

Ama THE AMERICAN WATER & GAS PIPE MANUFACTURERS OF KNIGHT-BAILEY'S PATENT Wrought gron and Cement PROTECTED WATER PIPE, GREENE AND BAY STREETS. Jersey City, N. J. NEW YORK: KENNARD & HAY STATIONERY M'FG AND PRINTING CO., 89 Liberty Street. 1874.

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AMERICAN WATER AND GAS PIPE COMPANY,

N. W. COR. GREENE & BAY STREETS,

JERSEY CITY, N. J.,

MANUFACTURERS OF

KNIGHT-BAILEY'S

PATENT

Wrought Knon & Cement Protected Water Pipe.

AND

CONTRACTORS FOR THE WATER SUPPLY AND DRAINAGE OF CITIES AND VILLAGES.

NEW YORK : KENNARD & HAY STATIONERY M'FG AND PRINTING COMPANY, 89 Liberty Street.

1874.

DIRECTORS.

JOHN R. HALLADAY, GARWOOD FERRIS, WILLIAM KEENEY, JAMES CRAWFORD, STEPHEN MORGAN, JOB FALKENBURGH.

JOHN E. HALLADAY.

OFFICERS.

JOHN R. HALLADAY, President. GARWOOD FERRIS, Secretary and Treasurer.

Incorporated under the General Manufacturing Laws of the State of New Jersey.

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WATER SUPPLY OF CITIES AND VILLAGES.

The American Water and Gas Pipe Company of Jersey City, New Jersey, Manufacturers of the above-mentioned Pipe, and Contractors for the Water Supply of Cities and Villages, beg leave to submit the following for the notice of such as feel an interest in improvements in any branch of manufacture, and for the information of parties desiring to construct or extend Water Works.

INDESTRUCTIBLE PIPE FOR SUPPLYING PURE WATER TO CITIES AND VILLAGES.

Those who have any practical knowledge of the older Water Works, are aware of the difficulty under which all those using east-iron pipes labor in the rapid oxydation to which they are subject, by which, in the course of a few years, the formation of accretions on the inside of the pipes greatly reduces their capacity, increases the frictional resistance (consequently diminishing the discharge) and discolors the water.

This has come to be a crying evil in the water works of this country and in Europe, and recourse has been had to various expedients to remove the difficulty. Practical and scientific men have experimented, and pipes have been coated with various preparations, but few have met with any reasonable success. The process of coating cast-iron pipes that seems to promise the best result is that of Dr. Smith's, of dipping the pipes while hot in a bath of coal tar. Many of the foundries of this country are using this process, but this, even, is only a palliative, not a preventive.

To remedy this difficulty was the object of the WROUGHT IRON AND CEMENT PIPE.

A shell of wrought iron, of strength commensurate with the pressure, is lined with hydraulic cement, and, when laid in the ground, is bedded and completely covered with the same material. The iron resists the pressure, and the cement protects the iron from oxydation by completely insulating the iron from contact with the air. The cement grows harder with age, and thus is furnished a pipe which, while it delivers water to the consumer as pure as at the fountain head, is absolutely indestructible.

The experience of over twenty years has proved the value of Wrought Iron and Cement Pipe, and it is now extensively used by water works throughout the country.

That it possesses sufficient strength for any desired pressure of water, that it is durable, and that it is not liable to the great objection to cast iron pipe, but retains its original size, increases in strength and value with age, and furnishes water free from discoloration, are facts which experience has demonstrated. In the improvements which this Company has introduced it has been the aim, by the use of more mechanical methods and improved tools and machinery, to render the pipe more perfect, and thereby to enhance the value of that which has been proved by experience to be intrinsically good. TRANSVERSE SECTION

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LONGITUDINAL SECTION OF FINISHED PIPE SHOWING PATENTED JOINT AND TAPPING DEVICE

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We are confident that a careful examination of the processes by which we work will show the value of these improvements, and we invite the attention of those desiring to build or extend water works. Besides the advantages above enumerated, this pipe can be furnished and laid about 20 per cent. cheaper than cast iron pipe. The pipes are in all cases laid and guaranteed by the Company, and prices will be furnished on application.

The patented improvements introduced by this Company are as follows:

1st. In the method of lining the iron shells with cement.

2d. In the form of joint.

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3d. In the mode of tapping.

IMPROVED METHOD OF LINING.

By the old mode the cement lining is applied to the wrought iron shell by means of a cone with a short cylindrical follower, the cylindrical end being of the size of the interior bore of the pipe. The cone, attached to a rope, is passed down through the shell as it stands on end, cement mortar is thrown in the pipe, and the cone, point forward, is drawn from the bottom to the top, in its passage displacing the cement and pressing it against the side of the pipe. The cone is guided by thin spurs of sheet iron, which project from it, and run in contact with the metal shell. These spurs necessarily cut through the cement, but it is presumed the channels thus formed are closed by the passage of the cone. After the cone has passed through, there is of course nothing but its own power of cohesion and adhesion to cause the cement to retain its position. It will readily be seen that a thin body of cement, seven feet in height, and of the consistency of ordinary brick mortar, must necessarily settle toward the bottom

end of the pipe, so that the lower end of the bore will be reduced in diameter by the bulging inward of the cement, while the upper part of the bore will be correspondingly enlarged. The surplus cement may be scraped out and the deficiency supplied when the pipe is sufficiently hard to handle, and this is what has to be done with every pipe lined by the above method, where an *approximate* uniformity of bore is accomplished.

By the patented process of the American Water and Gas Pipe Company, the shells are lined by forcing them when filled with the requisite quantity of cement, down and around cast iron cores, longer than the shells, and lathe-turned to the exact diameter of the required pipes. Attached to both ends of the shells are appropriate devices, through which the core must pass, and by which it is absolutely centred, rendering certain a perfectly even distribution of the lining on all sides of the core. The quantity of cement used is somewhat in excess of that actually required to line the pipe, and the surplus is forced to pass through a small aperture in the cap covering the top of the pipe. The power required to accomplish this thoroughly fills the entire space between the shell and the core with a compact body of cement. The pipe is left in this position on the core until the cement has hardened to such an extent that when the pipe is drawn off, no movement of the lining can take place. By this improvement is obtained a pipe of smooth interior surface, uniform diameter of bore, and one which requires no hand patching, for the pipes leave the core with shoulders and ends as perfectly finished as if cast in a mould.

IMPROVED FORM OF JOINT.

Before our patented joint, that important portion of the pipe was formed as follows: The shells were made of like diameter at each end, the ends were butted together, a loose sheet iron sleeve

PIPE SHOWING PATENTED TAPPING DEVICE

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was placed around the junction, and the space between the sleeve and the shell filled with cement.

The least carelessness of the workman might place this sleeve in a wrong position, so that the junction would not be properly protected, and even when properly placed each joint so formed would be, in fact, two joints, one on each side of the sleeve, which needlessly added to the possibility of leakage.

