallons.
5,000 to 10,000 gallons per day, 12½ cents per 1,000 gallons.
Over 10,000 gallons per day, 10 cents per 1,000 gallons.

All other consumers by meters, outside of manufacturers, are charged by the original scale of prices. No consumer who gets his water by meter is charged less than $1 per month for water and 40 cents per month meter rent. The record-book of the pumping service shows that 716,008,518 gallons of water have been pumped since the works were accepted. The total revenue received therefor was $31,876.89; outside of measured water, $24,892.94. The meter-book gives the quantity of measured water supplied during that time 40,764,259 gallons, and the revenue therefor was $6,983.95, or at the rate of 17.13 cents per 1,000 gallons, while the water which was sold at the regular rates only brought 3.68 cents per 1,000 gallons.

From this statement it is clearly to be seen that the measured water, amounting to but one-seventeenth of the whole distribution, actually supplied 72.34 per cent. more revenue per 1,000 gallons than the unmeasured water. The contrast is thus seen to prove the valuable properties of the meter as a revenue-producing agent, despite its great seeming cost and sometimes unreliable operation.

But this statement taken alone falls far short of enumerating all the benefits to be derived from the use of the meter. As a labor-saving and cost-reducing agent it has wondrous abilities, and as a remedy against waste it is practically possessed of creative powers.

Our experience has demonstrated the fact that in proportion as we have made use of meters we have lessened the per capita quantity supplied, and have obtained a larger per capita revenue, thus adding to the net revenue in two ways—by lessening the expense and by increasing the price obtained for a given quantity of water. It is clearly evident that by putting a meter on every service pipe we would have got a revenue of 4.6 times as much, and if we had received the same rate for unmeasured water that we did for measured water to date, in place of receiving $31,876.89 we would have received $122,653.29, and also stopped entirely the waste of water, which would have been quite an item during the hot summer months. It may be stated as an axiom that waste of water increases as the facilities for its use and the pressure upon the mains are increased, if no restraining influence be brought to bear against it. Let it be understood that every gallon of water is to be paid for at a specific price, and the wastage becomes a matter of consideration for the consumer alone, but one of no importance to the water department, except to increase the revenue at the cost of the parties who knowingly indulge in useless waste.

I would suggest that your Board authorize the purchase of a meter for every service pipe where there is a water-closet, urinal, or any running stream attached; and if this cannot be done at once, I would suggest that you buy enough meters to set in places where waste is suspected; and if the results prove beneficial, the practice to be continued from time to time, until all the service pipes are furnished with them. With the introduction of meters would follow a fair and impartial scale of water rent assessments, reduced to the lowest rates consistent with the actual needs of the servic

We have at present 59 meters in use.

The amount of water measured daily in the year 1881 has been 71,385 gallons; revenue from the same, $10.86 per day, or 15.22 cents per 1,000 gallons.

In the year 1881 there was measured by meter 26,055,612 gallons; revenue from the same, $3,966.85.

The amount of water pumped, aside from the meters, was 318,290,148 gallons; the revenue from the same was $11,868.36, being only 2.48 cents per 1,000 gallons, as against 15.22 cents for measured water.

Total amount of meter rent received to date, $464; amount of meter rent received for the year 1881, $224.60; amount of repairs on meters, $36.46. The amount of revenue received from the city, from the acceptance of works to date has been $34.70. This amount, added to the amount of revenue received from private consumers, makes a gra d total of $66,-616.89, or a rate of 8.82 cents per 1,000 gallons.

On motion the paper was accepted and placed on file.

The Convention then resolved itself into an experience meeting, and spent the remainder of the evening in the discussion of filtration, settling reservoirs, meters, etc.

On motion adjourned until to-morrow at 10 o'clock.

THIRD DAY, MARCH 16, 1882.

The Convention having accepted the invitations of the Ohio Penitentiary and Columbus Water Works, did not convene in business session until two o'clock P. M.; President in the chair.

