

THE AMERICAN
WATER AND GAS PIPE CO.,

N. W. COR. GREENE & BAY STREETS,

JERSEY CITY, N. J.

INCORPORATED BY THE GENERAL MANUFACTURING LAWS OF THE STATE OF NEW JERSEY.

MANUFACTURERS OF

KNIGHT-BAILEY'S PATENT

WROUGHT IRON & CEMENT PROTECTED WATER-PIPE

AND

KNIGHT'S PATENT

Hydraulic-Cement Drain, Sewer, Culvert and Well

PIPE.

CONTRACTORS FOR

THE WATER SUPPLY AND DRAINAGE OF
CITIES AND VILLAGES.

JERSEY CITY:

EVENING JOURNAL JOB PRINT, 142 GREENE STREET,

1870.

DIRECTORS.

JOHN R. HALLADAY,
GARWOOD FERRIS,
G. H. BAILEY,

WILLIAM KEENEY,
JAMES CRAWFORD,
STEPHEN MORGAN.

OFFICERS.

JOHN R. HALLADAY, *President,*
GARWOOD FERRIS, *Secretary and Treasurer.*
G. H. BAILEY, *Engineer.*

Knight-Bailey Patent

Wrought Iron & Cement Protected Pipe,

FOR WATER SUPPLY OF CITIES AND VILLAGES,

AND

KNIGHT-PATENT

Hydraulic Cement Drain, Sewer, Culvert and Well Pipe.

The American Water and Gas Pipe Company of Jersey City, New Jersey, Manufacturers of the above mentioned pipes, and Contractors for the Water Supply and Sewerage 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 or systems of Sewerage and Drainage. For this purpose this circular will treat :

- 1st. Of the Improved Water-Pipe furnished and laid by this Company.
- 2d. Of the Drain and Sewer-Pipe manufactured and sold by them.

INDESTRUCTABLE 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 cast iron pipes labor in the rapid *oxidation* 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 oxidation 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.

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.
- 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 forwards, 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 towards the bottom end of the pipe, so that the lower end of the bore will be reduced in diameter by the bulging inwards 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 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 stop-cock, 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 oxidation of the iron by the use 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 oxidation 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, are disturbed; the connection is made without solder, and at 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, 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,	} <i>Late Trustees.</i>		R. GARDNER,	} <i>Trustees.</i>
J. A. COREY,			H. P. HAYDE,	
W. S. ALGER,			J. L. PERRY,	
WILLIAM COOK,			J. D. BRIGGS.	
G. M. DAVIDSON,		} <i>Water Commissioners."</i>		
R. PUTNAM,				
N. B. DOE,				

"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."

(The above 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 cleanness, 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 incrustation 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,

Boston, February 1856.

Consulting Engineer."

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 nearly eleven (11) miles of main and distributing pipes have been put down, beside 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*."

Plymouth, March 1, 1856.

FROM SAMUEL McELROY, CIVIL ENGINEER.

ENGINEER'S OFFICE, NASSAU WATER CO.,

355 Fulton St., 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 20th, 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-eighth 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 oxydization 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 & Gas Pipe Co.,
Jersey City, N. J.

GENTLEMEN:

In response to your inquiry as to your pipe, I 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.

OFFICE OF WATER COMMISSIONERS,
MIDDLETOWN, ORANGE COUNTY, N. Y.

April 14, 1870.

Garwood Ferris, Esq.,

Sect'y and Treas'r, 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 trifling 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, } *Water Commissioners.*
WM. W. REEVE.

OFFICE OF SAINT PAUL WATER CO.,
SAINT PAUL, MINN., March 1, 1870.

G. Ferris, Esq.,

Sec'y and Treas'r 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 Co.

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 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, } *Commissioners.*
J. S. WELLS,
WM. E. TAYLOR
T. A. SEDGWICK, *Superintendent.*

OFFICE OF PORTLAND WATER CO.,
PORTLAND, MAINE, February 20, 1870.