By our patents a regular hub and socket-joint is formed. Our iron shells are made slightly tapering, and in the process of lining four to five inches of the larger ends are left free from cement. The smaller ends are of such a size that they enter the larger ends of the next pipes to the depth which is free from lining, leaving an annular space of that depth between the two shells, which, to complete the joint, is filled with cement. As the pipe in which the joint is made is firmly bedded and cannot move, the cement for the joint can be driven and caulked with some force, so as to afford a certainty that the space is thoroughly filled. By a simple method when laying, the pipes are centred so that a continuous and uniform bore is maintained. It will be observed that the chances of leakage are reduced one-half as compared with the old style, even if there were no certainty of making a more perfect joint, for the water can escape in but one direction ; we think, besides, we have a stiffer joint.

MODE OF TAPPING.

The old style consisted in cutting off the cement covering, brightening the surface of the iron, and soldering fast the stopcock, then with a drill inserted through the water-way of the cock, boring through the cement and iron of the pipe. The objections to this were the danger of the solder becoming detached from the iron, or the oxydation of the iron by the use

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of acids in soldering, and the uncertainty of always drilling a round hole through the cement lining, in which case the cement lining might be broken off, leaving a part of the iron around the connection exposed and liable to oxydation and leakage.

By our patents a composition tube or nipple is inserted in the sheet iron shell before it is lined. This tube has a flange on the, inside which projects nearly to the surface of the cement when the pipe is lined. It is held in position by a lock-nut on the outside of the pipe, screwed firmly against the iron. This tube extends above the top of the nut with a screw thread cut the whole length, by which the stop-cock is attached. The tube is filled with cement when the pipe is lined, and the whole operation of tapping consists in screwing the stop-cock fast and boring out the cement plug. In this way neither the cement covering the pipe, nor the lining, is disturbed; the connection is made without solder, and et much less cost, and in less time than by the old method.

Having endeavored to explain the patented improvements introduced by our Company, we would invite your attention to a few reports and extracts, from engineers and others, who have had an opportunity of comparing the Wrought Iron and Cement Pipes with cast iron ones, and to certificates from parties who have used the pipe with our improvements.

The following is from the Water Trustees and Commissioners of the village of Saratoga Springs, N. Y.:

"In answer to the numerous inquiries in relation to Indestructible Water Pipe, composed of Iron and Cement, and in use in our village, the undersigned Water Commissioners, Trustees and late Trustees of the village of Saratoga Springs, take this method of saying that we have perfect confidence in the utility,

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goodness and durability of said pipe. The village of Saratoga Springs has some twenty thousand feet of this pipe, varying from six and a half to one and a half inches in diameter, under a head of about eighty feet. It has been laid since the fall of 1846. Since it was first fully completed it has cost nothing, comparatively, to keep it in repair, and, although some portions are exposed to the frost, it seems to stand the test well, and answer all the purposes for which it was designed and constructed. We believe it preferable to iron pipe; is much cheaper and more durable; and we would not exchange it for any other kind of pipe yet invented, if we could without any additional expense or inconvenience.

"The water comes through clear and pure, and where we have had any occasion to take any part of it up to improve or alter the grounds, it appeared to be just as sound and imperishable as the moment when it was laid down.

"SARATOGA SPRINGS, December, 1849.

"Signed,

S. CHAPMAN, J. A. COREY, W. S. ALGER, WILLIAM COOK,	R. GARDNER, H. P. HAYDE, J. L. PERRY, J. D. BRIGGS,	
G. M. DAVIDSON, R. PUTNAM, N. B. DOE.	Water Commissioners."	

"I certify that I was Chief Engineer of the above work in charge, and fully concur in the foregoing statement.

"Signed,

"S. R. OSTRANDER, "Civil Engineer."

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INDESTRUCTIBLE PIPE FOR SUPPLYING

(The foregoing is published by us, as coming from the first place of any size where Wrought Iron and Cement Pipe was used, and the latest reports of engineers and others upon its condition confirm our claim that the style of pipe is *imperishable*. It was constructed before our patents, and, of course, without our improvements.)

The following is an extract from the report of W. S. Whitwell, Esq. (former Chief Engineer of the Cochituate Water Works, Boston, Mass., and also former Chief Engineer of the Jersey City Water Works, New Jersey), to the Board of Water Commissioners of Plymouth :

"The next question was the kind of pipe to be used. Two kinds of pipe were proposed: the Cast Iron Pipe and the Iron and Cement Pipe; with the latter I had been acquainted several years, and from its cleanliness, cheapness and durability I was much inclined to advise its adoption without any qualification. As a precautionary measure I proposed that a Committee of your Board should visit where these pipes had been in use, to learn if any objections existed, and if they had answered the expectations that had been formed of them. Your Committee returned so well satisfied, that they were adopted without further hesitation.

"The great objection to the iron pipe is found in the rapid incrustation which takes place on the inside of the pipe, and very soon seriously diminishes its capacity; this becomes a matter of much more consequence with the small pipes than with the large sizes, and, while in a thirty-inch pipe the diminution of capacity would scarcely be perceptible for seven or eight years, in a pipe of ten inches diameter the incrustations of four years would probably reduce the capacity one-fifth. The Iron and Cement Pipe is free from this objection; the bore remains always of the same diameter, always clean, and becomes harder and more durable by age. With proper care in selecting the best quality

of cement in the manufacture of the pipes, and making the joints, I consider this as the best water pipe now in use for the supply of towns and villages.

"The Board have reason to be satisfied with the decision they have made, as they have materially decreased the cost of the work by the use of this pipe.

"Respectfully submitted,

"W. S. WHITWELL, "Consulting Engineer.

"Boston, February, 1856."

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Extract from the Report of the Water Commissioners of Plymouth, Mass., for 1856:

"The most important question to be decided by the Commissioners was the kind of pipes through which the water should be conveyed. The largest experience in this country, as well as in Europe, pointed to cast iron as the principal material used in the construction of water pipes. But the experience of the last few years has shown that where water approximates in any considerable degree to purity, the iron pipes through which it has been conveyed have become coated with rust and tubercles, in some cases diminishing the size of the pipes as much as fifty per cent.; and the iron coupling used for connecting the wooden logs of the old aqueduct in this town in some instances were found to have been diminished in their capacity for conveying water more than seventy-five per cent. by the accumulation of these tubercles. The report of a Committee of the Town in 1854 having presented some important evidence relative to the use of an article called 'Indestructible Cement Pipe,' the Commissioners decided to test that evidence by inquiries in places where this pipe had been introduced, the result of which was so entirely corroborative of the facts presented by the Committee of 1854, that an adoption of this pipe was decided upon, and a contract was made by which

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nearly eleven (11) miles of main and distributing pipes have been put down, besides a corresponding amount of service pipe of the same material.

"And so far as we can form an estimate of the value of this pipe by our experience thus far, it has been in the highest degree satisfactory.

"The water has been flowing through a considerable portion of the pipes since the 15th of August, and appears to flow with perfect purity and freedom. Where occasions have been presented for disturbing the pipe, it has been found in a condition to warrant the belief that it will be what the manufacturers claim for it, *indestructible*.

" Рсумовтн, March 1, 1856."

The extensions of distribution pipe required at Plymouth during '72 and '73 were furnished by this Company.