Mr. Dyer offered the following resolution, which was adopted:

WHEREAS, During this the second annual meeting of the American Water Works Association, held at Columbus, Ohio, the Trustees of the Water Works of the city of Columbus have been untiring in their efforts to serve our convenience and pleasure; and,

WHEREAS, We appreciate the difficulties under which they have labored; therefore, be it

Resolved, That the members of this Association herewith tender their sincere thanks to the Trustees of the Columbus Water Works, for their uniform kindness and courtesy, and also herewith express their sympathy with Mr. Frank Doherty in this time of his illness, and sincerely hope for his speedy recovery.

Resolved, That these resolutions be spread upon the minutes of the Association, and a copy of the same be handed the trustees of said water works and to Mr. Doherty.

The committee appointed to prepare testimonial to Mr. Doherty, through their chairman, Mr. Briggs, made the following report

Mr. President and Members of the Association:

Your Committee on Testimonial have purchased as a token of esteem and sympathy, a silver water service, which you see before you, and have had the same appropriately inscribed in the name of this Association, and have also prepared the following testimonial of our sympathy:

COLUMBUS, OHIO, March 16, 1882.

Frank Doherty, Esq., Supt. Columbus Water Works:

SIR,—The members of the American Water Works Association deeply deylore the illness which has prevented your taking part in the deliberations of the Association, and loss to it the benefit of your experience.

As an expression of our sympathy for you and a testimonial of our appreciation of your efforts to secure our comfort and pleasure, we respectfully tender this token of our regard, coupled with our earnest wish for your speedy recovery and continued contribution to the share of information so greatly needed on water works matters.

[Signed] J. G. BRIGGS, Chairman,
J. H. DECKER,
SIDNEY M. DYER,
} Committee.

The Secretary here read the following letter from W. L. Cameron, Second Vice-President of the Association:

MEMPHIS, March 11, 1882.

Col. J. T. Foster, Prest. American Water Works Assoc'n, Columbus, O.:

MY DEAR SIR,—Your kind favor of the 17th to hand; contents noted and appreciated. I regret more than I can express that I will not be able to meet you all the 14th inst. My only brother, who has been ill for years, grew rapidly worse Friday and died Saturday morning. You may know, my dear friends, that aside from the sorrow and grief caused by this sad event in my family, I cou d hardly feel a more deep one than not being able to meet with you this time at Columbus. My heart and interest is with you, and in the subjects of plumbing, meters and waste I am very much interested, and hoped to have gained much information from the members on these subjects. I herewith enclose you circulars and answers received to them.

I was preparing a few remarks on the subject, but this sad event has made it impossible for me to go, and I know I could not express myself on paper as I could had I been able to have looked into the bright, intelligent eyes of my co-laborers in the cause, and therefrom received inspiration.

I send these papers, containing the few scraps of information I have been enabled to glean, in the hope that they may aid you in some degree to arrive at some conclusions as to ways and means to stop the waste of millions of gallons of water now going on. Present, with my regrets, my personal regards to my friends of our former meeting, and retain for yourself my warm expression of regard and friendship.

Yours very truly,

W. L. CAMERON.

Letter was on motion received and spread upon the records of the meeting.

The President stated that he had deferred the announcing of topics for discussion and the assignment of committees thereto until to-day, and requested the Secretary to read the list.

TOPICS FOR DISCUSSION AT NEXT MEETING.

I. The consumption of smoke, or smoke burners of water works boilers. Ira A. Holly, Burlington, Ia.

II. The relative economy of constant and intermittent pumping. W. C. Stripe, Keokuk, Ia.

III. The methods of filtration of water in use in the United States and Europe, with details of construction, cost and efficiency. J. James R. Croes, New York City.

IV. The relative economy to towns of a supply of water under municipal control, and under control of private corporations. J. G. Briggs, Terre Haute, Ind.

V. Plumbing work; its effect on the health of the family. Peter Milne, Jr., Brooklyn, N. Y.

VI. The operation of hydraulic elevators; difficulties found in their service, and remedies for the same; also, amount of water used by water motors supplied from mains. B. F. Jones, Kansas City, Mo.

VII. Subsidence and filtration of Western river waters, and availability of natural flow into filtering wells and galleries. G.W. Pearsons, Kansas City, Mo.