J. R. Halladay, Esq.,
Pres't of Am. 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,

HENRY G. BEATLEY,

Superintendent of Portland Water Co.

KNIGHT-PATENT

Hydraulic-Cement Sewer, Culvert and Well Pipe.

SIZES FROM THREE INCH TO THIRTY INCH BORE.

This pipe is manufactured of a Concrete, made from Hydraulic Cement and clean sharp gravel or sand, very carefully mixed, and moulded under pressure around a smooth polished cast iron core, by which the interior surface of the pipe is left perfectly smooth and uniform, thereby reducing the loss of flow from friction to the smallest minimum. The Sewer and Culvert Pipe are formed with a flange by which a hub and socket-joint is obtained.

We claim for our Drain and Sewer Pipe a great superiority over brick or stone sewers, or the stone ware pipe, in regard to *perfection of form and finish*, and in *uniformity of bore*, while particularly in the larger sizes, a great *saving* in first cost is effected.

Smoothness and uniformity of bore is a great requisite, as it allows smaller diameters to be used than would otherwise be necessary—thus again being more economical—while the probability of the sewer being self-cleansing is very much enhanced. Brick and stone sewers are usually, and to some extent necessarily, built of so much greater capacity than is required by the amount of sewerage passing through them, that the velocity and scour is very much decreased by the spreading of the water over a large surface, with small depth, thus exposing the greater part of it to friction upon the rough bottom and sides of the sewer. As a consequence deposits are formed, which in a few years fill up the sewer, and render it useless.

The only remaining requisite in a sewer—*durability*—is in our pipe demonstrated by over twenty years' use, while apart from that, the knowledge common to all familiar with hydraulic cement, that it increases in strength with age and exposure to moisture, would of itself testify conclusively, that the material used by us is the best and most durable for its purpose known.

Engineers of acknowledged skill and reputation have, after thorough trial, given to the pipe manufactured under our patents, their unqualified approval, and annexed we print a few of the numerous endorsements we have received.

We would call particular attention to the *cement well tubes* lately introduced by us, as affording an exemption from surface water, and as being much more economical than stone. Where the soil is sandy or gravelly and free from rock or large boulders, their use is specially economical.

Our Sewer and Well Pipe is now being manufactured largely under a royalty from this Company, by parties in various parts of the country. Similar arrangements would be made with responsible parties in districts not yet occupied.

PRICES OF SEWER, CULVERT AND WELL PIPE AT JERSEY CITY FACTORY.

	per lineal foot.		per lineal foot.
3 inch bore, round,	\$0 15	18 inch bore, round,	} 1 15
4 " " " "	0 18	with flat bottoms,	
5 " " " "	0 22	24 inch round, for wells,	1 75
6 " " " "	0 28	30 " " " "	2 00
9 " " " "	0 40	Egg bore pipe, equivalent to an 18 in. circle,	} 1 25
12 " " " "	} 0 60	Egg bore pipe, equivalent to a 24 in. circle,	
with flat bottoms,			1 50
15 inch bore, round,	} 0 85		
with flat bottoms,			

Bends and connection branches also furnished.

FROM MOSES LANE, CIVIL ENGINEER.

ENGINEER'S OFFICE, SEWERAGE DEPARTMENT,
BROOKLYN, N. Y., October 26, 1864.

There has been laid in this City about fifteen miles of the "Knight Patent Cement Sewer Pipe" of 12, 15, 18 and 24 inch interior diameter. We are now using the same pipe for the pipe sewers we are building the present year. This pipe when properly laid has so far answered the purpose satisfactorily.

Signed,

MOSES LANE,
Chief Engineer.

FROM GAMALIEL KING, Esq., BROOKLYN.

SEWER COMMISSIONER'S OFFICE,
CITY OF BROOKLYN, May 30, 1868.