FROM SAMUEL MCELROY, CIVIL ENGINEER.

ENGINEER'S OFFICE, NASSAU WATER COMPANY, 355 Fulton Street, Brooklyn, March 25, 1857.

SIR: I have examined, at your request, a specimen of wrought iron and cement pipe of three inches bore, and one of cast iron pipe of three inches bore, the former laid in 1845, and the latter in 1842. The inspection was made on the ground, March 20, with the pipe just taken from the trench, and subsequently with the specimens in this office.

The exterior of the cast iron pipe, except at the joint, which is much corroded, is in very good condition. The entire interior is coated with tubercles, in some cases separate, but. generally in groups, varying from a quarter-inch depth on the upper side of the tube, to five-eighths-inch in the lower. A large proportion of those on the lower side extend horizontally across the tube, reducing its vertical height to two and one-eighth inches, where the upper tubercles occur. The exterior coating of cement of the wrought iron pipe I find very solid, requiring considerable effort with a hammer and cold chisel to remove it from the iron tube. The lining has also set very compactly, so that in cutting through the pipe with the chisel very little is broken away from the edges of the cut. There is a slight discoloration on the lower side of the interior, owing to the sedimentary deposit of its contents, but the entire interior is as perfect in form and smoothness as when first laid down.

Examining the iron (which is about twenty to twenty-two wire gauge), especially with regard to the joints, rivets and sleeves, I find no traces of oxydation whatever, the iron in these several parts retaining its freshness of color and perfection of form as if newly laid. At the time of laying the pipe a piece of twine, not quite one-sixteenth inch thick and two feet long, was imbedded in the cement, the preservative influence of which is singularly illustrated in the fact that the twine still keeps its original color, and, when tested with a spring balance, stood for some time a regular strain as high as twelve pounds.

This examination simply confirms, by its clear and forcible testimony, a conclusion at which I arrived on this subject several years ago, having taken pains to study the character of this pipe since it first attracted my notice at Albany in 1847. Cast iron pipe is objectionable, in my opinion, from its costliness and weight, its losses of length at the joints, its discoloration of the water by oxydes, its reduction of area by tubercles, and the difficulty of making and *keeping* tight and strong joints, points in which the superiority of the other pipe is clearly demonstrated.

> Very respectfully yours, SAMUEL McELROY, Assistant Engineer Brooklyn Water Works.

CITY CLERK'S OFFICE, CITY OF HUDSON, N. J., July 6, 1868. American Water and Gas Pipe Co., Jersey City, N. J.: GENTLEMEN: In response to your inquiry as to your pipe, I

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would say that we have tried the old patent, and have well tried yours. I am perfectly satisfied with yours in every respect, and have yet to find the first break or rupture in your pipe. The joints, generally the weakest part of the pipe, are, if anything, in your pipe, the strongest. Indeed, in my opinion, it is sufficient to say that I find no fault in them. They are all they claim to be, and that under a pressure of about one hundred and twenty feet at almost an angle of forty-five degrees.

CHARLES J. ROE, City Clerk, In charge of the Water Department, City of Hudson, N. J.

Extract from a letter of Hon. E. M. Madden, June 9, 1868, at that time President of the Board of Water Commissioners, Middletown, New York.

"We investigated the subject of supplying our town with water, fully, and also looked carefully at the kinds of pipe used, and concluded to give the contract to Mr. Halladay and his associates, who constructed our works to our entire satisfaction in every particular. Mr. Halladay and those connected with him are gentlemen of great force of character, energy and responsibility, and finished our works in the best manner, and within the contract time, notwithstanding a very wet season, which interfered greatly with their operations. Had we another contract of the same kind, we should not look any further for a company with whom to contract for the construction of the same, or for a kind of pipe of which to construct it."

> Office of WATER COMMISSIONERS, MIDDLETOWN, ORANGE COUNTY, N. Y., April 14, 1870.

Garwood Ferris, Esq., Sec. and Treas. Am. W. & G. P. Co.:

DEAR SIR: In reply to your inquiries in regard to the KNIGHT-BAILEY PATENT WROUGHT IRON AND CEMENT WATER PIPES laid by your Company in this village for the Middletown Water Works, we have to say that since the pipes were laid, in the summer of 1867, to the present time, through our line of some six and a half miles of pipe, at many points under the pressure of nearly two hundred feet, there has been no bursting of pipes, and no leakage except in occasional and triffing instances. And though at the first faith in their sufficiency for such a pressure was very weak, to-day we believe no better pipes for the purpose are made.

Yours truly,

UZAL T. HAYES, JOHN L. BONNELL, WM. W. REEVE,

Water Commissioners.

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STATE HOMCOPATHIC ASYLUM FOR THE INSANE, MIDDLETOWN, N. Y., JANUARY 22, 1872.

Garwood Ferris, Secretary :

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DEAR SIR: It gives me pleasure to add my testimony in behalf of the "Wrought Iron and Cement Water Pipe." I would call it stone water pipe. That laid by your Company for the Asylum in July last has answered our fullest expectations, and while for us and for the people of Middletown (where it has been laid and in use for some five years) it has proved strong enough for all practical purposes, viz.: to sustain a head of from 150 to 200 feet, we have pure water, uncontaminated by iron or lead poisons. The wrought iron shells being lined with and enveloped in stone (artificial), your pipe must be the most durable of water conductors, while it is also free from any soluble elements which might render the water impure. Enough, I am sure, to commend it to every rational mind that has given this subject the least thought.

Respectfully yours,

DR. GEO. F. FOOTE, Medical Superintendent.

OFFICE OF ST. PAUL WATER COMPANY, ST. PAUL, Minn., March 1, 1870.

G. Ferris, Esq., Sec. and Treas. of Am. W. & G. P. Co.:

DEAR SIR: The "Wrought Iron and Cement Pipe" laid by your Company the last season—being about ten miles of the different sizes from sixteen-inch to four-inch bore—has so far exceeded our expectations. Only one joint was found to leak in the entire length when tested, and but one joint has leaked since the water works were in operation. We could not have expected so favorable a result in cast iron pipe. Were it possible we would not exchange it evenly for cast iron pipe. We are satisfied that the water will be purer than when conducted in any other kind of pipe, while service pipes can be connected more readily and cheaply.

Yours respectfully,

JAMES GILFILLAN, President of St. Paul Water Company.

OFFICE OF WATER COMMISSIONERS, BINGHAMTON, N. Y., March, 1870.

American Water and Gas Pipe Co., Jersey City, N. J .:

GENTLEMEN: At your request, and for the information of the public, we would state that our system of water distribution consists of about fourteen (14) miles of the "KNIGHT-BAILEY PATENT WROUGHT IRON AND CEMENT PIPE," of the different diameters, from twelve (12) to four (4) inches bore, the same being laid by your Company. Through these water has been flowing since 1868.

The water is furnished on the "Holly system," for supplying cities with water for fire protection, as well as for domestic use.

The water is forced direct into the main pipe without the use

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of reservoirs, and a uniform pressure of from fifteen (15) to one hundred and ten (110) pounds to the square inch can be maintained as circumstances may require; one hundred and ten (110) pounds being the highest pressure to which the pipes have been subjected.