VIII. The use of iron or steel tanks. Thos. J. Bell, Cincinnati, Ohio.

IX. Systematic compilation of annual reports. J. T. Foster, Chicago, Ills.

X. Records of engine duties. Frank W. Holly, Lockport, N.Y.

XI. How can the quantity of water passing through a water main, which is in operation, be ascertained? Geo. A. Ellis, Springfield, Mass.

XII. How important a factor in the economic management of water works is engine duty? Is its importance over-estimated or brought forward so as to cause less consideration of other important items of economy than should be given them? Prof. Chas. A. Smith, St. Louis, Mo.

XIII. Repair and maintenance of machinery, valves, hydrants, etc., data and comparative cost of maintenance of different pumps, valves, hydrants, etc., with observations. Thos. J. Whitman, St. Louis, Mo.

The President then stated that the Executive Committee had

selected these from among the many topics presented for their consideration, and in making the assignments had done so to the best of their judgment. He hoped that each member to whom a topic had been named would fulfill his duty to the best of his ability.

On motion the action of the Executive Committee was approved.

Mr. Briggs here read the following paper:

Probably one of the greatest benefits to be attained by our annually meeting together, is the interchange of our personal experiences and ideas.

Few, if any, of us ever served any apprenticeship in this particular line of business. Circumstances have led us to adopt it; and I know of none that has more varied, unexpected and perplexing phases and emergencies to encounter and overcome. The business is made up of experiences and experiments, the latter, of course, all looking plausible at the time, some proving a success and some a failure. I have thought that if each member would make a note of anything new that might occur, to keep them in mind and give the Association the benefit of them, with the result, it might often prevent a repetition of blunders, and save many a hard hour's study.

For the greater part of our duties we have no text-books for reference, are too widely separated to visit each other and ask advice: and generally a water works emergency is—an emergency. But, until time has shown an experiment to be a success, great care should be taken in advertising it as such, or it might be like the man with the sick horse, rushing up and asking his neighbor what he had given his for the same disorder a few days before. "A pint of turpentine." Next day he returned and said his horse had died. "So did mine," was the answer.

I thought, perhaps, as since our last meeting, I had had the perplexing and responsible duty of purchasing sufficient machinery to double our former capacity, suddenly forced upon me, it would be at least a legitimate experience to relate before this Association, showing what I have done and my reasons therefor; but I cannot tell before our next meeting whether it will kill the horse or not.

During the extreme dry weather of last July, I was rudely awakened to the fact that the city of Terre Haute had outgrown the water works; to the fact that, with the great consumption, or rather waste, of water by hand-hose, one set of machinery was not adequate to the demand in case of a large fire. The only factor of safety in all direct supply works (including the ordinary stand pipe), when you are dependent on the pressure in the mains for fire protection, is that there should be at least twice the maximum capacity ever required, one-half being held in reserve for fear of accidents, which *will* happen.

Our works are situated on the banks of the Wabash river, which raises annually from 20 to 27 feet. It is essential that vertical engines should be used, under the circumstances, otherwise they would have to be placed many feet down in a damp pit, with no light except from above, to avoid a high lift in the suction; and I would here remark that I consider it a matter of the greatest importance that pumps should be placed as near the level of the water as possible; that 10 or 12 feet is as much as any pump should draw its water, where it is possible for a higher lift to be avoided. This is my opinion, based on many years' experience with water works and mining pumps.

After much correspondence and carefully investigating the different kinds of pumping machinery in use throughout the country, all of which

have their peculiar merits, I concluded to adopt a set designed by the makers of that we have now in use.

Now, gentlemen, I wish you to plainly understand that I have no prejudice against any other standard machinery, have not the slightest interest in this concern, and perhaps, under other circumstances, would not select this style; but, as I said before, this seemed to me to be the best adapted to our situation. Another point which probably had some influence was that the record of the pumps and engines now in use is good and there are several points about it that adapt it to this direct supply system. Perhaps a brief description of those now in use will explain my meaning:

There are four vertical-condensing beam engines, two in a set, (or, to borrow the late Mr. Worthington's phraseology two duplex engines), steam cylinders 20x36, water cylinders 9x36. Each set has been worked at the rate of over 3,000,000 gallons per day for hours at a time. It would be impossible to calculate their duty by any standard rule, as our consumption is very irregular, and it is in my opinion the most objectionable feature in this system that the water must be pumped as it is needed, no more, no less; but in a level country it is about the only system practicable. Our fuel is also nothing but the screenings of block coal, the relative value of which to anthracite or Pittsburg coal is mere guesswork, eepecially as different car-loads will vary probably 30 per cent. in quality; but with all its disadvantages, it is our cheapest fuel. One of the peculiarities of this machinery is the enormous air-chamber attached to each pump, being 30 feet in height by 24 inches in diameter, the large amount of air therein acting as a cushion for the water and producing the same results as an open stand-pipe, the needle on the pressure-gauges showing no vibration under any circumstances from pulsation or ram. Another point is the great speed at which they can be run, and the versatility with which they can be changed from ten revolutions or sixty feet piston speed, to sixty revolutions or 360 feet per minute, working equally well at either motion, the change being easily made in less than one minute. The expense of repairs has been lighs. No packing but the writer itself is required for the pump plungers, saving the expense and labor of putting in rubber, leather or hemp gaskets. I would here remark that there is a fine sand in the water at times, sharp as emery, which necessitates boring out the feed-pump about once a year.

For the first six years and eight months the total cost of repairs was $75.25. Two years ago I replaced the wooden foundations with iron, and took the occasion of the beams being down to thoroughly overhaul them, turning off rods, boring out air pumps (which had been cut at one time by sand), etc., at a cost of $260, or $335.25 all told to date, nearly 9 years.

The set now in process of construction have steam cylinders 30x24, pumps 12⅝x24 of the same patent, steam jackets, and will throw with ease from 3,000 to 3,500 gallons per minute.

Another feature of this new machinery is that the condensation of the steam will take scarcely any fuel from the coal pile, as the water above the bucket of the air-pump is nicely calculated to balance the weight of the piston-rods, etc., drawing its own supply from the river at a height of not over eight feet above low water mark.

In this set the beam is dispensed with, using, however, a fly-wheel and crank. It is also provided with adjustable cut-offs.

Another very important point was the price. We felt very poor in the face of this unexpected outlay as, in addition to pumps and boilers, we have to buy a large amount of pipe. I felt like the Chinese miner buying boots; he always gets the largest he can get for the money. I found that the prices of most of the standard builders for a 5,000,000 set of condensing or compounding engines, with the preponderance of power

I consider necessary for this system (at least 5 to 1), was from $25.000 to $30,000.

I will explain why I require this great difference between team and water cylinders. The steam can be worked expansively to advantage, we all know, and most of us have been painfully aware of the fact that on the occasion of a sharp fire, where six or eight fire-steamers, in addition to the ordinary work, are turned on, in less than as many minutes it will for a time cut the steam very low, especially if (as is generally the case) we are caught with dirty fires in the furnace. It may run down from 75 or 80 pounds to perhaps 30, on extraordinary occasions, before things can be got straight. In that case, with two or even three times advantage, it would be impossible to carry 125 pounds water pressure.

This new machinery can be put in position for less than $10.000, making a saving of at least $15,000 on first cost. Now for the relative economy in operating—there is the rub.

They will probably give a 50.000.000 duty, on steady work with Pittsburg coal. Other makers claim from 75,000,000 to 100,000,000, and can get it, too, when the machinery is worked to advantage. We will assume a saving of 30 per cent. over mine. Mr. Worthington. in his very able work issued some three years ago, calculated 14 per cent. as the very lowest rate of interest chargeable for money invested in pumping machinery, again t 7 per cent. loaned on mortgage, and illustrates his theory very plainly. Suppose we call it 12 per cent. on the $15,000 saved on first cost; we have $1,800 against the 30 per cent. of savin . Now, as our total fuel bill averages less than $1,400 per annum, that question was settled in this case. The saving in first cost, its adaptability to our situation, and my experience with the same style of pumps in a nine-years' trial, decided me in its favor and I am in hopes when we next meet to give you a favorable account of its performance.