GENTLEMEN:

You inform us that statements have been made at Lockport, N. Y., that several miles of "Knight Patent Cement Sewer Pipe" have been taken up in this City, having proved worthless, being decomposed by the action of acids and sewerage matter, and that we are substituting glazed stoneware pipe in place of cement pipe.

We are happy to contradict the above named report. There is now laid in this City fifty (50) miles of your sewer pipes, and we have no failures to complain of, except where the pipe has been carelessly laid, and in all, there has not been over two to three hundred feet taken up, and that for the reason of being improperly laid, and not from the failure of the pipe.

As a proof that we still have confidence in your Cement Sewer Pipe, we may state for the information of outside parties, that we are now laying your pipe in

District 24, Sub Division 9 and 10,	35,000 ft.—12 in.
" 11, " " 4 - - -	6,400 "—15 "
	7,025 "—12 "
	3,235 "—15 "

Yours respectfully,

Signed,

GAMALIEL KING,
President.

FROM JULIUS W. ADAMS, CIVIL ENGINEER AND DANIEL L. NORTHRUP, COMMISSIONER.

PERMANENT BOARD OF
WATER & SEWERAGE COMMISSIONERS,
CITY HALL, BROOKLYN, July 1, 1869.

GENTLEMEN:

In answer to your inquiry as to our experience in the use of your Cement Pipe, (Knight's Patent) we reply that our opinion has not changed since the date of our late President, Mr. King's letter to you, under date of May 30, 1868.

So well satisfied are we with the good qualities of the Cement Pipe manufactured under your patent, that we have contracted for its use this year in the following Districts :

May 6, 1869,	Dist. 20, Map H,	9,450 ft.—12 in.	2,200 ft.—15 in.
" 20, 1869,	" 24, " L,	11,900 "—12 "	3,560 "—15 "
June 3, 1869,	" 21, " F,	5,750 "—12 "	4,190 "—15 "
" 10, 1869,	" 11, " F,	10,200 "—12 "	5,100 "—15 "
" 10, 1869,	" 21, " F,	4,800 "—12 "	975 "—15 "
" 10, 1869,	" 24, " L,	10,400 "—12 "	1,190 "—15 "
" 21, 1869,	" 24, " L,	4,375 "—12 "	765 "—15 "
" 21, 1869,	" 24, " L,	320 "—12 "	1,120 "—15 "

Signed,

D. L. NORTHRUP,
Commissioner and Secretary.

Signed,

JULIUS W. ADAMS,
Chief Engineer.

FROM ROBERT C. BACOT, CIVIL ENGINEER.

OFFICE OF JERSEY CITY WATER WORKS,
JERSEY CITY, *January 23, 1866.*

This will certify that the "Knight Patent Cement Sewer Pipe" has been manufactured in Jersey City for the last ten years. That I am well acquainted with said pipes, having used them extensively in the construction of sewers in this City, and am satisfied that no better article is made or can be made for such purposes.

Signed,

ROBERT C. BACOT,
Superintendent and Engineer, Jersey City Water Works.

FROM COLGATE & CO.

JERSEY CITY, *January 20, 1869.*

GENTLEMEN :

We are now using, and have been using "Knight's Cement Drain Pipe" for over fifteen years, and to all appearances it is just as good as when first put in. We hold it is entirely impervious to alkaline matter.

Signed,

DAVID TAYLOR,
Supt. of Works.

COLGATE & CO.

FROM HEINRICH & SOMMERS, JERSEY CITY.

HEINRICH & SOMMERS' OIL FACTORY,
Cor. Warren and South 8th Sts.,
JERSEY CITY, *March 1, 1866.*

GENTLEMEN :

We have been using your Cement Pipe (Knight Patent) for draining our Oil Works, and for conveying acid and lye washings, etc., during the past four years; the pipes are still in constant use, and to all appearances in perfect order; they have never leaked or required any repairs or any other attention, and the practical use and durability of your Cement Pipe cannot fail to give entire satisfaction.