We have the highest opinion of your method of lining the wrought iron shells, by which a uniform distribution of the cement is effected, and of your method of joining the pipes; the latter speaks for itself in the almost entire exemption from leaks which we have enjoyed. We can also commend very highly your patented appliance for facilitating the making of service connections without the risk of injury to the pipes.

We have every demonstration that the pipes are all that they claim to be, that they are indestructible, and furnish water without contaminating it, and are reliable and economical in use. They have fully answered our expectations; in fact, much better than anticipated.

> W. P. POPE, SABIN McKINNEY, FREDERICK LEWIS, J. S. WELLS, WM. E. TAYLOR,

> > T. A. SEDGWICK, Superintendent.

OFFICE OF BINGHAMTON WATER COMMISSIONERS, BINGHAMTON, NEW YORK, January 21, 1874.

DEAR SIR: Your favor under date of 19th inst. is before me. In reply will say that we have twenty-two miles of water mains of the "Wrought Iron and Cement Water Pipe," manufactured by the American Water and Gas Pipe Company of Jersey City.

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We think, from over five years' experience, that this is the best water pipe ever in use, for the reason that the water is perfectly pure and without sediment. The pipe costs much less than cast iron pipe, can have branches inserted for cross streets or for fire hydrants with but little expense compared with cast iron pipe, and once in every seven feet nipples are inserted to facilitate plumbing for service pipe, saving considerable expense to water takers.

The wrought iron (which is lined and covered with cement mortar) is made of sufficient thickness to resist any pressure desired.

We have made several extensions in our water mains, and in all cases have used the "cement pipe."

Yours truly,

T. A. SEDGWICK, Superintendent.

Office of Portland Water Company, Portland, Maine, February 20, 1870.

J. R. Halladay, Esq., Pres't of American W. &. G. P. Co., Jersey City, N. J.

DEAR SIR: Your letter of inquiry reached me yesterday, and in reply will state that everything connected with the works has so far fully answered my expectations, no trouble having been experienced since you left Portland.

The main (16 miles of twenty-inch pipe) is working excellently, and out of the fifteen miles of distribution already laid down, but four slight leaks have been developed; and when I consider the mode of manufacture, the material and the care used in laying down the pipe, I should have been greatly disappointed had any serious leak occurred. The pipe, differing as it does from any other, inasmuch as the manner of lining insures an equal distribution of mortar upon the sides, not attained by any other process; the mode of making the joints, together with the brass nipples which are inserted for service connections, all make it, in my estimation, the best conductor of water in the world. And I cannot refrain here from congratulating you on the completion of the work so advantageous to your reputation and so much to our satisfaction.

Very truly yours,

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> HENRY G. BEATLEY, Superintendent of Portland Water Company.

Extract from published Official Report of the Superintendent of the Portland Water Company.

January 1, 1872.

Too much cannot be said in praise of the whole line of Wrought Iron and Cement Distribution Pipe throughout the city, which so far has given entire satisfaction. Probably no similar work, with same head of water, has ever before been attended with the same favorable results.

During the month of February, 1871, portions of the pipe in some parts of the city were found frozen in places where it did not interfere with consumers, near dead ends. Eight hundred or one thousand feet in length were frozen solid and left until spring before being freed from ice. These pipes (iron and cement) were not in the slightest degree injuriously affected by the freezing, and no leak has occurred in them during the year. In all cases where cast iron pipes were frozen they were destroyed, and had to be relaid with new pipe.

> HENRY G. BEATLEY, Superintendent Portland Water Company.

OFFICE OF PORTLAND WATER COMPANY, PORTLAND, MAINE, September 27, 1871.

Garwood Ferris, Esq., Sec. and Treas. Am. W. &. G. P. Co.

DEAR SIR: We prefer "Wrought Iron and Cement" Pipe, and we prefer your pipe and your joint or mode of connecting pipe. We prefer your pipe because we have tested it during the severest winter on record; because thus far, under the severest pressure, it stands firm; because we now find the pipe in good condition and not rusting; because we are confident that the pipe is constantly improving in quality; because water has frozen solid in the cement pipe without bursting the pipe, and, so far as we can judge, without injuring the same; whereas we have suffered from the bursting of *cast iron pipe* under the same circumstances. During the past three months we have hardly had a leak in sixteen miles of distribution pipe made of wrought iron and cement, and furnished and laid by you. The Portland Water Company will always be ready to bear testimony to the admirable qualities of your pipe.

Yours truly,

C. J. GILMAN, Treasurer of the Portland Water Company.

Boston, January 15, 1872.

The subscriber, under whose direction the water works in Plymouth, Mass., were constructed (works so thoroughly built that the annual expense to the town for repairs has, in sixteen years, been less than \$5), having examined the method of lining, tapping and connecting "Wrought Iron and Cement Pipes," known as the "*Knight-Bailey Patent*," manufactured by the AMERICAN WATER AND GAS PIPE COMPANY of Jersey City, N. J., is fully satisfied of its superiority over the plan hitherto adopted, both in the avoidance of air-blisters by the new method of lining

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and in the *socket-joint*, which obviates the difficulty so long experienced of making the "sleeve-joint" tight, especially when made by incompetent workmen. The new method of connecting the service pipe by a *patent tup*, which leaves the cement lining undisturbed, is of itself a sufficient improvement to recommend this over any other cement pipe now in use.

MOSES BATES, Civil and Hydraulic Engineer, Chief Engineer Plymouth Water Works, 51 Water street, Boston.

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OFFICE OF THE WATER COMMISSIONERS, HARTFORD, CONN., October 3, 1871.

This is to certify that in the summer of 1868 about 5,000 feet of the *Knight-Bailey* Wrought Iron and Cement Water Pipe was laid for the Hartford Water Works in Hartford, Conn., and since completed by the Company there have been only two leaks, and those in defective joints, and it is now believed to be in a good and sound condition.

HIRAM BISSEL, President.

OFFICE OF HURLBUT PAPER COMPANY, South Lee, Mass, January 24, 1872.

American Water and Gas Pipe Company.

GENTLEMEN: In reply to your favor of the 19th inst., we are pleased to report that the 8-inch Wrought Iron and Cement Water Pipe—5,600 feet in length, under 110 feet head—which you laid in 1870, has given us entire satisfaction. We like your pipe so well that we propose laying a number of hundred feet more during the coming season.

Yours truly,

HURLBUT PAPER COMPANY, T. O. HURLBUT, Treasurer.

(At the above point the water is used in the cleansing processes requisite in the manufacture of the finer grades of white paper, where any discoloration of the water would be fatal to the purity of color required.)

CITY OF NORWICH WATER WORKS, NORWICH, CONN., January 18, 1872.

American Water and Gas Pipe Company.