As I mentioned before, our fuel is peculiar to the locality, and many kinds of boilers (different sorts of tubular and tubulous) have been experimented with in its use, with no good results. I adopted some 52 inches diameter by 18 feet long, made of Sligo special iron, 5-16 of an inch thick; heads of the same, ½ in h thick, flanged for the flues, of which there are 12, 6 inches in diameter, secured by 7-86 inch rivets, instead of being expanded, smaller tubes stopping up very quickly with a fine cinder, also peculiar to the coal; and these are the only departures from the common flue boiler which have not been a failure in the block-coal region. when slack is burned; and I am not prepared to say whether they will prove more economical or not, until I work them near r to their capacity. Without knowing particulars, my choice would be criticised; smaller tubes and more of them would be used. Another advantage is that every inch of the internal surface can be reached with a scraper.

While on the subject of boilers I would say that I have been trying some compound sold by R. S. Robinson, Pittsburg which I think is a success in removing scales and keeping boilers clean without injury to the iron. but have not had experience enough with it to state positively that it will not kill the horse.

My great solicitude was in regard to the foundations for the engine-house. It was literally to be a house built on the sand, an very treacherous sand at that, situated on the side of a steep bank full of springs, and so located that it would have been a very expensive job to drive piles. After leveling off the ground I wet and pounded it as solid as possible, covered it with two-inch refuse plank; put on top of them 18 inches of concrete, made of one part cement and one of sharp sand to two of carefully screened coarse gravel. Then built walls of rubble masonry, three feet six inches thick, to high-water mark. The house has brick walls 18 inches thick, with truss roof, capable of holding 10 tons extra weight with safety. I am pleased to say that although the water has been sev-

eral times within a few feet of the top of foundations, t e building at the eaves shows but very little crack. I think that horse will live.

I expect to have improvements in running order by the first of June, when (or for that matter before) I would be gratified by a visit from any or all of you.

NOTE.—What price does your unmetered water bring in?

On motion the paper was received and ordered spread upon the minutes.

PRESIDENT: I take this opportunity to tender my thanks to you as your presiding officer, for your very kind attention, and I hope that our meeting in the coming year will be as pleasant and as agreeable, and that it will continue so to be in all of our meetings in the future in fact, and I hope and believe, that our next meeting will be as much an advantage in regard to the matter of diffusing knowledge in relation to water works as this has been. I again thank you for your kind attention.

Mr. Wood said that as the expenses of the Association would necessarily be high for this meeting, he would move that the dues of all members be assessed from time of their connection with the Association, and that all old members be requested to pay dues for the past year. Carried.

On motion adjourned *sine die.*

THE BANQUET.

At the close of the regular session of the Association, the members in response to an invitation to attend a banquet at the Neil House, repaired to the parlors where an informal reception was held. This banquet was given by the Trustees of the Columbus Water Works to the visiting association and a number of invited guests, the City Council, Police Commissioners and the Press.

The elegant dining rooms were the scene of the festivities, and certainly never donned a gayer appearance than upon this occasion.

The Mayor sat at the head of the tables, doing the honors of the evening. After all had partaken generously of this bountiful repast, Mayor Peters arose and in a few well chosen remarks expressed the pleasure Columbus had felt in having the Association meet in this city, extending a hearty invitation to "call again."

President Foster here responded in a happy manner, thanking on the part of the Association all for their magnificent treatment during our stay in the city, assuring them that the many courtesies extended will long be remembered with the most kindly feelings.

Speeches followed from Messrs. McClung, Pearsons and Croes, after which the quartette rendered a pleasing selection.

Mr. W. C. Stripe read a paper entitled "The Infant Born in the Last Two Days," namely The American Water Works Association, followed by Mr. John G. Thompson, Sr., who told about the water works at Washington.

Mr. S. M. Dyer read a paper bringing in the names of all prominent members present, which was very amusing, and was loudly applauded.

Rev. Mr. Poindexter was called for, and responded in a neat address.

W. J. Elliott replied to the question "How to Buy a Newspaper," in a convulsing manner.

Mr. E. C. Briggs here made one of the hits of the evening.

Here Mr. Charles Elliott, City Superintendent of the Spring Valley Water Works, San Francisco, was introduced. He had come all the way from his city to attend the Convention and had arrived just as the banquet was closing.

Music followed, when the Mayor arose, bidding our members adieu.