Very respectfully yours,

Signed,

HEINRICH & SOMMERS.

FROM DETLEF LIENAU, ARCHITECT.

NEW YORK, *November 4, 1869.*

American Water & Gas Pipe Co.

GENTLEMEN :

I have been using the Drain Pipe manufactured by your Company, of Hydraulic Concrete, under the Knight Patents, for the last twelve years, and find that it answers all the requirements of a good sewer pipe. It increases in strength with age and use, and is not in any way affected by the sewerage from water closets.

Yours, etc.,

Signed,

D. LIENAU,
Architect.

111 BROADWAY, N. Y.

FROM NEW HAVEN BOARD OF ROAD COMMISSIONERS.

NEW HAVEN, CONN., *February, 1868.*

GENTLEMEN :

The Board of Road Commissioners of the City of New Haven have directed me to say, that said City has used the Cement Pipe manufactured by the New Haven Pipe Company, (under the Knight Patents) for several years past, and they are now laying down said sewer pipe exclusively.

They have some brick sewers, and some glazed pipe sewers, but they find the "Knight Patent Cement Pipe," on the whole, best adapted for their purpose in sewerage the streets.

Signed,

HENRY E. PARDEE,

Clerk of the Board of Road Commissioners.

FROM F. COLLINGWOOD, CITY ENGINEER, ELMIRA.

"The 20x30 inch Cement Pipe laid in our streets last Summer, is answering its purpose admirably. I had occasion a short time since, to connect a side sewer with it, and although the inclination is very slight (but 2 inches per 100 feet), I was surprised to find it perfectly free from sediment.

"I am satisfied the water runs with considerably greater velocity in it, than in a brick sewer under the same conditions. We have just laid another sewer of 2,200 feet in length of the same pipe."

OPINION OF SAMUEL McELROY, CIVIL ENGINEER.

"Preference has been given in Brooklyn and some other Cities to pipes manufactured of concrete, made from hydraulic cement mortar and clean gravel, very carefully mixed and molded under pressure. These pipes have great perfection in form, since the process fully admits perfect moulding, and in common with other preparations of cement mortar which has been thoroughly mixed, their strength is increased by age and insured by moisture. They set rapidly so as to become abundantly hard in six weeks or two months; are easily transported and are cheaper for sewerage than stone ware or brick work. A number of miles of this kind have been laid in Brooklyn, and the whole theory of hydraulic construction confirms the principle of their manufacture. Built on polished cast-iron cores, their internal curves are exact duplicates of each other, so that perfect lines of discharge may be laid, with close socket-joints, and with great smoothness of surface. In friction, durability, readiness of manufacture and cost, they may be considered the best sewer pipes in use.

"Their operation on a large scale and under trying circumstances, for city sewerage, has been entirely satisfactory; and for use as railway culverts, I consider them especially valuable, from considerable observation and experience. For various cities in this country, I have had no hesitation in expressing my unqualified opinion of their superior merits, and have no doubt that their use will be largely increased as the correct laws of hydraulic construction obtain a more careful study and development.

Signed,

SAMUEL McELROY,

Civil Engineer."

OPINION OF DANIEL RICHMOND, CITY ENGINEER, ROCHESTER.

"I have had the supervision of the laying of quite a number of pipe sewers in this city for the past year, and they have in all cases fully answered the purpose desired.

"The material from which it is made, namely, Rosendale Cement carefully mixed with clean sharp gravel or sand, becomes by age nearly as indestructible as stone. The smooth, uniform interior surface of the pipe, reduces the friction to the smallest minimum and secures the greatest flow through them.

"For some distance in Hickory street, a pipe sewer was laid in a bed of quick sand. A few days after the pipe thus laid was overhauled, when it was found that the quick sand was thoroughly drained.

"I would recommend that the pipe be laid on a foundation of plank wherever quick sand occurs, for the purpose of more effectually securing a uniform grade.