DEAR SIRS: After a long practical experience in the manufacture and laying of Cement-lined Water Pipe, I am fully satisfied that your method of *lining under pressure* is by far the best, and produces a remarkablysolid, perfectly cylindrical and uniform bore, very smooth, and when properly laid the *joints* are superior to any other. The method of *tapping* is almost invaluable for all ordinary services, and removes all danger of breaking the lining of the pipes—a danger much to be feared in all the old styles of tapping. We have in this city about sixteen miles of your pipe, under an average pressure of about 100 lbs. per square inch, and feel that no better pipe can be laid.

Yours truly,

H. B. WINSHIP, Superintendent.

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OFFICE OF TOWN SURVEY COMMISSION OF KINGS Co., BROOKLYN, February 1st, 1872.

Civil Engineers of experience in construction in the United States have had continued occasion to use and to value the superior hydraulic limes of our geological formations, and to rely implicitly on their good results, particularly in hydraulic works. In this respect they accept and confirm the practice of the engineers of past ages, many of whose works yet remain in use.

The application of hydraulic cement to cast iron water pipes as a palliative of tubercular corrosion has been attempted, but

PURE WATER TO CITIES AND VILLAGES.

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like the tar coating is nothing more than a temporary palliative : while the use of wrought iron pipes, carefully lined and coated with a substantial layer of cement mortar, secures a practical result, which is durable, economical, and highly advantageous to the supply of water itself. Here theory and experiment combine to indicate the best plan. While there can be no question that water pipes of the ordinary grades of cast iron, as used, are open to grave objections, the advantages of such a substitute as this are clear, and merit investigation and trial. As to detail processes of their construction and use, theory and trial also combine to indicate certain simple laws. There can be no question that wrought iron pipes must be carefully riveted and made of first-class material and workmanship, so as to prevent buckling or opening of the seams in handling or under pressure; also that they must be properly coated at the joints and taps to prevent gradual corrosion and leakage; and also lined and coated in so perfect a manner that the cement will firmly adhere to the iron shell, and be thoroughly compressed and formed.

On principle, then, I have not hesitated for many years to advise the use of cement-lined water pipe in preference to cast iron, and I am also satisfied on principle and from various opportunities of observation, that a very decided advantage in detail has been secured by the *Knight-Bailey* process of *lining*, *jointing* and *tapping*. This process secures greater perfection of form, greater compactness of cemented lining, better protection of the main pipe riveted seams, with a much more simple method of tapping and protection of the pipe-shell at the tap, and a much better joint in trench work than were secured by the original patented processes.

SAMUEL McELROY, Civil Engineer.

OFFICE BOARD OF WATER COMMISSIONERS, WARWICK, N. Y., February 2, 1872.

American Water and Gas Pipe Company. GENTLEMEN: In compliance with your request, we will state

the (Knight-Bailey Patent) Wrought Iron and Cement Pipe laid by you last season for the purpose of carrying water to and through our village, and everything connected with the works built by you, has so far fully met our expectations, and we believe your pipe, when well made and laid, to be equal to any, if not the very best water pipe in use.

> THOMAS BURT, WM. H. CHARDAVOYNE, JAMES H. HOLLY,

OFFICE OF ENGINEER WEST PITTSTON WATER WORKS, PITTSTON, Pa., February 7, 1872.

Garwood Ferris, Esy.

DEAR SIR: The Pipe you put down for West Pittston Water Company has so far given entire satisfaction; but one leak developed on putting the water in—none since. I have had no previous experience with this kind of pipe. Scranton, Wilkesbarre, Providence and Carbondale have used it for years, and report favorably—but my own experience does not yet authorize me to say more than that it is so far perfectly satisfactory to us, and I have no doubt will continue to be so.

Very truly yours,

GEO. JOHNSON, Engineer.

Office of Chief Engineer, Board of Public Works, Jersey City, N. J., January 30, 1871.

Garwood Ferris, Esq., Secretary, etc.

SIR: In reply to yours of the 24th inst., would state that I have no hesitation in endorsing the iron and cement water pipe

PURE WATER TO CITIES AND VILLAGES.

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as laid by your Company, believing it superior for the purpose used to any other pipe in the market. Prejudiced originally in favor of cast iron pipe, my skepticism concerning iron and cement was due to doubts concerning the perfection of joints, and a fear that in tapping the lining would be so fractured as to allow the water to come in contact with the iron, and the metal be so weakened by oxydation as to be unable to sustain any considerable hydrostatic pressure. The method of joining and tapping adopted by your Company obviates these difficulties, and the maintenance of distribution pipes laid here by you (aggregating over twenty miles) costs less than for iron pipes on the same levels. That the bore of the pipe laid by you will not diminish in diameter, is also an argument in its favor as compared with iron pipe, while the certainty that the quality of the water suffers no deterioration either from passing through or remaining in it renders it preferable.

Respectfully, J. P. CULVER, *Chief Engineer.*

Extract from the Report of the Chief Engineer of the Board of Public Works of Jersey City, N. J., for the year 1871.

"The iron and cement pipe laid by the American Water and Gas Pipe Company during the year, aggregating 25,525 feet, has given perfect satisfaction, and a decided preference is expressed for it by parties soliciting extensions. Its merits are so well known and acknowledged that no necessity exists for recapitulating them."

Extract from published Official Report of Chief Engineer of Board of Public Works, Jersey City, N. J., for the year 1872.

The former engineer of our water works suggested in his report for 1870 that in a few years the then existing conduits would be

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"The reasons that have guided your Committee in arriving at such conclusion are as follows:

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"The action of Passaic water on cast iron, as shown in existing conduits and distribution pipes, develops the formation of accretions, which in their early stage are small in size and hemispherical in shape, covered with a thin scale, and filled with a substance resembling black mould, slightly moist, and of an offensive odor-They appear to increase rapidly in bulk and numbers until the entire inner surface of the pipe is covered with them.

"Their growth not only diminishes the diameter of the pipe but affects its stability, as they destroy the metal beneath them, changing its characteristics and tending to render it unequal to the strain of even light hydraulic pressures.

" They also taint the water, imparting to it a discernible flavor.

"The oxydation of the outer surface of cast iron pipe reduces its strength, and experience teaches that coal tar varnish, as applied to cast iron, while a protection, is not a certain preventive against rust.

"The action of Passaic water on cemenet-lind pipe is entirely different; the diameter is not reduced, and the face of the lining, after years of use, is as clean as when first applied The sole effect of the water is beneficial, hardening the cement until its consistency equals stone.

"The cost of a conduit of iron and cement compared with cast iron pipe (other things being equal) is enough to warrant the selection of the former, as by its use the sum of \$130,000 can be saved.

"Another consideration (although a minor one) is that the iron and cement pipe will be manufactured here, giving employment to our own citizens.

"The adoption of iron and cement pipe will not be testing any

insufficient to supply this city with water. Considering the rapid increase in consumption since the date of his report, and foreseeing that if continued during the ensuing twelve months the conduits would be taxed beyond their capacity, it was determined to lay a new line of pipes to connect the receiving reservoir with the branch conduit and submerged pipe which were contracted for in 1871. Accordingly specifications were prepared, bids received, and contract awarded to the American Water and Gas Pipe Co., of this city, for such new line. As considerable comment was had on the action of your Honorable Body, I beg leave to quote the report of your Committee on Pumping and Reservoirs, recommending the adoption of the cement-lined iron pipe -the more especially that numerous inquiries have been made from various water boards concerning this conduit, and general information requested not easily imparted by correspondence.