"When the size of the pipe is properly proportioned to the amount of sewerage to be passed through it, it proves itself entirely self-cleansing.

"The egg shape for the large varieties of pipe, has the advantage that the flow is concentrated at the bottom, thus increasing the depth and velocity, and in consequence the scour.

"From a practical knowledge of the working of the cement pipe sewer (Knight's Patent), manufactured by Mr. Copeland, I most unhesitatingly recommend it as preferable to any other up to the limit of its capacity.

Signed,

DANIEL RICHMOND,
City Engineer."

OPINION OF PROFESSOR I. F. QUINBY, ROCHESTER
UNIVERSITY.

ROCHESTER, N. Y., *February 19, 1868.*

"In modern times the question of sewerage has become one of vast importance, not only in reference to the convenience, cleanliness and hygiene of the large cities to which the increased population and commerce of the world have given rise, but also on account of the large sums expended in their construction.

"Formerly in the large European cities the sewers were made of much larger size than required by the drainage they were intended to afford, that they could be entered and the accumulations removed. Experience has proved, however, that by giving a sewer a suitable form of cross section, and adjusting the dimensions to the amount of drainage it is to receive and carry off, it will become self-cleaning.

"Pipe sewers have been thoroughly tested and extensively used of late years, and in all cases in which the material has been good and they have been carefully laid, they have given satisfaction. Being much smaller than brick or stone sewers, their first cost is less, and while they have been found to subserve all the purposes of drainage, from their cleanliness they give out at the street openings but little of the noxious exhalations coming from the fermentations of the matter which collects in the other forms of sewers.

"Pipe sewers are now extensively used in London, Liverpool, and other large cities in Great Britain, and also on the Continent of Europe, and in this country they have been introduced in New York, Brooklyn, Buffalo, Cleveland and other cities, and have answered the fullest expectations of their advocates.

"It may be regarded as demonstrated, therefore, that a properly constructed pipe sewer is not only better for the purposes intended, but much less expensive than the old forms of stone and brick sewers, and the question with those who have given their attention to the subject of sewerage, is not as to the superiority of the pipe sewer, but as to the best material to be used in making it.

"The Hydraulic Cement pipes, (Knight's Patent) made by David Copeland, of this city, seem to possess all the requisites of cheapness, durability and adaption to insure their popularity, and it is believed that when their merits become known, they will be used in the construction of main and lateral sewers to the exclusion of other materials.

Signed,

I. F. QUINBY.

OPINION OF GEORGE VOM BERGE, CITY SURVEYOR
OF BUFFALO.

OFFICE OF THE CITY SURVEYOR,
BUFFALO, *February 11, 1868.*

"After a careful examination of the different sewers built of brick or cement pipes or earthen pipes, I have come to the conclusion that the Hydraulic Cement pipe, besides being cheaper, excels all the others. These cement pipes being in length three feet, have but one joint in that distance, while, in a brick sewer, one joint comes every eight and a half inches longitudinally and two and a half inches transversely. These mortar joints in brick sewers, do not always remain tight, and will leak. The leakage, either inward or outward, is objectionable in outlet sewers. In that regard the advantage is entirely with the pipe sewer.

"The roughness of all brick sewers, however well built, as compared with pipe, might well lead us to dispense with their use.

"For twenty-four inch main sewers, I would always recommend the Hydraulic Cement Pipe, and also for all branch and side sewers of smaller sizes.

"I cheerfully recommend the Hydraulic Cement Pipe, and particularly those manufactured by Copeland, Rathbun & Co. in Buffalo, (Knight's Patent) to the public. These pipes are made in the best and most perfect manner, and of the best materials, not only in circular, but also in egg-shaped forms. I would also state that in several instances, where cement pipes of the above form have been in use for several years, and had to be taken up on account of change of grade, the pipes were in as good order as ever.

Signed,

GEORGE VOM BERGE,

City Surveyor."