"Your Committee on Pumping and Reservoirs, to whom were referred, on the 30th of July, 1872, the proposals received on that date for building a 36-inch conduit from a point near the west bank of the Hackensack river to the receiving reservoir, with instructions to report which pipe they will recommend for adoption, have to report :

"That since the building of another conduit was suggested in December last, they have carefully considered the subject, and only after being fully satisfied that the necessities of the city demanded its immediate construction did they request authority to advertise for proposals.

"The alleged superiority of iron and cement pipe as a medium for the conveyance of water caused your Committee to include it in the specifications in competition with cast iron pipe, and the result of such competition is eminently satisfactory.

"Before deciding which style of conduit to recommend an impartial examination has been made, and the merits of each thoroughly canvassed. The result is that your Committee are unanimous in advising the adoption of iron and cement pipe.

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crude theory, as such pipes are in use in numerous towns and villages, and bid fair in the not far distant future to supercede cast Iron for water conduits.

" The city of Portland has a large main over sixteen miles long of iron and cement pipe. In our present 36-inch conduit there are two thousand feet of such pipe, laid, however, before the improvements in jointing and lining were made which render the pipe of the American Water and Gas Pipe Co. so superior to others of its kind.

"Your Committee have corresponded and had personal interviews with the officials of Water Boards of various cities where cement-lined pipes have been laid, and in response to our inquiries they have not only indorsed such pipe, but praised it in terms of highest commendation.

"The danger of rupture in the pipe is obviated by the gauge of the plate iron to be used. Samples which have been tested, together with the official certificate from the Southwark Foundry, are now in our possession. They show a tensile strength of about .52,000 pounds to the square inch. According to the formula this iron, in a tube of the required dimensions, will sustain over five times the pressure to which it will ever be subjected-a factor of safety sufficiently conservative to allay the fears of even the most timorous.

"In this connection the experience gained in other sections is of importance, and the following extracts from the Annual Cyclopædia of 1870 are of interest:

"' The history of hydraulic mining in California has been one of bold engineering feats. * * We find in many places that sheet iron pipes are employed, and succeed under pressures which startle engineers of acknowledged ability. The Spring Valley Water Company, in San Francisco, convey their city supply of water from their reservoirs over a distance of seventeen miles in two lines of sheet iron pipes 30 inches in diameter.

These pipes are made with circular seams single riveted, and longitudinal seams double riveted, and with thicknesses and pressures as follows: No 14 iron, 60 feet head; No. 12, 100 feet; No. 11, 200 feet ; and No. 9, 250 feet. These pipes have been in successful operation for many years.

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"'One line of 6,000 feet, after having been in use for ten years, was lifted and relaid in another place, being found in as good condition as when first put down. The success of this pipe led to the employment of one of greater magnitude. * * The inlet to the pipe is 150 feet above the outlet, with a vertical height from the lowest point to grade line of nine hundred feet."

"The thickness of iron used is No. 14 for 150 feet head; No. 12 for 275 feet; No. 10 for 350 feet; No. 7 for 425 feet; 1/2 incl. for 600 feet; 5 inch for 850 feet, and 3 inch for 900 feet. These pipes are merely iron shells coated with asphaltum, and a comparison of the conditions with those of our works must effectually silence cavil. The inlet to our conduit is less than thirty feet above the outlet, and greatest difference of elevations less than 160 feet. The iron called for in the specifications is No. 9 Birmingham gauge, and the size of rivets and method of riveting identical with that employed in California.

"It is stated that at places where iron and cement pipes are used in connection with the Holly system of water works the cement-lined pipes stand the immense fire pressure better than do cast iron pipes.

"Large mains have been laid by the American Water and Gas Pipe Co., where the pressure is from a permanent head of about 240 feet, in which the iron has not been in excess of onehalf the thickness proposed for our conduit.

" More examples might be cited, but we deem these enough.

"The method of fining has been examined by competent engineers and pronounced such as to insure the certain covering of

INDESTRUCTIBLE PIPE FOR SUPPLYING

the iron, the essential item, as the fact that cement is a positive and permanent protection of metal from oxydation is incontrovertible.

"The jointing is mechanical, and so arranged as to prevent leaking, rendering the pipes practically a continuous tube without flaw or break.

"While the utility of iron and cement pipe is generally conceded when laid upon the upland, objections have been urged against its use over the meadows, for the reason that its rigidity would render it liable to fracture at the joints in case of settling. Such objection is scarce valid and must proceed from ignorance concerning the nature of the foundation as shown on the plans and explained in detail in the specifications.

"A hard bottom underlies the Hackensack meadows at a depth averaging less than twenty feet below the surface, while the turf, muck and roots form a mass sufficiently compact to prevent any lateral motion to piles driven in it.

"The foundation, as designed, consists of two rows of piles, the rows being 2 feet apart, capped transversely by 12×12 inch timber, the bents being 12 feet apart from centres.

"Five courses of stringers of 8×10 inch timber extend (breaking joints on the caps) over the entire line on the meadows, and are covered with a plank flooring, all being securely spiked down. On this foundation a brick cradle laid up in hydraulic cement will be built, in which the pipes will be laid upon a bed of cement one inch deep. The cradle will be covered with a brick arch, the bricks being bedded so that an inch of cement will intervene between them and the iron of the pipe. The conduit will then be covered with twelve inches of earth and sodded.

"Disinterested engineers and builders of unquestioned ability and large experience, who are familiar with the nature of the meadows and have examined the plans, express themselves as being satisfied that the foundation will be stable, that it will be superior to the road-bed of any railway crossing the meadows. and are emphatic in their opinions as to its sufficiency.

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"The wood-work, being all below the surface, will be entirely protected, planks which have been laid in these meadows for many years remain sound and strong, and the condition of the roots and stumps is evidence that no danger need be apprehended from decay.

"Viewed in every light the advantages are with the iron and cement pipe. The quality of the water is not impaired by transit through it, and as the health of our entire population is dependent to a great extent upon the purity of the water, this is a vital consideration and secondary to none other in importance.

"The permanency of the work is guaranteed by the method

and materials used in its construction. While cast iron pipe constantly deteriorates, the cement lining absorbs from the water elements that perfect the crystallization of its particles, and, by presenting an impenetrable barrier to oxydation, the tenneity

of the iron plates is preserved intact. "The saving to be had is no trivial one, as not only the difference in first cost, but also the durability and undiminished en-

"The natural sequence of our investigations is the selection of pacity, are to be considered.

the iron and cement pipe for the new conduit, and your Committee trust that the reasons as cited, based as they are upon facts supported by eminent anthority, and indersed by those whose opinions deserve acceptance, will compel convictant and

" WM. STARTUP,

merit your favorable consideration. " Respectfully submitted,

" Jersey City, 13th August, 1872."

Committee on Pung "BENJ. F. WELSH, ing and Basermeirs

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The internal diameter of the pipes, when lined, will be 36 inches; the length of the line 22,300 feet, of which distance about 17,500 feet will be on the Hackensack meadows. Doubts were expressed as to the thickness of metal in the shells being enough to give strength to withstand the pressure which the committee asserted the pipes would sustain, and as cast iron pipe was required in the specifications to stand a pressure of 300 pounds to the square inch, it was claimed that the cement-lined pipe should be equally strong. To allay such doubts, a section of pipe, similar to that to be used in the conduit, has been made, tested and resisted a hydrostatic pressure of 300 pounds to the square inch.

BOARD OF PUBLIC WORKS, BUREAU OF ENGINEERING AND SURVEYING, JERSEY CITY, N. J., January 23, 1874.

Garwood Ferris, Esq., Sec. Am. Water and Gas Pipe Co.

DEAR SIR: In reply to your request, that you be furnished with an official certificate from this office, concerning the conduit built by your company for the Jersey City Water Works, I take great pleasure in stating that the twenty days' test, under full head, has been had without developing a leak or defective joint, and that the work has been accepted as completed and final estimate given.

The length of the line is 21,610 lineal feet, and the location embraces earth and rock excavation on the upland, and pile foundation on swamp and meadow.

The conditions under which the line is laid include more risks than generally attend work of this character, and the success which has crowned your efforts proves not only the superiority of your method, but also careful workmanship and vigilant supervision. IRON AND CEMENT PIPE CONDUIT FURNISHED JERSEY CITY WATER WORKS

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The provisions of plans and specifications have been complied with, excepting that materials have been of even better quality than you were required to furnish by the terms of contract.

The internal diameter of the pipe (lined) is 36 inches; thickness of metal in shells No. 9 Birmingham gauge; the pressure sustained that due to a permanent head of one hundred and sixty feet.

A section of the pipe has resisted an internal pressure of three hundred pounds to the square inch.

Respectfully,

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JNO. P. CULVER, Chief Engineer.

Office of the Engineer of Newark Aqueduot Board, February 26, 1872.

Garwood Ferris, Sec. Am. Water and Gas Pipe Co.

DEAR SIR: In reply to your request, I give my opinion of the merits of Wrought Iron and Cement Pipe. My knowledge and experience in the use of this style of pipe extends over a period of nearly twenty years. I recognized its merits, and gave early proof of my faith in it when the manufacture of it was yet in its infancy. A good many miles of it have been laid under my direction.

My experience, while it confirmed my early impressions, satisfied me that there were many points connected with its manufacture and use susceptible of improvement, so that what had been proved to be intrinsically good might be greatly enhanced in value.

The improvements adopted by your Company are such as must commend themselves to every one capable of judging

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we have the most perfect and efficient water works in the country, and the result at the several fires we have had since their completion fully proves the correctness of my views. The first six months' expense of running them was about one hundred dollars.

The contract for putting in was faithfully performed, and in the most satisfactory manner.

I can cheerfully recommend the American Water and Gas Pipe Company as one that has given us the greatest sati faction.

I am very respectfully yours,

WM. MoECHRON.

Extract from the Annual Report of the Board of Water Commissioners of the City of Concord, N. H., for year ending December 31, 1873.

"With the exception of the setting of a few hydrants, which is necessarily deferred until next year, the contract of the American Water and Gas Pipe Company for the construction of the water works has been completed, and a settlement in full has been agreed on with the Company. In thus closing their connection with the Company, the Board with pleasure refer to the agreeable relations which have existed between the parties. No misunderstanding has arisen between them during the progress of the works. The agents of the Company have appeared to be desirous to perform the work not only in accordance with the contract, but also in a way as satisfactory to the Board and the public as circumstances would permit.

"The test thus far made of the works has been very satisfactory to the Board, and highly creditable to the Company. The final settlement has been agreed on without any difficulty ; and it is creditable to the fair dealing of the Company that, notwithstanding the unexpected difficulties and changes which have arisen

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between the rude and unfinished and the complete and workman-

Your form of joint, the mode of lining and method of tapping for service pipes, are all vast improvements, and render the pipe as nearly perfect as possible. I have no hesitation in saying of it that it is the best pipe for c onveyingwater of which I have any knowledge. It is cleanly, of sufficient strength for any desired pressure, and so durable as, when properly laid, to be indestruct-

Yours truly,

G. H. BAILEY, Engineer.

internet and i show they bear the

GLENS FALLS, N. Y., August 22, 1873.

DEAR SIR: 1 am requested by the American Water and Gas Pipe Company to give you my views of our water works as put in by them; also, as to the manner in which their work was

I had the honor of being President of the Board of Trustees having control of the letting and performing of the contract, and took much interest in its success.

The water is brought five miles through a 12-inch main and distributed about the village in eight miles of smaller pipe, making in all thirteen miles of pipe.

The head ranges from 250 to 300 feet, the pressure on the pipe under 250 feet head being about 107 pounds per square inch, and so far not a break has occurred. We have sixty fire hydrants, each capable of throwing two streams to a distance of one hun-

dred and seventy feet.

The connections with the mains for services are easily effected (owing to the tapping nipples inserted in the pipe), and I think

during the progress of its work, which included the entire construction of the main line from the pond to the city, and the distribution throughout the city ready for use, and at the contract price of \$143,681.02, yet the whole amount of extra charges made by the Company is only \$100.40.

> J. MINOT. JOHN M. HILL, BENJ. A. KIMBALL. DAVID .AWARDE, EDWARD L. KNOWLTON, JOHN ABBOTT, JOHN KIMBALL.

Board of Water Commissioners."

CHIEF ENGINEER'S OFFICE, CONCORD WATER WORKS, 1 Concord, N. H., December 31, 1873.

Garwood Ferris, Esq., Sec'y American Water & Gas Pipe Co., Jersey City, N. J.

DEAR SIR: In addition to the comments of the Board of Water Commissioners and of myself in the report of this date, made to the City Councils of this city, relative to the manner in which you have performed the contract for laying the main and distribution pipes of the Concord Water Works, I desire in a more personal way to make known to the officers of your Company my appreciation of their efforts to comply with all the requirements of the specifications, and to execute the work in a faithful and thorough manner. The contract in all its details has been satisfactorily performed, and the result is highly creditable to the skill and watchfulness of your agents. I am of the opinion that your style of lining the pipes and of making the joints has advantages over the ordinary method, and the very few leaks that have appeared attests how carefully and well the work has been done. You are at liberty to make such use of my name in relation to

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your business as you may deem desirable, as it will afford me pleasure to speak of your Company in terms of commendation at all times.

Signed,

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> JAMES A. WESTON, Chief Engineer.

CAMBRIDGE, Mass., February 11, 1873.

DEAR SIR: The city of Cambridge has laid, during the past year, about half a mile of 12-inch and about the same quantity of 20-inch water pipe of wrought iron and cement, made under the "Knight-Bailey Patent." This pipe has proved so satisfactory that the Board propose, during the coming season, to lay about three miles more of 20-inch main of this kind.

I believe the claims made for this pipe to be well sustained :

1st. The method of lining makes the cement harder, more compact, and free from minute air holes.

2D. The form of joint lessens the risk of leakage at that point. 3p. The mode of tapping does away with one of the greatest objections to the use of cement pipe.

I have witnessed the processes of making and laving the pipe. and both seem to be faithfully conducted.

Your ob't servant,

H. L. EUSTIS, Member of Cambridge Water Board, Professor of Engineering, Lawrence High School.

FARMINGTON, N. H., February 4, 1874.

Garwood Ferris, Esq., Sec'y Am. W. & G. P. Co.

DEAR SIR: The wronght iron and cement water pipe, laid by your Company for us in the years 1871 and 1872, is working

most satisfactorily. The aqueduct and hydrants have already been of great service in extinguishing three threatening fires, and the water is delivered as pure as at the fountain head.

We are so well pleased that we design making considerable extensions, and would cheerfully recommend this pipe as one of the best methods of conveying water under pressure for use of towns and villages.

J. F. CLOUTMAN, President Farmington Aqueduct Co.

OFFICE OF THE WATER COMMISSIONERS, GOSHEN, N. Y., February 2, 1874.

Garwood Ferris, Esq., Sec., etc., Am. Water and Gas Pipe Co.

DEAR SIR: In reply to your letter of the 27th ult. in relation to the Wrought Iron and Cement Water Pipes laid by your Company in the autumn of 1872, for the water supply of this village, we beg to say that in the entire four miles of main and distributing pipes but four or five trifling leaks have appeared, and these only during the first three months, since which time not a single leak has been discovered. The pressure is that due to about 113 feet head.

The water comes from the pipes without discoloration or taste from contact with the cement.

The entire work was executed promptly, and has given us the greatest satisfaction, and in our opinion it is very much superior

Yours very truly,

B. F. EDSALL, N. C. SANFORD, Water T. D. TUTHILL, Commissioners.

PURE WATER TO OFFIES AND VILLAGES.

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MAYOR'S OFFICE, Rome, N. Y., Feb. 10, 1874.

J. R. Halladay, Esq., Pres. of Am. Water and Gas Pipe Co.

DEAR SIR: Now that our Water Works have been in successful operation for more than one year, we take pleasure in assuring you that your Wrought Iron and Cement Water Pipe has given us entire satisfaction, and that your manner of dealing with us, in the performance of your contract, has been characterized throughout by the utmost liberality, and a determination to allow no ground for complaint or criticism on our part. We regard your company as model contractors.

We are respectfully yours,

GEORGE MERKILL,	Wate
B. J. BEACH,	Commissi
G. V. SELDEN,	} of
CYRUS HAYDEN,	City of
JNO. J. PARRY,	New Y
01101 01 -	

oners Rome, ork.

ALBANY, N. Y., February 2, 1874.

Garwood Ferris, Esq., Sec. Am. Water and Gas Pipe Co.

DEAR SIR: After a personal experience of over thirteen years in the use of Wrought Iron and Cement-lined Pipes, I do not hesitate to recommend them as being preferable in many respects to cast iron.

A large percentage of the leakage and waste in the water pipes and mains of the older cities have been traced to the rapid oxydation and destruction of the cast iron pipe in use.

The oxydation also tends to the formation of tubercles and obstructions which greatly impede the flow of water, and

instances have occurred in the smaller sizes of pipe where they have been completely closed from the above cause.

In addition to the destructive influence at work on the inside of the pipe, the outer surface is also soon subject to rapid disintegration where the pipes are laid in a porous, sandy or gravelly soil. To prevent this cast iron pipes are now being coated externally and internally with what is known as "Dr. Smith's process," being a preparation of coal tar with the volatile properties removed. This has been found of considerable service when properly applied at 300° of heat; but it has also disadvantages, as it may be used to cover defective castings.

Experience has demonstrated that where strength and durability are required it is necessary that proper metal should be used, and that certain refining processes are essential to adapt the same for the purposes intended. This I deem to be an important element in the wrought iron pipe. By the refining process in manufacturing the iron the maximum of tensile strength can be obtained, while the minimum amount of metal may be used; then, by properly coating on both sides with hydraulic cement, the essential elements of strength and perfect durability are secured.

Before adopting this kind of pipe for the Rome Water Works, a personal examination of similar pipe was made at Watertown, N. Y., which proved to be as perfect as when first put down, and this after eighteen years' use. I have seen cast iron pipe which had been in use a much less time, and which required replacing.

I am satisfied from personal observation that much of the trouble in the water supply of both large cities and smaller places could have been obviated by use of properly made wrought iron and cement pipes. You are at liberty to refer to me for recommendations as to the materials used by you, and also as to the manner of preparing your work, which I deem to be a very important matter in the construction of water works.

PURE WATER TO CITIES AND VILLAGES.

As a matter of interest connected with the above, a water main has recently been constructed from Marlette Lake to Virginia City, Nevada, which sustains probably the greatest water pressure in the world, namely, 1,720 feet head, equivalent to 750 pounds to the square inch. This main was constructed of wrought iron.

Respectfully yours,

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PETER HOGAN, C. E., Late Resident Engineer New York State Public Works, and Engineer of Rome, N. Y., Water Works and Grand Rapids, Mich., Water Works.

> •FFICE •F THE WATER COMMISSIONERS OF THE CITY OF RAHWAY, RAHWAY, N. J., February 27, 1874.

Garwood Ferris, Esq., Sec. and Treas.

DEAR SIR: In response to your inquiry I would state that during the year 1871 the American Water and Gas Pipe Company of Jersey City furnished and laid for our board about nine (9) miles of the Knight-Bailey Patent Wrought Iron and Cement Water Pipe, embracing all the water pipe then required for the supply of our city, and being of the various sizes of from 4 to 12 inches diameter of bore.

From natural causes the erection in our city of a reservoir was not feasible, and hence, to obtain the desired pressure, pumping engines are used which force water directly into and through the whole system of piping. By this means the pressure upon the interior of all the pipes varies with the requirement and the more or less rapid action of our pumps.

Our contract with the company stipulated that the pipes, after having been laid, should be tested by pumping as above, and

INDESTRUCTIBLE WATER PIPE.

that they should satisfactorily resist an internal pressure of 120 pounds to the square inch. This test was applied with the most satisfactory results, no leaks of any account were developed, nor was the slightest weakness shown, and since the test the pipes have been in constant use, and on several occasions the additional pressure required in case of fire over the ordinary pressure has been applied, and the pipes have in every instance proved entirely satisfactory.

During the year 1873, about two and a half miles of additional pipe being required in our city, and the pipe already laid having proved so entirely satisfactory, the same company were contracted with to lay such extension.

Very respectfully yours,

(Signed,)

C. D. MARSH, Clerk of the Board of Water Commissioners. BROWN UNIVERSITY LIBRARIES

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From Long Top, and horsen, to of their the structure of the second second and there Top, and horsen, top of their the structured presence, particular engines are the down of the trans within the structure theory of the whole system of pipings. He this means the processes the structure of the second second second second second second second in the second second second second second second second means as here right method of our promps.

Our contract with the company adjusted that the pipes after having been laid, should be tested by paraphasias above; and